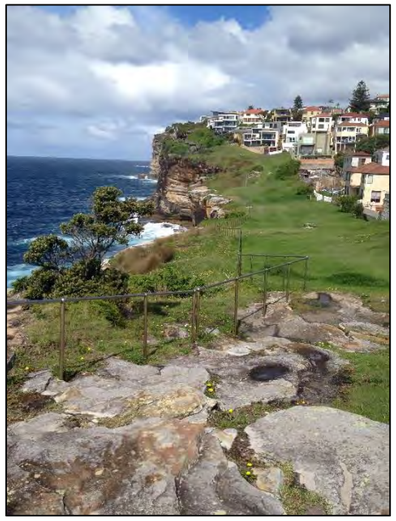
Biodiversity Action Plans – Remnant Sites

2014 – 2020



Waverley Council

total earth care

Prepared by: Total Earth Care Pty Ltd

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Prepared for: Waverley Council

Photo Credits – Appendix Report (TEC 2014)

Caffyn Park Remnant
Biodiversity Action Plan 2014-20

Map No: BAP_01
Prepared for: Waverley Council
Prepared by: C Wharfe - TEC
Date: May 2014
Plan Status: FINAL

Bushland Remnant

- F1
- F5
- F6

Vegetation Condition

- Good
- Fair
- Poor
- Very Poor

Revegetatation

- Understorey Patches (example)
- Buffer

0 3.75 7.5 15 Meters

N

Data Source:
Total Earth Care
Sydney Bush Regen Company
c/o Waverely Council
NearMap

F1 – Sandstone Dry Scrub
Management Actions: Bush Regeneration
Management Tasks:

- Consolidation of previously worked areas, continued bush regeneration works targeting re-occurring exotic species.
- Undertake ecological pile burns (or alternatives) within the western portion of the remnant at the Dry Scrub / Moist Heath interface. Burns to be guided by an approved Fire Management Plan.
  - Should burns be unable to proceed, alternatives are outlined in the Appendix Report (TEC 2014)
- Concentrated maintenance works following any ecological burning.
- Establish 6m x 14m buffer zone adjacent to narrow middle section of remnant vegetation.

F5 – Sandstone Moist Heath
Management Actions: Bush Regeneration / Buffer Planting
Management Tasks:

- Establish 2-3m planting buffer zone (as illustrated adjacent) to prevent run-off from the park introducing exotic species propagules and sediment.
- Targeted removal of Lantana, Pennywort (small population not as yet intractable), exotic grasses and herbaceous annuals.

F6 – Sandstone Dry Scrub
Management Actions: Bush Regeneration
Management Tasks:

- Removal of African Olive and *Acaica saligna* from within and surrounding remnant.
- Targeted treatment of all exotic understorey species and groundcover to the remnant extent (defined by the extent of *Kunzea ambigua*) including turf grasses to establish a defined Remnant Vegetation / Landscaped Vegetation boundary.
- Undertake regular secondary weeding combined with soil scarification to assess resilience. Pile burn areas to facilitate regeneration of the seedbank. All burns to be guided by an approved Fire Management Plan.
  - Should burns be unable to proceed, alternatives are outlined in the Appendix Report (TEC 2014)
- Revegetate understorey with a number of patches across the remnant each with a density of 4 plants/m^2.
- Undertake regular maintenance, especially following burning. Maintain remnant/landscape boundary.

Supplementary planting may be required within the Caffyn Park vegetation remnants should regeneration success be poor following at least 18 months of vegetation management works.

Remnant Description

The Caffyn Park remnant vegetation consists of two patches, within and adjacent to Caffyn Park, separated by Victory Street in Dover Heights. The vegetation consists of Dry Scrub and Moist Heath communities ranging in ecological condition from Good to Very Poor, on a low cliff-top, cliff-face and slopes above and below (SBR 2010).

In the time since flora surveys undertaken between 1995 and 2004 drying out of the wet heath vegetation and associated advance of *Kunzea ambigua* has resulted in the loss of a number of heath and moisture tolerant species from the within remnant, and potentially the entire LGA (SBR 2010).

Threats to the survival of the remnant occur in the form of over-mature vegetation with low floristic and successional diversity, particularly in the dry scrub, weed infestation, sedimentation / run–off from the surrounding parkland, isolation and small patch size.

Within the LGA, the moist heath cliff-soak vegetation is one of few such habitats within which remnant native vegetation persists, especially away from the coastal sea-cliffs.

Bush regeneration works have been undertaken within the vegetation which has improved and maintained the condition of the south eastern portion of the dry scrub community in Good Condition. Further on-going works are required to mitigate the threatening processes impacting on the remainder of the community.

It is expected that the prescribed vegetation management measures outlined in the Action Plan would increase the vegetation condition of approximately 40-70% of the remnant to Good by 2020.

F1 – Sandstone Dry Scrub vegetation consists of a low diversity scrubby patch dominated by *Kunzea ambigua* with occasional *Acacia longifolia* and little understory. Native understorey plants that do occur include *Commelina cyanea, Dichelachne crinita, Lobelia alata and Opercularia aspera* all at low abundance. Threats to the vegetation occur in the form of low successional diversity (ie. majority of the dominant plants at the same life stage – mature), low floristic diversity and sedimentation from overland flow and run-off through Caffyn Park.

Exotic species issues are minor with nuisance weeds such as *Ehrharta erecta*, *Cyperus eragrostis* and exotic Couch Grass occurring at low density and abundance.

F5 – The moist heath and cliff-soak habitat comprising vegetation remnant F5 is of generally Very Low (SBR 2010) Vegetation Condition and threatening processes must be abated if the native vegetation is to survive. Weed encroachment and low abundance and diversity of native species is a major issue in the western/southern-most portion of the remnant patch, above the cliff-soak. Exotic species are also prevalent at the boundary of the moist heath / dry scrub vegetation, where it has been assessed that *Kunzea ambigua* is encroaching as a result of drying out of the soils.

Whilst Caffyn Park is acting as a mini-catchment facilitating the moist substrates within the remnant vegetation, sedimentation and nutrification are negative aspects contributing to the declining health of the vegetation.

Exotic species present within the vegetation remnant include Kikuyu and other exotic grasses, *Bidens pilosa* and other herbaceous annuals, Lantana and Pennywort (at levels not yet intractable).

F6 - Remnant occurs as scattered mature native shrubs in a cosmopolitan mix of exotic trees, shrubs and groundcovers. Native species diversity is low with only seven (7) native species recorded within the remnant during SBR 2010 floristic surveys, four (4) of which are shrubs and three (3) are herbs / grasses.

Exotic species dominate the remnant vegetation with leaf-fall from the large *Acacia saligna* suppressing vegetation growth beneath it, and exotic grasses encroaching from the surrounding parkland dominating the ground-layer.

African Olive, Mother of Millions and Coreopsis are all present at moderate to high rates of occurrence.

Vegetation Communities (SBR 2010):

Sandstone Dry Scrub

Dense low growing dry vegetation dominated by sclerophyllous shrubs, characteristic PFC of >10 to 100% cover. Characteristic species listed as *Kunzea ambigua* which dominates at Caffyn Park, *Acacia longifolia, Monotoca elliptica* and *Leptospermum laevigatum* are also present. Community occurs >50m from sea-cliffs on sandstone slopes and ledges, supported by sandy lenses on sandstone.

Sandstone Moist Heath

An open low growing assemblage of sun-loving moisture tolerant species with a characteristic canopy layer PFC of >10 to <30% cover. *Banksia ericifolia, Callistemon citrinus* and *Callistemon linearis* are commonly recorded shrub/canopy species, and the vegetation is known to occur >50m from sea-cliffs on sandstone slopes and ledges with shallow skeletal sand and impeded drainage.

SEPP 19 Bushland

Approximately 270m^2 of F1 is considered SEPP 19 Bushland in Urban Areas vegetation. (SBR 2010).

Waverley Council is obliged to protect and preserve the bushland because of its value as part of natural heritage, its aesthetic value and its value as a recreational, educational and scientific resource, and must consider impacts upon it when assessing all relevant Development Applications.

Remnant Significance

Caffyn Park supports over 1100m^2 of remnant vegetation which provides habitat for a number of native flora species recorded nowhere else, or at only one other location, in the LGA during SBR (2010) floristic surveys. These plants include *Callistemon linearis, Centella asiatica, Juncus usitatus/continuous, Leptocarpus tenax, Psilotum nudum, Schoenus breviflorus* and *Wahlenbergia gracilis*.

The vegetation comprises >70% of the Sandstone Moist Heath vegetation community across the LGA and is one (1) of only eight (8) properties to support SEPP 19 bushland.

Remnant Condition (SBR 2010)

	Remnant Condition 2010 (SBR 2010)				
	V. Poor	Poor	Fair	Good	TOTAL
Area (m^2)	866	-	108	170	1144
Area (%)	76%	0%	9%	15%	100%

Area Likely to Reach "Good" Condition by 2020

R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020	R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020
F1.1	170	Good	170	F5	280	V Poor	150
F1.2	137	V Poor	137	F6	449	V Poor	100
F1.3	108	Fair	108	-	-	-	-

Area Good Condition 2010: 15% Area Good Condition 2020: 58% (665m^2)

Flora / Fauna Habitats

Sandstone Dry Scrub at Caffyn Park offers limited fauna habitat resources. The dense scrubby canopy may offer perching and foraging habitat for small native birds although the understorey is sparse and offers little by way of refugia.

The main habitat resources available at Caffyn Park are within the Moist Heath vegetation where consistently moist soaks offer habitat for hydrophilic plants and potentially native frogs. The overall damp nature of the area and dense ground-layer vegetation (currently dominated by weeds) could potentially support a small population of Common Eastern Froglet (*Crinia signifera*) although habitat for eggs and tadpoles is likely to be very limited.

Restoration of this moist habitat will improve the resources supported by this locally uncommon ecosystem, and potentially increase the flora and fauna populations it supports.

Remnant Restoration Goals & Associated Tasks

F1 – On-going regular bush regeneration works are likely to improve the remainder of the vegetation remnant to good condition through targeted treatment of persistent exotic species.

Sedimentation from Caffyn Park builds up along the log boundary that surrounds the remnant vegetation. This sediment should be regularly removed to prevent build-up and overflow of run-off into the bushland.

An area approximately 6m x 14m of Type 1 Buffer Revegetation should be undertaken adjacent to the narrow section of the remnant between patches F1.1 and F1.3. The area (within the Park lawn) should be sprayed out, mulched and planted out with dense native grasses and sedges at 4-6 plants/m^2.

It has been assessed (SBR 2010) that the edaphic conditions in the southern/western portion of the remnant have dried-out in recent times, leading to an increase in Kunzea and an associated loss of hydrophilic shrubs and graminoids. This increase in Kunzea may be resulting in exponential drying of the soil and loss of species, through an increase in the uptake of water from the soil by the Kunzea plants.

Staged removal of up to 30m^2 of Kunzea dominated vegetation along the Dry Scrub / Moist Heath boundary is recommended to assess the resulting change in soil moisture levels. Following removal of dry scrub, soil scarification followed by pile burns are recommended in the areas to stimulate regeneration, to stimulate germination of native species from the soil.

All works associated with ecological burning should be done under the guidance of an approved Fire Management Plan prepared by a qualified and experienced Consultant, and the fire undertaken by an experienced contractor of the Fire Brigade. Alternative options are outlined in the Appendix Report (TEC 2014) should burning not proceed.

Following any burning a concentrated weed removal maintenance effort is required to ensure native seedlings are able to compete and grow to establishment with reduced pressure form exotic species.

F5 – To complement weed control and bush regeneration works undertaken within the Moist Heath remnant, a buffer zone of native grasses and sedges is to be established to slow run-off flow from the Park and reduce volumes of exotic seed and sediments entering the remnant vegetation.

A 2-3m wide strip of Type 1 Buffer Revegetation established along the eastern edge of the remnant (within the Park lawn). Area should be sprayed out, mulched and planted out with dense native grasses and sedges at 4-6 plants/m^2. Care should be taken not to plant moisture-thirsty species in the buffer adjacent to the sandstone moist heath vegetation.

Revegetation may also be required within the remnant patch should passive regeneration works not result in sufficient increases in native species abundance and cover. See Appendix Report (TEC 2014) for details.

F6 – Weed removal, Remnant definition and stimulation of regeneration are the priority for work within the northern Sandstone Dry Scrub Remnant.

Patchy revegetation is recommended should 12-24 months of bush regeneration works, including pile burns, result in insignificant levels of native species regeneration.

Flora Species (SBR 2010)

Family	Genus species	Common Name	Family	Genus species	Common Name
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair	Juncaceae	*Juncus planifolius*	
Apiaceae	*Centella asiatica*	Indian Pennywort	Juncaceae	*Juncus (usitatus or continuus)*	
Campanulaceae	*Wahlenbergia gracilis*	Sprawling Bluebell	Lentibulariaceae	*Utricularia lateriflora*	Small Bladderwort
Centrolepidaceae	*Centrolepis fascicularis*		Lobeliaceae	*Lobelia alata*	
Commelinaceae	*Commelina cyanea*	Scurvy Weed	Myrtaceae	*Baeckea imbricata*	
Cyatheaceae	*Cyathea cooperi*	Straw Treefern	Myrtaceae	*Callistemon linearis*	Narrow-leaved Bottlebrush
Cyperaceae	*Baumea rubiginosa*		Myrtaceae	*Kunzea ambigua*	Tick Bush
Cyperaceae	*Cyperus polystachyos*		Myrtaceae	*Leptospermum laevigatum*	Coast Teatree
Cyperaceae	*Cyperus sanguinolentus*		Myrtaceae	*Leptospermum squarrosum*	
Cyperaceae	*Schoenus apogon*	Common Bog-rush	Orchidaceae	*Microtis parviflora*	Slender Onion Orchid
Cyperaceae	*Schoenus brevifolius*		Phormiaceae	*Dianella revoluta*	Paroo Lily
Dennstaedtiaceae	*Histiopteris incisa*	Bat's Wing Fern	Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Droseraceae	*Drosera pygmaea*	Pygmy Sundew	Poaceae	*Deyeuxia quadriseta*	
Ericaceae	*Epacris obtusifolia*	Blunt-leaf Heath	Poaceae	*Dichelachne crinita*	Longhair Plumegrass
Ericaceae	*Monotoca elliptica*	Tree Broom-heath	Poaceae	*Eragrostis brownii*	Brown's Lovegrass
Eriocaulaceae	*Eriocaulon scariosum*		Poaceae	*Lachnagrostis filiformis*	
Fabaceae - Mimosoideae	*Acacia longifolia* subsp *longifolia*	Sydney Golden Wattle	Psilotaceae	*Psilotum nudum*	Skeleton Fork-Fern
Gleicheniaceae	*Gleichenia dicarpa*	Pouched Coral Fern	Restionaceae	*Leptocarpus tenax*	
Goodeniaceae	*Goodenia paniculata*	Branched Goodenia	Rubiaceae	*Opercularia aspera*	Coarse Stinkweed

No Fauna records exist for the Waverley Cemetery Cliffs remnant.

Recommended Revegetation Species (B-Buffer only; R-Remnant only; BR-Buffer & Remnant)

Genus species	Common Name	Genus species	Common Name	Genus species	Common Name
Xanthosia pilosa **(R)**	Woolly Xanthosia	*Acacia suaveolens* **(R)**	Sweet Wattle	*Entolasia marginata* **(BR)**	Bordered Panic
Ficinia nodosa **(BR)**	Knobby Club-rush	*Lomandra longifolia* **(BR)**	Spiny-headed Mat-rush	*Imperata cylindrica* **(BR)**	Blady Grass
Epacris longiflora **(R)**	Fuchsia Heath	*Callistemon citrinus* **(R)**	Crimson Bottlebrush	*Microlaena stipoides* **(BR)**	Weeping Grass
Leucopogon juniperinus **(R)**	Prickly Beard-heath	*Melaleuca armillaris* **(R)**	Bracelet Honey-myrtle	*Banksia ericifolia* subsp *ericifolia* **(R)**	Heath-leaved Banksia
Monotoca elliptica **(R)**	Tree Broom-heath	*Dianella caerulea* **(B)**	Blue Flax-lily	*Hakea teretifolia* **(R)**	Needlebush
Dillwynia retorta **(R)**	-	*Dianella congesta* **(BR)**	-	*Pimelea linifolia* subsp *linifolia* **(R)**	Slender Rice Flower
Acacia longifolia **(R)**	Sydney Golden Wattle	*Dichelachne crinita* **(BR)**	Longhair Plumegrass		

Type 1 Revegetation – Low diversity graminoid dominant buffer revegetation
Type 2 Revegetation – Higher diversity, multiple plant forms buffer / non-buffer revegetation
See Appendix Report (TEC 2014) for details

Recommendations for Future Biodiversity Actions and Means of Achieving EAP3 Objectives

- Vegetation Condition Mapping is to be updated in 2015 with consideration given to the re-classification of remnants' 'Condition' as outlined in the Appendix Report – Waverley BAPs (TEC 2014). Update of mapping in 2015 will assess progress of restoration works towards the EAP3 targets and should be repeated every 24 months to 2019, followed by final assessment at 2020.
- Burning may not be appropriate at Caffyn Park and alternative means for stimulating seeding emergence may be required. See Appendix Report – Waverley BAPs (TEC 2014)
- In undertaking the revegetation surrounding remnant patch F1 & F5, regular removal of sediment build-up around F1, this Action Plan is contributing to EAP3 Targets of Minimising sediments and suspended solids in stormwater discharged into waterways, and Minimising nutrients in stormwater discharged into vegetation remnants, each by 2020.

CAFFYN PARK Biodiversity Action Plan - Actions Table

Remnant Code	Management Action	Responsibility	Performance Criteria	Timing	Total Cost of Mgmt Action (ex GST) See spreadsheet for more info and breakdown
F1	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Entire remnant condition to be assessed as Fair or better during 1st Condition Mapping update (2015) • Scrub removal and facilitated germination methods undertaken within 12-24 months of commencement works associated with this Action Plan • Remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken no less than quarterly to 2020 • Increased maintenance effort following any pile burns	$ 10,560.00
	Buffer Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 85m^2 of buffer revegetation undertaken at 4 plants/m^2 (as required) • Revegetation works completed within 6-12 months of commencement of vegetation management actions associated with this Action Plan • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works	As outlined adjacent	$ 4,376.30
F5	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Install physical barrier between buffer revegetation (as outlined below) and turf • ≥50% of remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • ≥50% of remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • ≥50% of remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 6 months of targeted works • Works undertaken no less than quarterly to 2020	$ 12,080.00
	Buffer Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 50m^2 of buffer revegetation undertaken at 4 plants/m^2 (as required) • Revegetation works completed within 6-12 months of commencement of vegetation management actions associated with this Action Plan • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works	As outlined adjacent	$ 4,3199.00
F6	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • ≥50% of remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • ≥50% of remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • ≥20% of remnant condition to be assessed as Good and the remainder assessed as Fair at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 6 months of targeted works • Works undertaken no less than quarterly to 2020	$ 12,080.00
	Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 50-70m^2 of patchy revegetation undertaken at 4 plants/m^2 (as required) • Revegetation works undertaken following implementation of no less that 24 months of vegetation management actions associated with this Action Plan • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works	As outlined adjacent	$ 3,966.80
Various	Ecological Burns	Waverley Council engaged Bush Regeneration Contractor	Undertake ecological burns as required ensuring the following conditions are met; • Prepare site and undertake burns as outlined in Fire Management Plan • Required approvals sought by Bushfire Consultant (not BR Contractor)	• Commence planning at the outset of this Action Plan • Undertake burns following 18 months of vegetation management works associated with this Plan	$ 3,400.00
	Supplementary Plantings	Waverley Council engaged Bush Regeneration Contractor	Install 200 native tubsestock within remnant vegetation if required as a result of low levels of natural regeneration following passive and active management works	• Following no less than 18 moths of vegetation management works	$ 2,944.00
	Stormwater Management	Various	Implement actions outlined in Stormwater Management Plan (to be prepared)	• As outlined in SMP	Undetermined
All areas	Ecological Monitoring	Waverley Council engaged Vegetation Management Consultant	Undertake regular monitoring visits to ensure bush regeneration works are progressing within the scope of this Action Plan and the specific project contract. • Establish fixed photo monitoring points within each remnant • Establish fixed quadrat or transect survey locations to assess weed cover abundance and native regeneration • Provide a report on the findings to Waverley Council	Monitoring events to occur at regular intervals to 2020. • Monitoring surveys and reports to be undertaken annually and provided to Council	$ 11,660.00
n/a	Project Admin	Bush Regeneration Contractor	n/a	Throughout Project	$ 2,520.00
				TOTAL	**$ 67,786.50**

Calga Reserve & Bronte Cutting and Cliffs
Biodiversity Action Plan 2014-20

Map No: BAP_02
Prepared for: Waverley Council
Prepared by: C Wharfe - TEC
Date: May 2014
Plan Status: FINAL

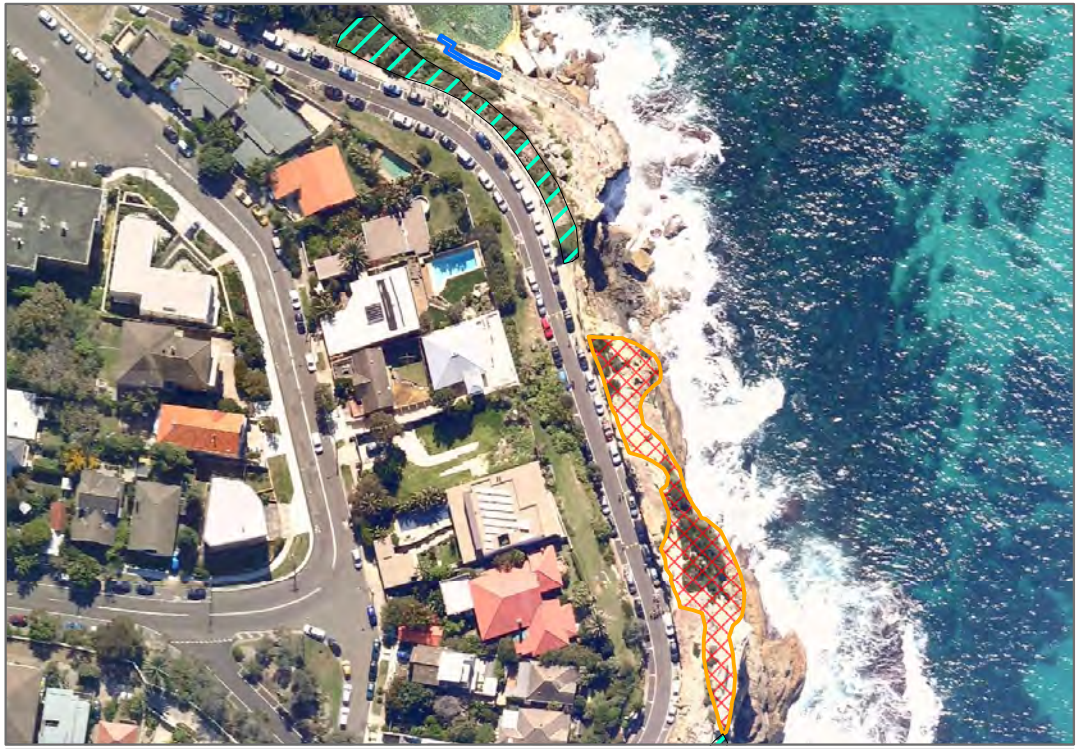
Vegetation Condition
- Good
- Fair
- Poor
- Very Poor

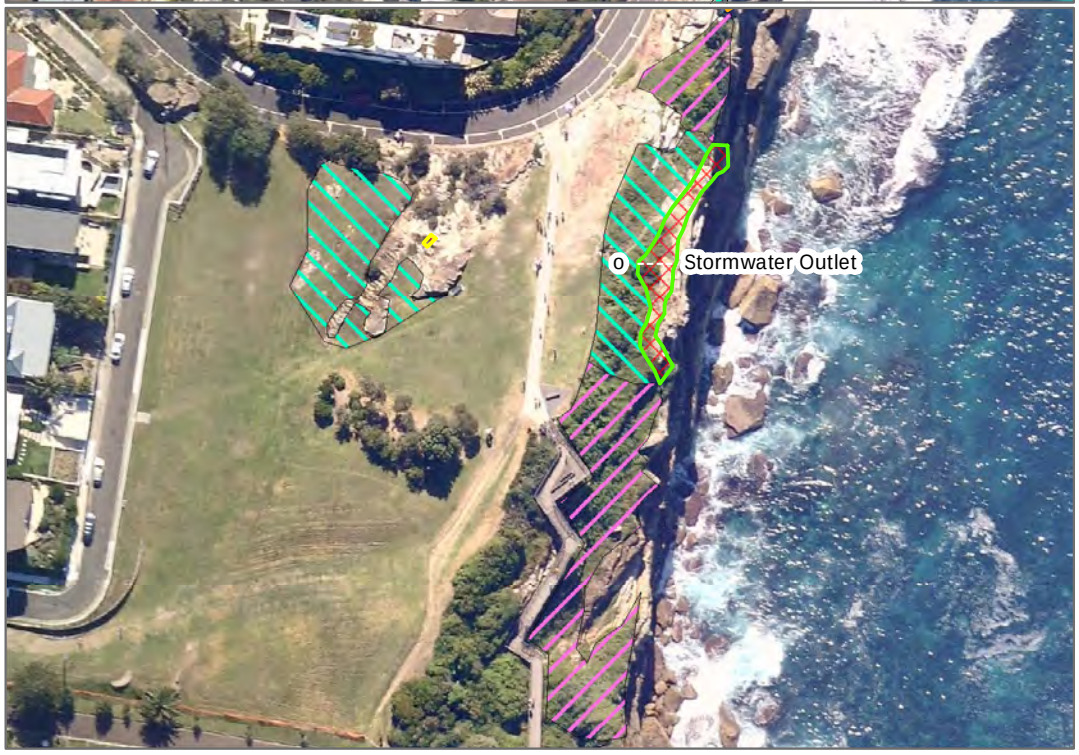
Revegetation
- Connectivity
- Buffer

Bushland Remnant
- B1
- B2
- B7
- B8

0 10 20 40 Meters
Approx.
N

Data Source:
Total Earth Care
Sydney Bush Regen Company
c/o Waverely Council
NearMap





B1 – Sea-cliff Heath

Management Action: Bush Regeneration

Management Tasks:

- Prioritised Works to be undertaken as follows; 1-Removal of vine weeds and Asparagus Fern. 2-Removal of Buffalo Grass and exotic shrubs. 3-Remove exotic species on slopes immediately surrounding remnant and revegetate

Management Action: Stormwater Impact Mitigation

Management Tasks:

- Installation of a rock rip-rap immediately below the outlet, plant dense native sedges within the rock voids and within surrounding 4-6m^2

Management Action: Buffer Revegetation

Management Tasks:

- Remove exotic species on slopes immediately surrounding remnant, install mulch and revegetate at 4-6 plants/m^2

B2 – Sea-cliff Heath

Management Action: Bush Regeneration

Management Tasks:

- Undertake bush regeneration works throughout remnant
- Continue maintenance within existing northern buffer vegetation

B7 – Sea-cliff Heath

Management Action: Bush Regeneration

Management Tasks:

- Herbicide spraying and manual removal is to be undertaken targeting Couch, Paspalum and Gazania

Management Action: Buffer Revegetation

Management Tasks:

- Spray out turf, install mulch and revegetate at 4-6 plants/m^2

B8 – Sea-cliff Grassland

Management Action: Target Weed Treatments

Management Tasks:

- Regular herbicide treatment and weed removal of exotic species.
- Consider cliff-face weed removal if long-term improvements are desired
- Remnant is unlikely to ever reach Good Condition, and should be managed so the remnant is not "Lost"

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CALGA RESERVE & BRONTE CLIFFS (SOUTH) Biodiversity Action Plan 2014 - 2020

Remnant Description

The remnant exists as three patches of Sea-cliff Heath and one patch of Sea-cliff Grassland between Calga Reserve and Bronte Baths, on and at the base of sea-cliffs. Remnants range in ecological condition from heavily weed infested to low levels of weed occurrence. All patches were mapped as being in Very Poor Vegetation Condition by SBR (21010). All vegetation remnants are isolated by incidents of disturbed exotic or landscaped vegetation, or lawn. Stormwater and run-off patterns impact on the remnants introducing sediment, nutrients and exotic propagules, and public access occurs throughout all patches.

Bush regeneration works have been undertaken within the largest remnant B2, and exotic species have been reduced to low levels in accessible areas. Targeted and staged weed removal is required within the more heavily weed infested remnants, and buffer / connectivity planting is recommended in a number of locations.

Two out of the four remnants are likely to reach Good Vegetation Condition as a result of prescribed management works. The remaining two remnants are impacted by intractable weed species or high levels of exotic propagule input and will not reach Good condition without prohibitively expensive input of resources.

B1 – Remnant vegetation includes mainly native shrubs and sedges occupying shallow soil deposits on top of high sea-cliff. Native vegetation is heavily impacted upon by exotic weeds in the ground and shrub/canopy strata. Remnant is very isolated from adjacent areas of native vegetation with no available habitat for expansion of native species.

Exotic species issues include Coastal Morning Glory, Cape Ivy, Gazania, Asparagus Fern, Buffalo Grass, Pennywort, Pellitory, Japanese Pittosporum and Mirror Bush.

B2 – Scattered patches of native shrubs, sedges and grasses growing on cliff-top between the Council Road (Bronte cutting) and the Tasman Sea. Exotic species occur at moderate to low densities across the remnant with highest levels of weed infestation occurring closest to the cliff edge. With the exception of these less accessible weeds, vegetation management works are likely to progress well and improve the condition of the majority of the remnant towards Good over the up-coming seasons.

Exotic species present amongst the remnant vegetation include Asparagus Fern, Gazania, Buffalo Grass (and other exotics), and NZ Christmas Bush. No weed infestations are considered intractable, at the time of survey for this Plan.

B7 – Remnant patch B7 has been mapped as encompassing only a small proportion of the heath vegetation occurring on the exposed sandstone platform within the northern portion of Calga Reserve. For the purpose of this Plan the vegetation referred to as 'the remnant' will include all of the vegetation supported on top of the exposed rock.

The remnant occurs as a relatively diverse patch of native species (mainly shrubs) surrounded on three sides by a turfed lawn. Native species occurring in the area include *Acacia longifolia, Leptospermum laevegatum, Monotoca eliptica, Westringia fruticosa* and *Eragostis brownii.*

Weed issues are not considered significant with the exotic species present within the remnant vegetation being minor occurrences of exotic Couch Grass (*Cynodon dactylon*), Paspalum and Gazania.

B8 – The remnant exists as a small patch of Saltwater Couch (*Paspalum vaginatum*), between the base of the sea cliff and the concreted walkway south-east of Bronte Baths. Knobby Club-rush (*Ficinia nodosa*), *Einadia polygonoides* and *Samolus repens* also occur with the native grass in the remnant patch.

Weed species currently present in the native vegetation include Gazania, Pennywort, Asparagus Fern and a number of exotic grass species. Significant volumes of exotic propagules enter the remnant from the cliff-face vegetation which is dominated by exotic shrubs, vines and Asparagus Fern.

Vegetation Communities (SBR 2010):

Sea-cliff Heath

Open to closed low growing community with <10 to <70% canopy FPC, characteristic species include *Baeckea imbricata, Banksia ericifolia, Melaleuca armillaris, Melaleuca nodosa, Westringia fruticosa*. Community distributed within 50m of sea-cliffs on skeletal sands to sand lenses on sandstone, drainage is often impeded.

Sea-cliff Grassland

Grassland vegetation of patchy to dense occurrence with .10 to 100% FPC, characteristic species include *Paspalum vaginatum, Sporobolus virginicus* and *Zoysia macrantha*. Sea-cliff Grassland occurs within 10m of sea-cliffs on skeletal sand to sand lenses on sandstone, and can often include areas of impeded drainage.

SEPP 19 Bushland

No remnant vegetation on the Waverley Cemetery Cliffs is considered SEPP 19 Bushland (SBR 2010)

Remnant Significance

Regeneration of the Sea-cliff Heath within the Calga Reserve and Bronte Cliffs site will promote connectivity of native vegetation through to the Waverley Cemetery Cliffs remnants and to the southern extent of the LGA. Regeneration of the patches to healthy functioning ecosystems and improvement of adjacent habitat will over time provide areas for native vegetation to disperse into, hence increasing the remnant vegetation cover along the coastline.

Remnant Condition (SBR 2010)

	Remnant Condition 2010 (SBR 2010)				
	V. Poor	Poor	Fair	Good	TOTAL
Area (m^2)	984	-	-	-	984
Area (%)	100%	0%	0%	0%	100%

Area Likely to Reach "Good" Condition by 2020

R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020	R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020
B1	149	V Poor	30	B7	2	V Poor	250*
B2	815	V Poor	734	B8	18	Poor	0

Area Good Condition 2010: 0% Area Good Condition 2020: 103% (1014m^2)

*NB// Remnant vegetation that comprises patch B7 is considered significantly larger than that mapped by SBR (2010). This has resulted in the increase of "Area (m^2) to Good 2020" from 2m^2 to 250m^2 and accounts for the 103% figure listed above.

Flora / Fauna Habitats

Remnants occurring at Calga Reserve and Bronte Cliffs are considered to support low to moderate levels of native flora and fauna habitat. The vegetation generally occurs as sparse to dense shrub layer with few areas of dense native understorey / groundcovers. The shrubby vegetation provides moderate perching and foraging habitat of value to small passerine birds though there is little food resources for nectar feeding species.

Large areas of open sandstone provide basking and foraging habitat for small skinks although adjacent shelter is minimal in areas.

Areas of suitable substrate available for germination or dispersal of native flora species is lacking due to either exotic weed infestation or little to no soil present on the sandstone benches.

Remnant Restoration Goals & Associated Tasks

To reach 'Good' Vegetation Condition by 2020, restoration works within the B2 and B7 remnants are generally to follow standard bush regeneration techniques, whereby exotic species are carefully and strategically removed from native vegetation, with a general progression from areas of higher ecological condition into more degraded areas.

B1 - As stated above the majority of remnant patch B1 (~80%) is unlikely to reach Good Vegetation Condition due to the dense occurrence of Pennywort throughout the native vegetation. Vegetation condition can be restored to Fair by staged removal of vine, shrub and groundcover weeds through appropriate treatment techniques as prioritised overleaf.

The establishment of a maintenance edge surrounding the native vegetation will facilitate ongoing suppression of exotic species, although revegetation of surrounding degraded slopes, and mitigation of stormwater impacts is recommended for long-term restoration of the patch.

Sedimentation, erosion and run-off issues associated with the small stormwater outlet directly above the remnant are to be mitigated by the installation of a rock rip-rap. As much as is practicable, the stormwater would be directed away from the remnant vegetation before flowing over the cliff.

Revegetation surrounding remnants B1 and B7 are recommended to perform a buffering function to reduce negative impacts on the remnants, reduce future maintenance requirements and promote to the longevity of the vegetation.

Type 2 Buffer Revegetation of the areas surrounding remnant B1 and stormwater impact mitigation are recommended as Priority 2 revegetation and should be undertaken as follows;

- Spray out all exotic grasses and treat vine and woody weeds across the slope west of the remnant.
- Install terracing as required, install rock rip-rap, and install native leaf mulch to 75mm depth following successful weed treatment, allow mulch to settle.
- Plant native groundcover species and occasional low-growing shrubs at a density of 4-6 plants/m^2.
- Water planting in, and as frequently as required to establishment.

B2 - The major issue facing the restoration of B2 to Good condition is the occurrence of exotic species on the edge of the cliff-top in areas too dangerous to access without the use of static lines or similar. Anchoring of safety lines to vehicles parked within the Council Road is a suggested option to allow for cliff-top works to proceed safely.

Buffer revegetation has recently been undertaken immediately north of remnant B2, maintenance works within this vegetation should progress concurrently with weed control within the B2 remnant.

Seed from native grasses present within patches B2 and B7 should be collected when/if available and used for re-broadcast into areas where exotic groundcovers have been eradicated and no native regeneration has occurred.

Public access through the remnant is an issue. Blocking access is likely to be unpopular with the community and unlikely to provide significant ecological benefit, due to the majority of the access being over exposed sandstone rock. Therefore it is not recommended.

B7 - To reduce potential sedimentation and exotic species encroachment within the vegetation remnant creation of a buffer zone surrounding the remnant is recommended. Spraying out of turf and revegetation of the area within the extent of the exposed sandstone will establish a buffer from up-slope run-off and increase potential habitat for remnant vegetation in move in to.

Type 1 Buffer Revegetation of the area surrounding remnant B7 is recommended as Priority 1 revegetation and should be undertaken as follows;

- Spray out all turf grass within the broader area encompassing the exposed sandstone rock.
- Install native leaf mulch to 75mm depth following successful kill of turf, and allow to settle.
- Plant native groundcover species and occasional low-growing shrubs at a density of 4-6 plants/m^2.
- Water planting in, and as frequently as required to establishment.

B8 - The Sea-cliff Grassland comprising patch B8 will can be restored to Fair condition although the patch will require ongoing maintenance until such time as the exotic species on the cliff above the remnant are removed (which is unlikely to ever occur). Regular targeted weed control visits should be undertaken by Waverley Council Park Staff sufficiently trained in identification of native and exotic species, and appropriate treatment techniques.

Flora Species (SBR 2010)

Family	Genus species	Common Name	Family	Genus species	Common Name
Aizoaceae	*Carpobrotus glaucescens*	Pigface	Myrtaceae	*Leptospermum laevigatum*	Coast Teatree
Apiaceae	*Xanthosia pilosa*	Woolly Xanthosia	Myrtaceae	*Melaleuca nodosa*	
Centrolepidaceae	*Centrolepis strigosa ssp*		Phormiaceae	*Dianella congesta*	
Chenopodiaceae	*Einadia polygonoides*		Phormiaceae	*Thelionema umbellatum*	
Cyperaceae	*Baumea juncea*		Poaceae	*Dichelachne crinita*	Longhair Plumegrass
Cyperaceae	*Cyperus polystachyos*		Poaceae	*Eragrostis brownii*	Brown's Lovegrass
Cyperaceae	*Isolepis cernua*	Nodding Club-rush	Poaceae	*Lachnagrostis billardierei*	
Cyperaceae	*Ficinia nodosa*	Knobby Club-rush	Poaceae	*Paspalum vaginatum*	Salt-water Couch
Fabaceae - Mimosoideae	*Acacia longifolia ssp longifolia*	Sydney Golden Wattle	Poaceae	*Sporobolus virginicus*	Sand Couch
Lamiaceae	*Westringia fruticosa*	Coastal Rosemary	Poaceae	*Zoysia macrantha*	Prickly Couch
Lobeliaceae	*Lobelia anceps*		Rubiaceae	*Opercularia aspera*	Coarse Stinkweed
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush	Theophrastaceae	*Samolus repens*	Creeping Bookweed
Myrtaceae	*Baeckea imbricata*				

Fauna Species (AMBS 2011)

Class	Genus species	Common Name	Class	Genus species	Common Name
Aves	*Acridotheres tristis*	Common Myna	Aves	*Phylidonyris novaehollandiae*	New Holland Honeyeater
Aves	*Columba livia*	Rock Dove	Aves	*Rhipidura leucophrys*	Willie Wagtail
Aves	*Eudynamys orientalis*	Pacific Koel	Aves	*Trichoglossus haematodus*	Rainbow Lorikeet
Aves	*Hirundo neoxena*	Welcome Swallow	Reptilia	*Eulamprus quoyii*	Eastern Water-skink
Aves	*Malurus cyaneus*	Superb Fairy-wren	Reptilia	*Oedura lesueurii*	Lesueur's Velvet Gecko
Aves	*Passer domesticus*	House Sparrow			

Recommended Revegetation Species (B-Buffer only; R-Remnant only; BR-Buffer & Remnant)

Genus species	Common Name	Genus species	Common Name	Genus species	Common Name
Acacia longifolia **(B)**	Sydney Golden Wattle	*Dillwynia retorta* **(B)**		*Leucopogon juniperinus* **(B)**	Prickly Beard-heath
Acacia suaveolens **(B)**	Sweet Wattle	*Entolasia marginate* **(B)**	Bordered Panic	*Lomandra longifolia* **(B)**	Spiny-headed Mat-rush
Acacia ulicifolia **(B)**	Prickly Moses	*Epacris longiflora* **(B)**	Fuchsia Heath	*Melaleuca armillaris* **(B)**	Bracelet Honey-myrtle
Baeckea imbricata **(B)**		*Eragrostis brownie* **(B)**	Brown's Lovegrass	*Melaleuca nodosa* **(B)**	
Banksia ericifolia subsp *ericifolia* **(B)**	Heath-leaved Banksia	*Ficinia nodosa* **(B)**	Knobby Club-rush	*Microlaena stipoides* **(B)**	Weeping Grass
Baumea juncea **(B)**		*Hakea teretifolia* **(B)**	Needlebush	*Monotoca elliptica* **(B)**	Tree Broom-heath
Carpobrotus glaucescens **(B)**	Pigface	*Imperata cylindrical* **(B)**	Blady Grass	*Olearia tomentose* **(B)**	Toothed Daisy-bush
Dianella caerulea **(B)**	Blue Flax-lily	*Juncus kraussii* **(B)**	Sea Rush	*Pimelea linifolia* subsp *linifolia* **(B)**	Slender Rice Flower
Dianella congesta **(B)**		*Juncus usitatus* **(B)**	Common Rush	*Westringia fruticosa* **(B)**	Coastal Rosemary
Dichelachne crinita **(B)**	Longhair Plumegrass	*Leptospermum laevigatum* **(B)**	Coast Teatree	*Xanthosia tridentate* **(B)**	Rock Xanthosia

Type 1 Buffer Revegetation – Low diversity graminoid dominant buffer revegetation
Type 2 Buffer Revegetation – Higher diversity, multiple plant forms buffer / non-buffer revegetation
See Appendix Report (TEC 2014) for details

Recommendations for Future Biodiversity Actions and Means of Achieving EAP3 Objectives

- Vegetation Condition Mapping is to be updated in 2015 with consideration given to the re-classification of remnants' 'Condition' as outlined in the Appendix Report – Waverley BAPs (TEC 2014). Update of mapping in 2015 will assess progress of restoration works towards the EAP3 targets and should be repeated every 24 months to 2019, followed by final assessment at 2020.
- Revegetation works recommended for the areas between remnants B1 and B2, and the area south of B1 to the Waverley Cemetery Cliffs remnants should be considered following successful primary and secondary weed control, and at least two (2) years of maintenance weed control works within the adjacent vegetation remnants.
- The goal of revegetation in these areas is to promote connectivity and adjacent remnants must be approaching self-reliance if the work is to be effective in reaching this target.
- Revegetation work in connectivity areas is to be done so by the installation of plantings of a range of growth stages, from seedlings to semi-mature, grown from locally collected seeds, at lower densities to retain space for remnant vegetation to further colonise. This process for Connectivity Revegetation is further explained in the Appendix Report – Waverley Biodiversity Action Plans Report (TEC 2014).
- In undertaking the revegetation surrounding remnant patches B1 and B7, and installing the mitigation measures associated with the stormwater outlet, this Action Plan is contributing to EAP3 Targets of Minimising sediments and suspended solids in stormwater discharged into waterways, and Minimising nutrients in stormwater discharged into vegetation remnants, each by 2020.

CALGA RESERVE & BRONTE CLIFFS (SOUTH) Biodiversity Action Plan - Actions Table

Remnant Code	Management Action	Responsibility	Performance Criteria	Timing	**Total Cost of Mgmt Action (ex GST)** See spreadsheet for more info and breakdown
B1	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair by 2nd Condition Mapping update (2017) • ≥80% area of remnant to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken no less than quarterly to 2020	$ 8,760.00
	Construction of Stormwater Mitigation Measures	Waverley Council (Contractor with Vegetation Management experience to be engaged)	Install rock Rip-Rap to industry approved standards, revegetate immediate surrounds to further reduce flow speeds. • Contractor engaged and works undertaken within 12 months of commencement of vegetation management actions • Rip-rap fully functional and plantings established 12 months from installation	As outlined adjacent	$ 1,110.00
	Buffer Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 375m^2 bank revegetated as per specifications outlined above • Revegetation works completed within 12 months of commencement of vegetation management actions • Planting's survivorship at no less than 80% at 12 months, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 15,816.40
B2	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Engagement of ropes works contractor to target cliff-edge weeds • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair by 2nd Condition Mapping update (2017) • Remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken no less than quarterly to 2020	$ 17,520.00
B7	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Remnant condition to be assessed as Fair (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken no less than quarterly to 2020	$ 8,760.00
	Buffer Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 425m^2 slope as per specifications outlined above • Revegetation works completed within 12 months of commencement of vegetation management actions • Planting's survivorship at no less than 80% at 12 months, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 11,764.00
B8	Targeted Weed Treatments	Waverley Council Parks Staff or Waverley Council engaged Bush Regeneration Contractor	Regular weed control to suppress exotic species within the remnant. • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair at 2020 Condition Mapping update	Weed treatment works to progress regularly to 2020. • Works undertaken no less than quarterly to 2020	$ 4,320.00
All areas	Ecological Monitoring	Waverley Council engaged Vegetation Management Consultant	Undertake regular monitoring visits to ensure bush regeneration works are progressing within the scope of this Action Plan and the specific project contract. • Establish fixed photo monitoring points within each remnant • Establish fixed quadrat or transect survey locations to assess weed cover abundance and native regeneration • Provide a report on the findings to Waverley Council	Monitoring events to occur at regular intervals to 2020. • Monitoring surveys and reports to be undertaken annually and provided to Council	$ 14,520.00
n/a	Project Admin	Bush Regeneration Contractor	n/a	Throughout Project	$ 2,520.00
				TOTAL	**$ 85,090.40**

Clifftop Remnants Biodiversity Action Plan 2014-20

Map No: BAP_03
Prepared for: Waverley Council
Prepared by: C Wharfe - TEC
Date: May 2014
Plan Status: FINAL

Clifftop Remnants

Vegetation Condition

- Good
- Fair
- Poor
- Very Poor

Revegetation

- Create Revegetation Buffer
- Existing Connectivity / Buffer Reveg

Various Scales.

N

Data Source:
Total Earth Care
Sydney Bush Regen Company
c/o Waverely Council
NearMap

Bronte to Tamarama: **T3a&b** Sea-cliff Heath; **T5** Sea-cliff Sedgeland a) Carex pumila; **T7** Beach Grassland; **Z15a&b** Sea-cliff Herbland a) Lobelia alata

Management Action: Targeted Weed Control

Management Tasks:

- Edge establishment between remnant core and surrounding exotics. Expand edge as core increases in condition and size.
- Regular weed control visits targeting most invasive exotics. Working outwards from areas of highest remnant native abundance.
- Noxious weed control

Gaerloch to South Bondi: **Z12d** Sea-cliff Herbland b) Dianella congesta; **Z13a&j** Sea-cliff Herbland a) Lobelia alata; **Z13b&h** Sea-cliff Sedgeland a) Carex pumila **Z13c,d,e,f&i, Z14a&b**-Sea-cliff Grassland; **Z13g, Z14c**-Sea-cliff Sedgeland a) Ficinia nodosa;

Management Action: Bush Regeneration / Targeted Weed Control

Management Tasks:

- Edge establishment between remnant core and surrounding exotics. Expand edge as core increases in condition and size.
- Regular weed control visits targeting most invasive exotics. Working outwards from areas of highest remnant native abundance.
- Noxious weed control

South Bondi: **Z11a,b Z12b** Sea-cliff Grassland; **Z11c** Imperata Grassland; **Z11d** Sea-cliff Herbland b) Dianella congesta; **Z12a** Sea-cliff Heath; **Z12c** Sea-cliff Sedgeland c) Ficinia nodosa

Management Action: Targeted Weed Control

Management Tasks:

- Edge establishment between remnant core and surrounding exotics. Expand edge as core increases in condition and size.
- Regular weed control visits targeting most invasive exotics. Working outwards from areas of highest remnant native abundance.
- Noxious weed control
- Static safety lines are required for works within remnants Z11a-d

Sam Fiszman Park: **Z9** Sea-cliff Grassland

Management Action: Targeted Weed Control

Management Tasks:

- Edge establishment between remnant core and surrounding exotic Couch Grass. Expand edge as core increases in condition and size.
- Regular weed control visits targeting exotic Couch to be undertaken by trained and competent staff in identification of grasses and sensitive herbicide spraying

Douglas Parade: **Z8** Imperata Grassland

Management Action: Targeted Weed Control

Management Tasks:

- Edge establishment between remnant core and surrounding exotics. Expand edge as core increases in condition and size.
- Regular weed control visits targeting most invasive exotics. Working outwards from areas of highest remnant native abundance.
- Noxious weed control
- Static safety lines are required for works within remnant

Kimberley Street: **Z5** Sea-cliff Sedgeland c) Ficinia nodosa

Management Action: Targeted Weed Control

Management Tasks:

- Edge establishment between remnant core and surrounding exotics. Expand edge as core increases in condition and size.
- Regular weed control visits targeting most invasive exotics. Working outwards from areas of highest remnant native abundance.
- Noxious weed control
- Static safety lines are required for works within remnant

Clarke, Jensen Ave, MacDonald St & Tower Reserves: **Z1** Sea-cliff Heath, **Z2&3, D1a** Sea-cliff Sedgeland c) Ficinia

Management Action: Targeted Weed Control

Management Tasks:

- Edge establishment between remnant core and surrounding exotics. Expand edge as core increases in condition and size.
- Regular weed control visits targeting most invasive exotics. Working outwards from areas of highest remnant native abundance.
- Noxious weed control
- Static safety lines are required for works within all remnants

total earth care

WAVERLEY CLIFFTOP REMNANTS Biodiversity Action Plan 2014 - 2020

Remnant Description

Remnant vegetation on the Waverley Cliff-tops comprises 34 separate vegetation patches between Bronte and Vaucluse on the cliff-tops, cliff-faces or at the base of the sea-cliffs. Vegetation condition is generally low with the majority of the remnants mapped as in Very Poor condition by SBR (2010), though a number of Sea-cliff Grassland remnants were assessed as Fair and Good (SBR 2010).

Remnants are of mostly small in size with the median area just 31m^2 (approx.), with the average remnant size of 145m^2 skewed by two (2) large patches of Sea-cliff Grassland, each over 100m^2.

Connectivity of the Cliff-top remnants is reduced by areas of low condition, weed infested vegetation and/or complete isolation from other areas of remnant native vegetation.

Remnant vegetation occurs as patches of Heath, Grassland, Sedgeland and Herbland communities a number of which are only found in one or two locations in the LGA and only within these Sea-cliff Remnants.

Bronte to Tamarama – Six patches of remnant vegetation were mapped by SBR (2010) on the sea-cliffs between the northern end of Bronte beach and the northern side of Tamarama beach. During site assessments undertaken for this BAP Remnant T7 (Beach Grassland) could not be located and was assessed as no longer present.

The remaining remnant patches are generally in low ecological condition with weed invasion the most threatening disturbance vector. Native species are present in all remnants at varying abundance with T3a containing the highest native presence.

Regeneration works will result in a number of areas reaching Good Condition, other areas will required management to prevent the Loss of the remnant vegetation.

Remnants are impacted upon by invasion from Gazania, Pennywort, Asparagus Fern, Buffalo Grass, Pellitory, as well as other exotic grasses and shrubs.

Gaerloch to South Bondi – Remnant vegetation runs from Gaerloch Av Tamarama along the cliffs adjacent to the Coastal Walkway to the southern extent of Hunter Park. All remnants consist of low growing sedge/herb/grassland communities and include 2 of the largest remnant vegetation patches on the Waverley Cliff-tops.

Two remnant vegetation patches, Z13j & Z13h, were not located during the site assessments for this BAP. Z13h was assessed as a patch of *Carex pumila* (of Very Common abundance) in 2010 by SBR, no *C. pumila* was observed in the area mapped in 2014 (TEC), only landscaped Lomandras. Z13j was a small patch of relatively diverse Sedgeland in 2010, and is now a landscaped garden bed (TEC 2014). The loss of these patches of remnant vegetation illustrates the need for integrated management of vegetation remnants between Council departments.

Exotic species impacting on the remnant vegetation include Buffalo Grass, exotic Couch, Asparagus Fern, Pennywort, Pampas Lilly-of-the-valley, Mirror Bush, Japanese Pittosporum and other exotic shrubs and groundcovers.

South Bondi – Encompasses remnant vegetation from within Hunter Park to the southern end of Bondi beach along the sea-cliffs north and south of Bondi Icebergs. One of only 2 occurrences of Imperata Grassland in the LGA encompassed by this set of Biodiversity Action Plans.

Remnant vegetation within Hunter Park (patch Z12a) exists as a single *Monotoca elliptica*, the remainder of the vegetation remnants are sedge/herb/grassland communities. Levels of weed invasion are high amongst the majority of the patches and all are isolated from each other to some degree by urban development or landscaped/disturbed vegetation.

Most abundant exotic species include Gazania, Kikuyu, Asparagus Fern, Mirror Bush and Pellitory.

Sam Fiszman Park – Supports a patch of Sea-cliff Grassland of a moderate size defined by the extent of Saltwater Couch (*Zoysia macrantha*) (SBR 2010) and threatened by encroachment from exotic Couch and other exotic herbs.

In order for the remnant not to be lost as a result of the exotic couch outcompeting the native variety, targeted treatment of the exotic grass will be required. In order to achieve this training in identification and treatment techniques will be required for those persons (Council Staff or Bush Regen Contractors).

Douglas Parade – Remnant supports the second patch of Imperata Grassland encompassed by a BAP. Vegetation condition was mapped as Poor by SBR (2010) and exotic species impacting on the remnant include Fishbone Fern, Arrowhead Vine, Kikuyu, exotic Couch, African Daisy, Asparagus Fern and Madeira Vine.

Bush regeneration works are required to prevent further encroachment of exotic species into the native grassland. Works will required safety lines and ladder access over the fence at the end of Douglas Pde.

Kimberley Street – Small patch of heavily weed infested sedgeland existing on a small vegetated outcropping between the eastern end of Kimberley St, Vaucluse, and the edge of the Sea-cliff. Access for vegetation management work is very dangerous and static safety lines would be required for any works being undertaken from the eastern side of the fence.

Exotic species requiring treatment include Arrowhead Vine, Kikuyu, Buffalo Grass, exotic Couch, Prickly Pear, Mirror Bush, Pellitory and Bitou Bush.

Clarke, Jensen Ave, MacDonald St and Tower St Reserves – Mapped by SBR (2010) as three (3) patches on Sea-Cliff Sedgeland and one patch of Seacliff Heath all in Very Poor vegetation condition. Patch Z3 was not confirmed by TEC during site assessments undertaken for this BAP, and it is concluded that the remnant is no longer present due largely to exotic species invasion.

All remaining patches are threatened by exotic species invasion with the most common species including Gazania, Asparagus Fern, Buffalo Grass, Mirror Bush, Pellitory, Pennywort and Prickley Pear among others.

Vegetation Communities (SBR 2010):

Sea-cliff Heath

Open to closed low growing community with <10 to <70% canopy FPC, characteristic species include *Baeckea imbricata, Banksia ericifolia, Melaleuca armillaris, Melaleuca nodosa, Westringia fruticosa*. The community distributed within 50m of sea-cliffs on skeletal sands to sand lenses on sandstone, drainage is often impeded.

Sea-cliff Sedgeland a) *Carex pumlia*

Low open vegetation community with <10 to <70% canopy PFC, characteristic species listed as *Carex pumila* dominant with other sedges present. Community occurs on beaches and within 10m of sea-cliffs on deeper sandy soils.

Sea-cliff Sedgeland c) *Ficinia nodosa*

Low open vegetation community with <10 to <30% canopy PFC, characteristic species listed as *Ficinia nodosa* dominant with other sedges present. Community occurrence is within 20m of sea-cliffs on skeletal sands to sand lenses on sandstone, often on modified soil.

Sea-cliff Herbland a) *Lobelia alata*

Low open vegetation community with <10 to <70% species PFC, characteristic species listed as *Lobelia alata* and *Samolus repens*. Community occurs within 10m of sea-cliffs on skeletal sands to sand lenses on sandstone, often with impeded drainage.

Sea-cliff Herbland b) *Dianella congesta*

Low tending to closed vegetation community with >30 to <70% canopy PFC, characteristic species listed as *Dianella congesta*. Community occurs within 10m of sea-cliffs on sand lenses on sandstone.

Beach Grassland

Low open vegetation community of *Spinifex sericeus* with >10 to <30% canopy PFC. Community occurs on beaches within deep marine sands.

Imperata Grassland

Low open to closed vegetation community characterised by *Imperata cylindrical* >10 to 100% canopy PFC. Community is widespread across the LGA on deeper, disturbed, sandy soills.

SEPP 19 Bushland

Two small patches, 16m^2 in total, of Sea-cliff Grassland at the southern end of Bondi Beach have been assessed as SEPP 19 Bushland in Urban Areas vegetation (SBR 2010).

Waverley Council is obliged to protect and preserve the bushland because of its value as part of natural heritage, its aesthetic value and its value as a recreational, educational and scientific resource, and must consider impacts upon it when assessing all relevant Development Applications.

Remnant Significance

Native vegetation comprising the Cliff-top Remnants encompasses bushland that greatly increases the connectivity of the Waverley's costal biodiversity and its conservation and improvement will increase genetic health and diversity and reduce isolation pressures felt by a significant number of bushland remnants.

Sea-cliff Grassland is of particular conservation significance due to its uncommon occurrence and high likelihood of significant impact or loss as a result of invasive exotic species and/or poor management practices. As the grass dominated communities comprise relatively low species diversity, they are fragile and highly susceptible to negative pressures.

Sea-cliff Remnants also support the only occurrences of *Lobelia alata* herbland, *Carex pumila* sedgeland and Beach Grassland, although remnants of the latter 2 communities appear to have been lost since 2010. This loss of significant cliff-top communities outlined the requirement for targeted vegetation management works as outlined in this set of Biodiversity Action Plans.

Remnant Condition (SBR 2010)

	Remnant Condition 2010 (SBR 2010)				
	V. Poor	Poor	Fair	Good	TOTAL
Area (m^2)	5666	93	187	21	5967
Area (%)	95%	1.5%	3%	0.5%	100%

Area Likely to Reach "Good" Condition by 2020

R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020	R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020
Bronte to Tamarama				Z14a	19	Fair	19
T3a	347	V Poor	250	Z14a	1096	V Poor	800
T3b	157	V Poor	70	Z14b	19	V Poor	0
T5	158	V Poor	30	Z14c	197	V Poor	0
T7	32	V Poor	0	South Bondi			
Z15a	173	V Poor	90	Z12a	3	V Poor	0
Z15b	156	V Poor	50	Z12b	10	Good	10
Gaerloch to South Bondi				Z12c	178	V Poor	178
Z12d	39	V Poor	39	Z11a	203	V Poor	50
Z13a	60	V Poor	0	Z11a	4	Fair	4
Z13b	32	Poor	0	Z11b	12	Good	0
Z13c	13	Fair	13	Z11c	99	Fair	60
Z13d	276	V Poor	100	Z11d	121	V Poor	40
Z13e	25	Poor	25	Sam Fiszman Park			
Z13e	58	V Poor	30	Z9	271	V Poor	0
Z13f	112	V Poor	0	Douglas Pde			
Z13g	1	V Poor	0	Z8	37	Poor	37
Z13h	72	V Poor	0	Kimberley St			
Z13i	10	Fair	10	Z5	65	V Poor	0
Z13i	11	Fair	11	Clarke, Jensen, MacDonald, Tower Res.			
Z13i	19	Fair	19	D1a	274	V Poor	75
Z13i	1076	V Poor	800	Z1	477	V Poor	150
Z13j	32	V Poor	0	Z2	11	V Poor	0
Z14a	11	Fair	11	Z3	2	V Poor	0

Area Good Condition 2010: 0.5% Area Good Condition 2020: 50% (2971m^2)

Flora / Fauna Habitats

Flora and fauna habitats supported by the Cliff-top Remnants are diverse as a result of the wide ranging area within which the remnants occur. Low open and closed shrubs and grasslands provide a wide range of foraging and sheltering resources for birds, reptiles and frogs. A range of wet and dry substrates provide opportunities for a wide range flora species to colonise and become established.

Bush regeneration works will improve a wide range of these habitats resulting in increased opportunities and likelihood of survival for native flora and fauna species.

Remnant Restoration Goals & Associated Tasks

Target weeding to mitigate weed invasion and its associated impacts on the Cliff-top Remnants is the highest priority for vegetation management works outlined in the BAP. It is unlikely that restoration of remnants to good condition will contribute significantly to the Waverley EAP3 target of 40% of remnant bushland in Good vegetation condition by 2020, and therefore the majority of efforts should be concentrated to ensure Cliff-top Remnants are not lost.

Bush regeneration works are recommend for patches Z13i and Z14a, as they are of significant size and their improvement will contribute to the EAP 40% goal.

Regular targeted weed control is to be undertaken within the remaining remnants outlined in this BAP to ensure the EAP3 target of ensuring no loss from 2009/2020 levels of remnant vegetation (although at least 2 patches have been assessed as loss at the time of preparation of this BAP).

Weed control works should target those species posing the highest threats to the survival of individual remnants and will generally consist of vine weeds, highly invasive shrubs and groundcovers and noxious species. Target weeding should be timed such that individual species are prevented from setting seed, and works should focus on alleviating specific pressures felt by remnant patches from exotic species.

The following patches are at highest risk of being lost (within 2-3 years) and should be highest priority for available resources (Priority 1);

- T5, Z2, Z11b, Z13a, Z13b, Z13h, Z13g, Z13f, Z15b

The next group of remnants are likely to persist but have significant weed incursions (Priority 2);

- D1a, T3b, Z1, Z5, Z8, Z9, Z11a, Z11d, Z12c, Z12d, Z13c, Z13d, Z13e, Z15a

These final remnants are likely to survive with only limited input of resources, occasional target weeding and noxious weed control are recommended (Priority 3);

- T3a, Z11c, Z12a, Z12b

T7, Z13j, Z3 are considered no longer present and hence allocation of resources is not advised.

Flora Species (SBR 2010)

Family	Genus species	Common Name	Family	Genus species	Common Name
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair	Juncaginaceae	*Triglochin striatum*	Streaked Arrowgrass
Aizoaceae	*Carpobrotus glaucescens*	Pigface	Lamiaceae	*Westringia fruticosa*	Coastal Rosemary
Aizoaceae	*Tetragonia tetragonioides*	New Zealand Spinach	Lobeliaceae	*Lobelia anceps*	
Asteraceae	*Sonchus hydrophilus*	Native Sowthistle	Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush
Commelinaceae	*Commelina cyanea*	Scurvy Weed	Myrtaceae	*Baeckea imbricata*	
Cyperaceae	*Baumea juncea*		Myrtaceae	*Melaleuca armillaris*	Bracelet Honey-myrtle
Cyperaceae	*Carex pumila*		Phormiaceae	*Dianella congesta*	
Cyperaceae	*Cyperus polystachyos*		Poaceae	*Dichelachne crinita*	Longhair Plumegrass
Cyperaceae	*Isolepis cernua*	Nodding Club-rush	Poaceae	*Imperata cylindrica*	Blady Grass
Cyperaceae	*Ficinia nodosa*	Knobby Club-rush	Poaceae	*Lachnagrostis billardierei*	
Ericaceae	*Brachyloma daphnoides*	Daphne Heath	Poaceae	*Lachnagrostis filiformis*	
Ericaceae	*Monotoca elliptica*	Tree Broom-heath	Poaceae	*Paspalum vaginatum*	Salt-water Couch
Faboideae	*Dillwynia rupestris*		Poaceae	*Sporobolus virginicus*	Sand Couch
Mimosoideae	*Acacia longifolia*	Syd Golden Wattle	Poaceae	*Zoysia macrantha*	Prickly Couch
Juncaceae	*Juncus kraussii*	Sea Rush			

No specific fauna species records exist for the Cliff-top Remnants.

Recommended Revegetation Species (B-Buffer only; R-Remnant only; BR-Buffer & Remnant)

Genus species	Common Name	Genus species	Common Name	Genus species	Common Name
Acacia longifolia	Sydney Golden Wattle	*Ficinia nodosa*	Knobby Club-rush	*Monotoca elliptica*	Tree Broom-heath
Baeckea imbricata		*Imperata cylindrica*	Blady Grass	*Paspalum vaginatum*	Salt-water Couch
Banksia ericifolia ssp ericifolia	Heath-leaved Banksia	*Juncus kraussii ssp*	Sea Rush	*Pimelea linifolia ssp linifolia*	Slender Rice Flower
Baumea juncea		*Juncus usitatus*	Common Rush	*Spinifex sericeus*	Hairy Spinifex
Carpobrotus glaucescens	Pigface	*Leptospermum laevigatum*	Coast Teatree	*Sporobolus virginicus*	Sand Couch
Dianella caerulea	Blue Flax-lily	*Leucopogon juniperinus*	Prickly Beard-heath	*Tetragonia tetragonioides*	New Zealand Spinach
Dichelachne crinita	Longhair Plumegrass	*Lomandra longifolia*	Spiny-headed Mat-rush	*Westringia fruticosa*	Coastal Rosemary
Epacris longiflora	Fuchsia Heath	*Melaleuca nodosa*		*Zoysia macrantha*	Prickly Couch

Suitability of species for Buffer / Remnant Revegetation is to be based on assessment of the requirements of each individual patch of remnant vegetation see *Appendix Report (TEC 2014)* for details.

Type 1 Buffer Revegetation – Low diversity graminoid dominant buffer revegetation
Type 2 Buffer Revegetation – Higher diversity, multiple plant forms buffer / non-buffer revegetation
See Appendix Report (TEC 2014) for details

Recommendations for Future Biodiversity Actions and Means of Achieving EAP3 Objectives

- Vegetation Condition Mapping is to be updated in 2015 with consideration given to the re-classification of remnants' 'Condition' as outlined in the Appendix Report – Waverley BAPs (TEC 2014). Update of mapping in 2015 will assess progress of restoration works towards the EAP3 targets and should be repeated every 24 months to 2019, followed by final assessment at 2020.
- Assessment of revegetation requirements surrounding and within each of the Cliff-top Remnants should be undertaken at the outset of management works, and again following 24 months progress of this Plan.

WAVERLEY CLIFFTOP REMNANTS Biodiversity Action Plan - Actions Table

Remnant Code	Management Action	Responsibility	Performance Criteria	Timing	**Total Cost of Mgmt Action (ex GST)** See spreadsheet for more info and breakdown
Z13i & Z14a – Gaerloch to South Bondi	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • Remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 12 months of targeted works • Works undertaken no less than quarterly to 2020	$ 51,100.00
Priority 1 Remnants - T5, Z2, Z11b, Z13a, Z13b, Z13h, Z13g, Z13f, Z15b **See above.**	Targeted Weed Treatments	Waverley Council engaged Bush Regeneration Contractor	Regular weed control to suppress exotic species within the remnant. • Weed control visits to be undertaken within all Priority 1 remnants within 3 months of commencement of works outlined in this BAP • No less than 1 weed control treatment within all Priority 1 remnants over any 2 month period for the initial 12 months of works outlined in this BAP • No less than one target weed treatment for all Priority 1 remnants per quarter to 2020. • No loss of Priority 1 remnants.	• As outlined adjacent	$ 9,720.00 Months 1-12 $ 32,400.00 Months 13-72
Priority 2 Remnants - D1a, T3b, Z1, Z5, Z8, Z9, Z11a, Z11d, Z12c, Z12d, Z13c, Z13d, Z13e, Z15a **See above.**	Targeted Weed Treatments	Waverley Council engaged Bush Regeneration Contractor	Regular weed control to suppress exotic species within the remnant. • Weed control visits to be undertaken within all Priority 2 remnants within 3 months of commencement of works outlined in this BAP • No less than one target weed treatment for all Priority 2 remnants per quarter to 2020. • No loss of Priority 2 remnants.	• As outlined adjacent	$ 77,760.00
Priority 3 Remnants - T3a, Z11c, Z12a, Z12b **See above.**	Targeted Weed Treatments	Waverley Council engaged Bush Regeneration Contractor	Regular weed control to suppress exotic species within the remnant. • Weed control visits to be undertaken within all Priority 3 remnants within 6 months of commencement of works outlined in this BAP • No less than one target weed treatment for all Priority 3 remnants per 6 month period to 2020. • No loss of Priority 3 remnants.	• As outlined adjacent	$ 17,280.00
All areas	Ecological Monitoring	Waverley Council engaged Vegetation Management Consultant	Undertake regular monitoring visits to ensure bush regeneration works are progressing within the scope of this Action Plan and the specific project contract. • Establish fixed photo monitoring points within each remnant • Establish fixed quadrat or transect survey locations to assess weed cover abundance and native regeneration • Provide a report on the findings to Waverley Council	Monitoring events to occur at regular intervals to 2020. • Monitoring surveys and reports to be undertaken annually and provided to Council	$ 28,600.00
n/a	Project Admin	Bush Regeneration Contractor	n/a	Throughout Project	$ 2,520.00
				TOTAL	**$ 219,380.00**

Diamond Bay Reserve Biodiversity Action Plan 2014-20

Map No: BAP_04
Prepared for: Waverley Council
Prepared by: C Wharfe - TEC
Date: May 2014
Plan Status: FINAL

Bushland Remnant

- D1b
- D1c
- D2a
- D2b
- D3a
- D3b
- D3c

Revegetation

- Buffer Planting
- Existing Buffer

Vegetation Condition

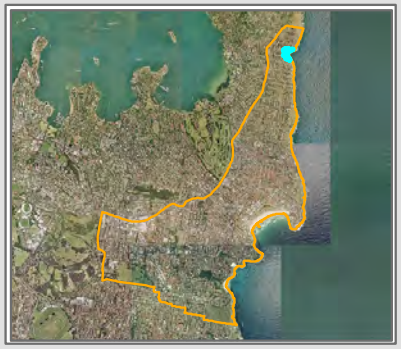
- Good
- Fair
- Poor
- Very Poor

0 12.5 25 50 Meters

Approx.

N

Data Source:
Total Earth Care
Sydney Bush Regen Company
c/o Waverely Council
NearMap



D1b – Sea-cliff Heath

Management Actions: Bush Regeneration

Management Tasks:

- Consolidation of previously worked areas, continued bush regeneration works targeting re-occurring exotic species.
- Buffer planting as outlined adjacent between the heath vegetation and turf to the north
- Establishment of differentiated edge between remnant and non-remnant weedy vegetation along the western boundary.
- Progression of works from consolidated areas into areas of lower condition. Initially targeting noxious and vine weeds, followed by highly fecund woody weeds and smothering groundcovers, then secondary treatments, shrubs and all exotic seedlings.
- Consolidation of newly treated areas prior to progression into adjacent areas of low condition.
- Static rope lines may be required to ensure contractor safety, anchoring lines from vehicles parked within adjacent turfed areas may be most suitable.

D1c – Sea-cliff Sedgeland c) Ficinia nodosa

Management Action: Target Weed Treatments

Management Tasks:

- Regular herbicide treatment and hand removal of exotic species.
- Consider surrounding cliff-face weed removal if long-term improvements are desired
- Remnant is unlikely to ever reach Good Condition, and should be managed so the remnant is not "Lost"

D2a – Sea-cliff Heath

Management Action: Target Weed Treatments

Management Tasks:

- Establish location of remnant vegetation (small patch of *Melaleuca armillaris* and *Wesrtringea fruticosa* above scattered native goundcover species)
- Regular removal of exotic species surrounding remnant natives.
- Establish buffer zone surrounding remnant native to reduce weed encroachment.
- Remnant is unlikely to ever reach Good Condition, and should be managed so the remnant is not "Lost"

D2b – Sea-cliff Heath

Management Action: Bush Regeneration

Management Tasks:

- Consolidation of previously worked areas, continued bush regeneration works targeting re-occurring exotic species.
- Establishment of differentiated edge between remnant and non-remnant weedy vegetation along the north-western boundary.
- Progression of works from consolidated areas into areas of lower condition. Initially targeting noxious and vine weeds, followed by highly fecund woody weeds and smothering groundcovers, then secondary treatments, shrubs and all exotic seedlings.
- Consolidation of newly treated areas prior to progression into adjacent areas of low condition.
- Static rope lines may be required to ensure contractor safety, anchoring lines from vehicles parked within adjacent turfed areas may be most suitable.
- Buffer planting as outlined adjacent to prevent run-off carrying sediments, exotic propagules and nutrients from entering remnant vegetation.

D3a – Sea-cliff Heath

Management Action: Target Weed Treatments

Management Tasks:

- Regular targeted treatment of exotic groundcover species beneath remnant native shrubs
- Install sediment fencing under boardwalk to act as a physical barrier for exotic propagules brought down slope from adjacent weedy areas.
- Static rope lines are required to ensure contractor safety, anchoring lines from adjacent boardwalk may be most suitable.

D3b – Sea-cliff Sedgeland b) Baumea juncea

Management Action: Target Weed Treatments

Management Tasks:

- Regular herbicide treatment and hand removal of exotic species.
- Establish buffer zone surrounding remnant native to reduce weed encroachment.
- Remnant is unlikely to ever reach Good Condition, and should be managed so the remnant is not "Lost"

D3c – Sea-cliff Sedgeland c) Ficinia nodosa

Management Action: Target Weed Treatments

Management Tasks:

- Regular herbicide treatment and hand removal of exotic species.
- Static rope lines are required to ensure contractor safety, anchoring lines from adjacent handrail may be most suitable (though not always available).

Supplementary planting may be required within the Diamond Bay vegetation remnants should regeneration success be poor following at least 18 months of vegetation management works. Small "at risk" remnants (D1c, D2a) may require earlier supplementary planting following completion of successful weed control.

DIAMOND BAY RESERVE Biodiversity Action Plan 2014 - 2020

Remnant Description

Within Diamond Bay Reserve, seven (7) patches of remnant vegetation persist on the sea-cliff and surrounding slopes. Two of the remnants are of considerable size at just under 3000m² and 4000m² respectively. With a total area of almost 8000m² Diamond Bay Reserve supports the largest area of remnant native vegetation considered in this group of Biodiversity Action Plans.

Vegetation condition is generally low and the majority was assessed as Very Poor by SBR (2010). Native species persist within all remnant patches although there is a variable level of negative vectors impacting on each of the patches. Weed invasion is the most common threat to the survival of the bushland with exotic groundcovers such as Gazania, Asparagus Fern and Pennywort among the most abundant.

Despite the high level of exotic species invasion the two largest patches appear to have retained natural resilience and each support a relatively diverse range of native shrubs and groundcover plants that would benefit greatly from concentrated bush regeneration activities.

It is expected that, with ongoing bush regeneration and environmental management works, the majority of the remnant vegetation will reach the EAP3 desired threshold of Good Vegetation Condition by 2020. The remaining vegetation will require ongoing management and targeted weed control.

D1b – Remnant vegetation occurs on-top, and on the face of the high sea-cliffs. Species richness in native shrubs, grasses and herbs is high and there is a considerable amount of habitat for native plants to disperse into. Exotic species occur at high abundance throughout the remnant with NZ Christmas Bush, Mirror Bush, Norfolk Island Hibiscus, Asparagus Fern, Gazania and Morning Glory among the most common.

The natural resilience appears to have remained high and an area of vegetation in Fair condition occurs to the western end of the remnant. Regular methodical bush regeneration works will improve the overall condition of this patch of native bushland significantly.

D1c – A small patch of native sedges exists in a cliff-soak at the western end of the northern incised gully to/from sea-level. The remnant vegetation is surrounded by exotic shrubs and grasses and will require regular weed removal if it is to persist.

D2a – Surrounded by non-remnant native and exotic vegetation a small patch of *Melaleuca armillaris, Westringia fruticosa,* and native sedges persists above the northern gully. Threats to the remnant are mainly in the form of exotic species invasion with Asparagus Fern totally covering the surrounding area.

Alleviation of the negative impacts such as smothering and resource competition through targeted and reoccurring bush regeneration / weed control works will greatly improve the condition and outlook of this small pocket of native species.

D2b – The largest patch of remnant vegetation within Diamond Bay Reserve supports the 2nd most native species, although it is considerably lower in species richness than D1b at 12 versus 29. The lower species richness recorded within D2b is likely to be, in-part, a result of the highly abundant Asparagus Fern and Gazania within the habitat supported by the remnant. Woody weeds and exotic grasses also occupy a large percentage of the available growth medium interspersed between the exposed sandstone.

There are large patches of native vegetation and in a number of areas native species can be observed persisting despite high levels of competition by smothering exotics. Methodical weed control utilising best practice bush regeneration techniques is recommended and is likely to result in significant improvements in condition.

Buffer planting within the steeper areas of the turfed Reserve is also recommended to reduce run-off and its associated negative pressures from being realised by the threatened vegetation remnant.

D3a – Remnant vegetation occurs as thin strip of scattered native heath plants on the high cliff-tops with an understorey dominated by exotic species encroaching from upslope (south) and non-native shrubs and vines spread throughout. Asparagus Fern, Gazania, exotic Couch Grass, Buffalo Grass and Pennywort are present within the native vegetation and are a result of their presence on the degraded and heavily weed infested batter directly to the south. NZ Christmas Bush and Japanese Honeysuckle are also impacting on the native vegetation and threaten the survival of the remnant.

D3b – A patch of Sea-cliff Sedgeland surrounded on all sides by highly degraded and weed infested waterlogged soils and marsh vegetation. Native species persist mainly as *Baumea juncea, Ficinia nodosa* and *Typha orientalis* with native shrubs occurring infrequently. The most abundant exotic species is Pennywort which is completely established and considered intractable, other exotics include water tolerant grasses and sedges, vines and occasional woody weeds.

Impacts on the remnant vegetation include encroachment of exotic species from all sides, previous dumping has altered the chemical composition of the substrate and is compounded by the urban run-off patterns from the surrounding residential properties. A sediment fence should be installed and maintained above the remnant vegetation to provide a physical barrier to reduce negative impacts on the vegetation.

Significant improvements in ecological condition are unlikely and establishment of a buffer zone surrounding the native vegetation and regular target weeding are recommended to prevent the loss of the remnant patch.

D3c – Patches of *Ficinia nodosa* and Saltwater Couch with other scattered native sedgeland species occur on top of the sea-cliffs between the boardwalk and the cliff-edge. Exotic species are numerous and include Pellitory, Asparagus Fern, Pennywort, Mirror Bush, Bitou Bush, Gazania and Norfolk Island Hibiscus. Regular treatment with broadleaf selective herbicide is likely to successfully treat many of the exotic shrubs, and hand removal with the use of static safety lines could greatly reduce the occurrence of the remaining exotic vegetation.

Vegetation Communities (SBR 2010):

Sea-cliff Heath

Open to closed low growing community with <10 to <70% canopy FPC, characteristic species include *Baeckea imbricata, Banksia ericifolia, Melaleuca armillaris, Melaleuca nodosa, Westringia fruticosa*. Community distributed within 50m of sea-cliffs on skeletal sands to sand lenses on sandstone, drainage is often impeded.

Sea-cliff Sedgeland b) *Baumea juncea*

Low open to closed vegetation community with >10 to <70% canopy PFC, characteristic species listed as *Baumea juncea* dominant with other sedges present. Community occurrence is within 20m of sea-cliffs on sand lenses on sandstone, drainage is often impeded.

Sea-cliff Sedgeland c) *Ficinia nodosa*

Low open vegetation community with <10 to <30% canopy PFC, characteristic species listed as *Ficinia nodosa* dominant with other sedges present. Community occurrence is within 20m of sea-cliffs on skeletal sands to sand lenses on sandstone, often on modified soil.

SEPP 19 Bushland

Approximately 430m² of Diamond Bay bushland is considered SEPP 19 Bushland in Urban Areas vegetation (SBR 2010).

Waverley Council is obliged to protect and preserve the bushland because of its value as part of natural heritage, its aesthetic value and its value as a recreational, educational and scientific resource, and must consider impacts upon it when assessing all relevant Development Applications.

Remnant Significance

Combined, Diamond Bay vegetation supports the 2nd largest area of remnant bushland in the LGA (behind the York Road Remnant), it contains the 3rd most indigenous plant species surveyed by SBR (2010) and of those species six (6) are considered rare in Waverley (SBR 2010).

Patch D1b supports populations of *Paspalidium distans, Juncus krausii, Gahnia* and *Olearia tomentosa* all found in less than 3 other places in the LGA. The 12 species supported by patch D2b was well over the median number of species of other vegetation patches studied by SBR (2010) and SEPP 19 Bushland occurs at only 8 other areas within the LGA.

Remnant Condition (SBR 2010)

	Remnant Condition 2010 (SBR 2010)				
	V. Poor	Poor	Fair	Good	TOTAL
Area (m²)	7371	282	149	-	7802
Area (%)	94%	4%	2%	0%	100%

Area Likely to Reach "Good" Condition by 2020

R'nant Code	Area (m²)	2010 Cond'n	Area (m²) Good 2020	R'nant Code	Area (m²)	2010 Cond'n	Area (m²) Good 2020
D1b.1	2651	V Poor	2651	D2b	3985	V Poor	3985
D1b.2	149	Fair	149	D3a	269	V Poor	0
D1b.3	101	Poor	101	D3b.1	181	Poor	0
D1c	7	V Poor	0	D3b.2	92	V Poor	0
D2a	21	V Poor	0	D3c	73	V Poor	0

Area Good Condition 2010: 0% Area Good Condition 2020: 88% (6886m²)

Flora / Fauna Habitats

Remnants vegetation at Diamond Bay Reserve is considered to support moderate levels of habitat for native flora and fauna. There is considerable diversity in the vegetation present across the Reserve from low open heathlands with numerous rock outcroppings, to rock crevasses and areas of more dense and taller vegetation, and habitats occur within areas of both permanent and ephemeral moist substrates. Although the majority of the habitat across the site is in low condition, this diverse range provides for a diverse range of fauna species.

Flora species habitat is also considered diverse but the majority is currently occupied by exotic species.

Bush regeneration works will remove the weeds and alleviate other external pressures on the natural habitats supported by the remnant bushland which in turn will improve the resources available for native flora and fauna species.

Remnant Restoration Goals & Associated Tasks

Bush regeneration works should progress from areas of higher ecological quality towards more degraded areas initially targeting species most damaging to the health of the native vegetation, followed by species occupying significant areas of habitat that could support native plants.

Works are to be methodical and treated areas are to be stable, in secondary / maintenance phase, before moving on to adjacent areas and undertaking primary works.

In areas where weed removal has resulted in a lack of vegetation cover soil scarification and brush matting with native plant material should be undertaken to facilitate germination, provide protection to seedlings and prevent erosion as a result of exposed. Replacement of exotic shrubs with native species grown from remnant provenance seed may also be required if regeneration of shrubs is unsuccessful.

Revegetation of the area surrounding remnant D1b and D2b is to be undertaken to establish a buffer zone around the remnant. Revegetation works should be undertaken as follows;

- Spray out all turf grass within the areas illustrated, planting is to take place mainly in steeper areas where views are less likely to be obstructed.
- Install terracing (as required), native leaf mulch to 75mm depth following successful kill of turf, and allow to settle.
- Type 1 Buffer Revegetation adjacent to D1b and D2b
- Type 2 Buffer Revegetation west of existing buffer vegetation from D3b
- Water planting in, and as frequently as required to establishment.

Maintenance of recent buffer revegetation established north and west of remnant D3b is also to be undertaken as part of management works.

Revegetation may also be required within the remnant vegetation patches should passive regeneration works not result in sufficient increases in native species abundance and cover. See Appendix Report (TEC 2014) for details.

Investigation is required into stormwater / swimming pool-water (wastewater) inputs into remnant D3b, and undertake mitigation as required.

Flora Species (SBR 2010)

Genus species	Common Name	Genus species	Common Name	Genus species	Common Name
Adiantum aethiopicum	Common Maidenhair	*Epacris longiflora*	Fuchsia Heath	*Austrodanthonia setacea*	
Carpobrotus glaucescens	Pigface	*Monotoca elliptica*	Tree Broom-heath	*Austrodanthonia sp*	
Platysace lanceolata	Shrubby Platysace	*Breynia oblongifolia*	Coffee Bush	*Deyeuxia quadriseta*	
Xanthosia pilosa	Woolly Xanthosia	*Acacia longifolia* subsp *longifolia*	Sydney Golden Wattle	*Dichelachne crinita*	Longhair Plumegrass
Olearia tomentosa	Toothed Daisy-bush	*Acacia suaveolens*	Sweet Wattle	*Entolasia marginata*	Bordered Panic
Blechnum ambiguum		*Gleichenia rupestris*		*Eragrostis brownii*	Brown's Lovegrass
Centrolepis fascicularis		*Juncus kraussii*	Sea Rush	*Lachnagrostis billardierei*	
Commelina cyanea	Scurvy Weed	*Juncus pallidus*		*Lachnagrostis filiformis*	
Cyathea cooperi	Straw Treefern	*Westringia fruticosa*	Coastal Rosemary	*Paspalidium distans*	
Baumea juncea		*Lobelia anceps*		*Themeda australis*	Kangaroo Grass
Cyperus polystachyos		*Lomandra longifolia*	Spiny-headed Mat-rush	*Zoysia macrantha*	Prickly Couch
Gahnia (siberiana?)	Red-fruit Saw-sedge	*Baeckea imbricata*		*Banksia ericifolia* subsp *ericifolia*	Heath-leaved Banksia
Isolepis cernua	Nodding Club-rush	*Melaleuca armillaris*	Bracelet Honey-myrtle	*Hakea teretifolia*	Needlebush
Ficinia nodosa	Knobby Club-rush	*Melaleuca nodosa*		*Smilax glyciphylla*	Sweet Sarsaparilla
Lepidosperma (concavum?)		*Dianella congesta*		*Pimelea linifolia ssp linifolia*	Slender Rice Flower
Histiopteris incisa	Bat's Wing Fern	*Dianella revoluta*	Paroo Lily	*Typha orientalis*	Broadleaf Cumbungi
Hypolepis muelleri	Harsh Ground Fern	*Pittosporum undulatum*	Sweet Pittosporum		

Fauna Species (AMBS 2011)

Genus species	Common Name	Genus species	Common Name	Genus species	Common Name
Anthochaera carunculata	Red Wattlebird	*Eulamprus quoyii*	Eastern Water-skink	*Pycnonotus jocosus*	Red-whiskered Bulbul
Anthochaera chrysoptera	Little Wattlebird	*Hirundo neoxena*	Welcome Swallow	*Rhipidura leucophrys*	Willie Wagtail
Cacatua galerita	Sulphur-crested Cockatoo	*Lampropholis delicata*	Dark-flecked Garden Sunskink	*Saiphos equalis*	Three-toed Skink
Chalinolobus gouldii	Gould's Wattled Bat	*Malurus cyaneus*	Superb Fairy-wren	*Strepera graculina*	Pied Currawong
Columba livia	Rock Dove	*Manorina melanocephala*	Noisy Miner	*Streptopelia chinensis*	Spotted Turtle-Dove
Coracina novaehollandiae	Black-faced Cuckoo-shrike	*Ocyphaps lophotes*	Crested Pigeon	*Trichoglossus haematodus*	Rainbow Lorikeet
Corvus coronoides	Australian Raven	*Oedura lesueurii*	Lesueur's Velvet Gecko	*Trichosurus vulpecula*	Common Brushtail Possum
Eudynamys orientalis	Pacific Koel	*Phyllurus platurus*	Broad-tailed Gecko	*Zosterops lateralis*	Silvereye

Recommended Revegetation Species (B-Buffer only; R-Remnant only; BR-Buffer & Remnant)

Family	Genus species	Common Name	Family	Genus species	Common Name
Acacia longifolia **(BR)**	Sydney Golden Wattle	*Dillwynia glaberrima* **(R)**		*Leptospermum polygalifolium* **(R)**	Yellow Tea-tree
Acacia suaveolens **(R)**	Sweet Wattle	*Entolasia marginate* **(BR)**	Bordered Panic	*Leucopogon juniperinus* **(R)**	Prickly Beard-heath
Baeckea imbricata **(R)**		*Epacris longiflora* **(R)**	Fuchsia Heath	*Lomandra longifolia* **(BR)**	Spiny-headed Mat-rush
Banksia serrata **(R)**	Old-man Banksia	*Ficinia nodosa* **(BR)**	Knobby Club-rush	*Melaleuca armillaris* **(R)**	Bracelet Honey-myrtle
Baumea juncea **(BR)**		*Grevillea speciosa* **(R)**	Red Spider Flower	*Microlaena stipoides* **(B)**	Weeping Grass
Bossiaea heterophylla **(R)**	Variable Bossiaea	*Hakea teretifolia* **(R)**	Needlebush	*Monotoca elliptica* **(R)**	Tree Broom-heath
Callistemon linearis **(R)**		*Imperata cylindrical* **(BR)**	Blady Grass	*Olearia tomentose* **(R)**	Toothed Daisy-bush
Carpobrotus glaucescens **(BR)**	Pigface	*Juncus usitatus* **(BR)**	Common Rush	*Pimelea linifolia* subsp *linifolia* **(R)**	Slender Rice Flower
Dianella caerulea **(B)**	Blue Flax-lily	*Kunzea ambigua* **(BR)**	Tick Bush	*Westringia fruticosa* **(BR)**	Coastal Rosemary
Dichelachne crinita **(BR)**	Longhair Plumegrass	*Leptospermum laevigatum* **(BR)**	Coast Teatree	*Xanthosia pilosa* **(R)**	Woolly Xanthosia

Type 1 Buffer Revegetation – Low diversity graminoid dominant buffer revegetation
Type 2 Buffer Revegetation – Higher diversity, multiple plant forms buffer / non-buffer revegetation
See Appendix Report (TEC 2014) for details

Recommendations for Future Biodiversity Actions and Means of Achieving EAP3 Objectives

- Vegetation Condition Mapping is to be updated in 2015 with consideration given to the re-classification of remnants' 'Condition' as outlined in the Appendix Report – Waverley BAPs (TEC 2014). Update of mapping in 2015 will assess progress of restoration works towards the EAP3 targets and should be repeated every 24 months to 2019, followed by final assessment at 2020.
- Revegetation within remnant vegetation may be required should passive works not result in significant improvements in ecological condition. Refer to *Appendix Report (TEC 2014)* for details.

DIAMOND BAY Biodiversity Action Plan - Actions Table

Remnant Code	Management Action	Responsibility	Performance Criteria	Timing	Total Cost of Mgmt Action (ex GST) See spreadsheet for more info and breakdown
D1b	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • ≥50% of remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • Remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 12 months of targeted works • Works undertaken no less than quarterly to 2020	$ 38,500.00
	Buffer Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 1300m^2 of low growing buffer revegetation undertaken at 4 plants/m^2 (as required) • Revegetation works completed in stages over 0-12 months from the commencement of vegetation management actions • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 23,079.00
D1c	Targeted Weed Treatments	Waverley Council engaged Bush Regeneration Contractor	Regular weed control to suppress exotic species within the remnant. • Establish maintained buffer zones within 3 months of commencement of management activities • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair at 2020 Condition Mapping update	Weed treatment works to progress regularly to 2020. • Works undertaken no less than quarterly to 2020	$ 4,320.00
D2a	Targeted Weed Treatments	Waverley Council engaged Bush Regeneration Contractor	Regular weed control to suppress exotic species within the remnant. • Establish maintained buffer zones within 3 months of commencement of management activities • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair at 2020 Condition Mapping update	Weed treatment works to progress regularly to 2020. • Works undertaken no less than quarterly to 2020	$ 4,320.00
D2b	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • ≥50% of remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • Remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 12 months of targeted works • Works undertaken no less than quarterly to 2020	$ 38,500.00
	Buffer Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 1700m^2 of low growing buffer revegetation undertaken at 4 plants/m^2 (as required) • Revegetation works completed in stages over 0-24 months from the commencement of vegetation management actions • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 30,980.00
D3a	Targeted Weed Treatments	Waverley Council engaged Bush Regeneration Contractor	Regular weed control to suppress exotic species within the remnant. • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair at 2020 Condition Mapping update	Weed treatment works to progress regularly to 2020. • Works undertaken no less than quarterly to 2020	$ 4,320.00
D3b	Targeted Weed Treatments	Waverley Council engaged Bush Regeneration Contractor	Regular weed control to suppress exotic species within the remnant. • Establish maintained buffer zones within 3 months of commencement of management activities • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair at 2020 Condition Mapping update	Weed treatment works to progress regularly to 2020. • Works undertaken no less than quarterly to 2020	$ 8,640.00
	Stormwater / Wastewater Management	Waverley Council or engaged Contractor	Implement actions outlined in Stormwater Management Plan (to be prepared)	• As outlined in SMP	Undetermined
D3c	Targeted Weed Treatments	Waverley Council engaged Bush Regeneration Contractor	Regular weed control to suppress exotic species within the remnant. • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair at 2020 Condition Mapping update	Weed treatment works to progress regularly to 2020. • Works undertaken no less than quarterly to 2020	$ 4,320.00
Various	Supplementary Plantings	Waverley Council engaged Bush Regeneration Contractor	Install 1000 native tubsestock within remnant vegetation if required as a result of low levels of natural regeneration following passive and active management works	• Following no less than 18 moths of vegetation management works	$ 7,280.00
All areas	Ecological Monitoring	Waverley Council engaged Vegetation Management Consultant	Undertake regular monitoring visits to ensure bush regeneration works are progressing within the scope of this Action Plan and the specific project contract. • Establish fixed photo monitoring points within each remnant • Establish fixed quadrat or transect survey locations to assess weed cover abundance and native regeneration • Provide a report on the findings to Waverley Council	Monitoring events to occur at regular intervals to 2020. • Monitoring surveys and reports to be undertaken annually and provided to Council	$ 14,520.00
n/a	Project Admin	Bush Regeneration Contractor	n/a	Throughout Project	$ 2,520.00
				TOTAL	**$ 181,299.00**

Eastern Reserve
Biodiversity Action Plan 2014-20

Map No: BAP_05
Prepared for: Waverley Council
Prepared by: C Wharfe - TEC
Date: May 2014
Plan Status: FINAL

Bushland Remnant

- Ea
- Eb
- Ec
- Ed

Revegetation

- Connectivity
- Buffer

Vegetation Condition

- Good
- Fair
- Poor
- Very Poor

0 15 30 60 Meters

N

Data Source:
Total Earth Care
Sydney Bush Regen Company
c/o Waverely Council
NearMap

Ea – Sea-cliff Sedgeland c) Ficinia nodosa

Management Action: Bush Regeneration

Management Tasks: Sea-cliff Sedgeland c) Ficinia nodosa

- Establish maintenance edge between remnant vegetation (and surrounding habitat) and turfed area.
- Bush regeneration works targeting removal of Buffalo Grass, Gazania, Mirror Bush, Pennywort and Asparagus Fern.
- Progress outward from areas where native grasses/sedges/groundcovers are most common into areas where exotics dominate.
- Undertake buffer revegetation of 2-3m wide strip along the length of the remnant.
- Static rope lines may be required to ensure contractor safety, anchoring lines from vehicles parked within adjacent turfed areas may be most suitable.

Eb – Sea-cliff Sedgeland c) Ficinia nodosa

Management Action: Bush Regeneration

Management Tasks:

- Establish maintenance edge between remnant vegetation (and surrounding habitat) and turfed area.
- Bush regeneration works targeting removal of Buffalo Grass, Gazania, Mirror Bush, Pennywort and Asparagus Fern
- Progress outward from areas where native grasses/sedges/groundcovers are most common into areas where exotics dominate.
- Undertake buffer revegetation of 2-3m wide strip from northern extent of remnant to edge of adjacent Ec remnant.
- Static rope lines may be required to ensure contractor safety, anchoring lines from vehicles parked within adjacent turfed areas may be most suitable.

Ec – Sea-cliff Heath

Management Action: Bush Regeneration

Management Tasks:

- Consolidation of previously worked areas, continued bush regeneration works targeting re-occurring exotic species.
- Establishment of defined edge between remnant vegetation and turf in the northern section, and weedy vegetation in the south. Maintain and increase physical boundary (sediment fence) surrounding treated areas.
- Progression of works from consolidated areas into areas of lower condition. Initially targeting noxious and vine weeds, followed by highly fecund woody weeds and smothering groundcovers, then secondary treatments and shrubs and all exotic seedlings.
- Consolidation of newly treated areas prior to progression into adjacent areas of low condition.
- Staged weed control and revegetation of highly weed infested areas directly south and west of remnant vegetation producing a constant supply of exotic vegetation and propagules entering the remnant.
- Static rope lines may be required to ensure contractor safety, anchoring lines from vehicles parked within adjacent turfed areas, or wooden boardwalk may be most suitable.

Ed – Sea-cliff Heath

Management Action: Bush Regeneration

Management Tasks:

- Consolidation of previously worked areas, continued bush regeneration works targeting re-occurring exotic species.
- Establishment of defined edge between remnant vegetation and turf in the southern section, and weedy vegetation in the north.
- Consolidation of newly treated areas prior to progression into adjacent areas of low condition.
- Consider pile burning within area of over-abundant *Westringia fruticosa* to stimulate regeneration and promote floristic diversity
  - Should burns be unable to proceed, alternatives are outlined in the Appendix Report (TEC 2014)
- Static rope lines may be required to ensure contractor safety, anchoring lines from vehicles parked within adjacent turfed areas, or wooden boardwalk may be most suitable.

Stormwater – Various

- Implement actions outlined in Stormwater Management Plan (to be prepared)

total earth care

EASTERN RESERVE Biodiversity Action Plan 2014 - 2020

Remnant Description

Remnant vegetation at Eastern Reserve, Dover Heights, occurs as a liner strip of Sea-cliff Sedgeland and Sea-cliff Heath in variable ecological condition, bordered by turfed lawns and disturbed, weed infested slopes and rock-shelves.

Sedgeland vegetation in the northern portion of the Reserve is currently infested with exotic grasses and groundcovers that have encroached into the remnant due to a lack of concentrated maintenance. Stormwater and run-off flows from the urban setting (to the west), through the turf, into the remnant and over the cliff. As a result sediments carried by the run-off as well as nutrients and weed seeds are deposited over the native vegetation.

Sea-cliff Heath at the southern end of the Reserve occurs on higher ground than the sedgeland to the north. It too is impacted upon by exotic grasses and groundcovers encroaching from the landscaped parkland. Large areas of highly abundant woody, vine and herbaceous weeds also exist towards the southern extent of the remnant, directly impacting upon the vegetation through smothering, overshading and resource competition.

Bush regeneration works have been undertaken, and have been successful, in the southern most patch of remnant vegetation. Previously heavily weed infested areas have been improved in ecological condition and now support a diverse range of native species, many of which were absent at the commencement of management works. Continuation of these bush regeneration works, and establishment of a regular and targeted maintenance regime is likely to result in significantly increased vegetation condition for a substantial portion of the cliff-top remnant.

Ea – Patches of *Ficinia nodosa* and *Paspalum vaginatum* established along the top of the sea-cliff. Native graminoids occupy a considerable proportion of the available habitat between the exposed sandstone shelf, although weed infestation is a significant threat to the survival of the remnant.

There is no defined edge between the lawn area of the Reserve and the native vegetation on the cliff-tops, with turf grasses encroaching frequently. Exotic species common throughout the remnant vegetation include Buffalo Grass, exotic Couch, Coprosma, Pennywort and Asparagus Fern.

Establishment of a maintenance edge is required, followed by on-going targeted treatment of exotic groundcovers within the remnant vegetation area.

Eb –Remnant Eb is very similar to Remnant Ea in terms of native vegetation, and the threats and impacts acting upon it, and hence management practices can be aligned with the adjacent vegetation.

The southern section of the patch occurs directly down-slope from a heavily weed infested patch of heath vegetation, part of Remnant Ec. Establishment of a boundary and buffer zone between to two patches is required to ensure bush regeneration works undertaken within Eb are not negatively impacted upon should works be prioritised elsewhere within the adjacent Ec remnant patch.

Ec – Ecological restoration works undertaken within the remnant vegetation are to involve continued methodical regeneration works within, and radiating outwards from, previously worked areas, and mitigation of negative impacts on the remaining vegetation patches.

Methodical bush regeneration works utilising best practice techniques are to continue outwards from the area of Fair condition, ensuring treated areas have reached secondary/maintenance stage prior to commencement of primary works in adjacent lower quality areas. Works should be compartmentalised and undertaken in manageable stages where maintenance of treated areas will remain achievable.

Weeds impacting on this southern portion of the remnant include Lantana, Morning Glory, Coastal Morning Glory, Pellitory and Crofton Weed.

Within the northern portion of the remnant, edge definition is required between the heath vegetation and the Reserve lawn.

Exotic species present within this patch of heath include Buffalo Grass, Kikuyu, Gazania, Asparagus Fern, African Daisy, Pellitory, Mirror Bush, Prickly Pear, Japanese Pittosporum, African Olive, Bitou Bush and Lantana.

Ed – Remnant heath vegetation of variable vegetation condition as a result of on-going bush regeneration works. Bush regeneration works are to continue and move into new areas following successful restoration of current work zones.

A dense patch of over-mature *Westringia fruticosa* exists in the centre of the remnant and pile burns should be considered in this area to stimulate germination and increase successional diversity. *Westringia* can be removed in a mosaic pattern over approximately half of their area of occurrence and used as fuel for the pile burns.

Vegetation Communities (SBR 2010):

Sea-cliff Sedgeland c) *Ficinia nodosa*

Low open vegetation community with <10 to <30% canopy PFC, characteristic species listed as *Ficinia nodosa* dominant with other sedges present. Community occurrence is within 20m of sea-cliffs on skeletal sands to sand lenses on sandstone, often on modified soil.

Sea-cliff Heath

Open to closed low growing community with <10 to <70% canopy FPC, characteristic species include *Baeckea imbricata, Banksia ericifolia, Melaleuca armillaris, Melaleuca nodosa, Westringia fruticosa*. Community distributed within 50m of sea-cliffs on skeletal sands to sand lenses on sandstone, drainage is often impeded.

SEPP 19 Bushland

Almost 1000m^2 of Ec and Ed vegetation is considered SEPP 19 Bushland in Urban Areas (SBR 2010).

Waverley Council is obliged to protect and preserve the bushland because of its value as part of natural heritage, its aesthetic value and its value as a recreational, educational and scientific resource, and must consider impacts upon it when assessing all relevant Development Applications.

Remnant Significance

At approximately 4800m^2 the Eastern Reserve remnant vegetation is the 2nd largest patch on Council Land, it contains SEPP 19 bushland and supports a higher than average number of indigenous plant species when compared to other patches of remnant vegetation (SBR 2010).

Patches Ec and Ed are both relatively large, floristically diverse and in-tact occurrences of remnant vegetation (SBR 2010), and hence hold particular conservation significance.

Bush regeneration works in these patches has increased condition and recent floristic surveys (SBR 2010) have recorded a number of species not previously present (Hirschfeld 1996). These species include *Pittosporum undulatum, Dichelachne crinita, Acacia longifolia, Baumea juncea* and *Gleichenia rupestris* (SBR 2010).

Remnant Condition (SBR 2010)

	Remnant Condition 2010 (SBR 2010)				
	V. Poor	**Poor**	**Fair**	**Good**	**TOTAL**
Area (m^2)	3895	551	167	250	4863
Area (%)	80%	12%	3%	5%	100%

Area Likely to Reach "Good" Condition by 2020

R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020	R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020
Ea	643	V Poor	643	Ed.1	1468	V Poor	1100
Eb	520	V Poor	520	Ed.2	115	Poor	115
Ec.1	1264	V Poor	850	Ed.3	141	Poor	141
Ec.2	295	Poor	295	Ed.4	110	Fair	110
Ec.3	57	Fair	57	Ed.5	250	Good	250

Area Good Condition 2010: 5% Area Good Condition 2020: 84% (4081m^2)

Flora / Fauna Habitats

Fauna habitats within the Eastern Reserve remnant vegetation occur as two separate elements in the northern and southern sections of the Reserve. In the north, low sedge/grassland exists providing foraging habitat for small birds, and an abundance of exposed sandstone providing basking opportunities for native reptiles. At the southern end of the Reserve within patches Ec and Ed, dense native and exotic heath vegetation provides sheltering, foraging and nesting habitat for small birds and reptiles. The weed impacted drainage line also provides potential habitat for frog species commonly found in urban areas.

Eastern Reserve supports a large area of remnant cliff-top habitat capable of supporting both low growing graminoides and taller heath plants. Flora habitat is impacted by exotic species encroachment and infestation, bush regeneration works will result in more flora habitat becoming available, and at a higher quality for native plants to move into.

Remnant Restoration Goals & Associated Tasks

Ea & Eb – Bush regeneration works focusing on prevention of encroachment of exotic grasses from the Reserve lawn and methodical treatment and removal of grasses and other exotic groundcovers within the remnant is required to improve the condition of the vegetation.

A buffer zone is to be established to protect the remnant vegetation against future encroachments of turf grasses, and establishment of other weeds as a result of seed laden run-off flowing through the Reserve form the urban environment.

A spray buffer extending from the edge of the remnant to no less than 1m into the Reserve lawn (within the fence line) is to be established at the outset of management works. This spray buffer is to be maintained for 12-24 months of on-going vegetation management works, following which time Buffer Revegetation is to be undertaken as illustrated on the accompanying Map.

A smaller maintenance edge / buffer zone is also required between remnants Eb and Ec to maintain the integrity of bush regeneration works within the sedgeland community (Eb), and to protect against encroachments from the weed infested heath directly upslope and adjacent (Ec).

Ec – Within the northern portion of the remnant bushland, edge definition is required between the heath vegetation and the Reserve lawn. This is to be established as a spray edge from the outset of management works.

Following edge establishment, targeted staged weed removal is to be undertaken, with the most invasive and ecologically damaging weeds treated as the highest priority, followed by species yet to become fully established, leaving established but less-invasive exotics to be treated as bush regeneration works progress into the area.

Maintenance of the sediment control fence as a physical barrier between the treated vegetation and the degraded drainage-line, within the southern portion of the remnant vegetation, will be required until such time as the drainage-line and the surrounding weedy vegetation is fully removed and the area is revegetated.

Ed – Continuation of regular bush regeneration works within the heath vegetation of Ed will continue to improve the vegetation condition to the point where the majority of the remnant can be assessed as in Good Condition. Establishment of a buffer area in the north-eastern portion of the remnant may be required until such time as the adjacent weedy vegetation is removed and revegetated.

Pile burns are recommended on the higher, western portion of the remnant to stimulate germination and increase age-class diversity in the area.

Due to the small nature of the area, pile burns are most suited and would be undertaken in a mosaic pattern. Fuel for the piles should be sourced from vegetation present at the site (woody exotics and limbs of overabundant natives), piled and allowed to dry out completely to facilitate a hot burn. Piles should be placed in areas where a seedbank is likely to be present and remain viable, and the soil is not waterlogged.

All works associated with ecological burning should be guided by an approved Fire Management Plan prepared by a qualified and experienced Consultant, and the fire undertaken by an experienced contractor of the Fire Brigade. Alternative options are outlined in the Appendix Report (TEC 2014) should burning not proceed.

Revegetation - Buffer Revegetation works are recommended as part of management actions and are to be prioritised as follows.

Priority 1 – Type 1 Buffer Revegetation adjacent to patches Ea & Eb to arrest grass encroachment and urban stormwater run-off.

Priority 2 – Type 2 Buffer Revegetation adjacent to patch Ec. This is a large, resource heavy project, albeit one that will provide long-term benefit to the adjacent native vegetation. Lower priority has been afforded to this revegetation as bush regeneration works can continue to progress north from the currently worked area improving remnant condition, whilst managing the weedy batter adjacent as a buffer zone for the treated areas.

Stormwater / Wastewater Management – Stormwater influx from roads leading into Eastern Reserve, adjacent properties and potentially residential swimming pools is impacting on the remnant vegetation by increasing waterlogging, erosion, nutrient load and increasing exotic propagate input. Investigation into these issues and implementation of mitigation measures is required to reduce negative impacts on remnant bushland.

Flora Species (SBR 2010)

Family	Genus species	Common Name	Family	Genus species	Common Name
Aizoaceae	*Carpobrotus glaucescens*	Pigface	Lobeliaceae	*Lobelia anceps*	
Commelinaceae	*Commelina cyanea*	Scurvy Weed	Myrtaceae	*Baeckea imbricata*	
Cyperaceae	*Baumea juncea*		Myrtaceae	*Melaleuca armillaris*	Bracelet Honey-myrtle
Cyperaceae	*Cyperus polystachyos*		Myrtaceae	*Melaleuca nodosa*	
Cyperaceae	*Isolepis cernua*	Nodding Club-rush	Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Cyperaceae	*Ficinia nodosa*	Knobby Club-rush	Poaceae	*Sporobolus virginicus*	Sand Couch
Fabaceae - Mimosoideae	*Acacia longifolia* subsp *longifolia*	Sydney Golden Wattle	Poaceae	*Zoysia macrantha*	Prickly Couch
Fabaceae - Mimosoideae	*Acacia suaveolens*	Sweet Wattle	Proteaceae	*Banksia ericifolia* subsp *ericifolia*	Heath-leaved Banksia
Gleicheniaceae	*Gleichenia dicarpa*	Pouched Coral Fern	Proteaceae	*Hakea teretifolia*	Needlebush
Gleicheniaceae	*Gleichenia rupestris*		Ranunculaceae	*Ranunculus repens*	Creeping Buttercup
Lamiaceae	*Westringia fruticosa*	Coastal Rosemary			

No Fauna records exist for the Eastern Reserve remnant.

Recommended Revegetation Species (B-Buffer only; R-Remnant only; BR-Buffer & Remnant)

Genus species	Common Name	Genus species	Common Name	Genus species	Common Name
Acacia longifolia **(BR)**	Sydney Golden Wattle	*Ficinia nodosa* **(BR)**	Knobby Club-rush	*Lomandra longifolia* **(BR)**	Spiny-headed Mat-rush
Baeckea imbricata **(R)**		*Grevillea speciosa* **(R)**	Red Spider Flower	*Melaleuca armillaris* **(BR)**	Bracelet Honey-myrtle
Banksia serrata **(R)**	Old-man Banksia	*Imperata cylindrical* **(BR)**	Blady Grass	*Melaleuca nodosa* **(BR)**	
Baumea rubiginosa **(BR)**		*Juncus kraussii* **(BR)**	Sea Rush	*Microlaena stipoides* **(B)**	Weeping Grass
Dianella caerulea **(B)**	Blue Flax-lily	*Juncus usitatus* **(BR)**	Common Rush	*Monotoca elliptica* **(BR)**	Tree Broom-heath
Dianella congesta **(BR)**		*Kunzea ambigua* **(BR)**	Tick Bush	*Paspalum vaginatum* **(BR)**	Salt-water Couch
Dichelachne crinita **(BR)**	Longhair Plumegrass	*Leptospermum laevigatum* **(BR)**	Coast Teatree	*Sporobolus virginicus* **(BR)**	Sand Couch
Dillwynia glaberrima **(BR)**		*Leptospermum polygalifolium* **(BR)**	Yellow Tea-tree	*Westringia fruticosa* **(BR)**	Coastal Rosemary
Entolasia marginate **(B)**	Bordered Panic	*Leucopogon ericoides* **(R)**	Pink Beard-heath	*Zoysia macrantha* **(BR)**	Prickly Couch

Type 1 Buffer Revegetation – Low diversity graminoid dominant buffer revegetation
Type 2 Buffer Revegetation – Higher diversity, multiple plant forms buffer / non-buffer revegetation
See Appendix Report (TEC 2014) for details

Recommendations for Future Biodiversity Actions and Means of Achieving EAP3 Objectives

- Vegetation Condition Mapping is to be updated in 2015 with consideration given to the re-classification of remnants' 'Condition' as outlined in the Appendix Report – Waverley BAPs (TEC 2014). Update of mapping in 2015 will assess progress of restoration works towards the EAP3 targets and should be repeated every 24 months to 2019, followed by final assessment at 2020.
- Burning may not be appropriate at Eastern Reserve and alternative means for stimulating seeding emergence may be required. See Appendix Report – Waverley BAPs (TEC 2014)
- Revegetation work in connectivity area is to be done by planting a range of growth stages, from seedlings to semi-mature, grown from locally collected seeds, at lower densities to retain space for remnant vegetation to further colonise. This process for Connectivity Revegetation is further explained in the Appendix Report – Waverley Biodiversity Action Plans Report (TEC 2014).
- In undertaking the revegetation surrounding remnant patches Ea, Eb and Ec, and implementing stormwater mitigation measures this Action Plan is contributing to EAP3 Targets of Minimising sediments and suspended solids in stormwater discharged into waterways, and Minimising nutrients in stormwater discharged into vegetation remnants, each by 2020.

EASTERN RESERVE Biodiversity Action Plan - Actions Table

Remnant Code	Management Action	Responsibility	Performance Criteria	Timing	**Total Cost of Mgmt Action (ex GST)** See spreadsheet for more info and breakdown
Ea	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Establish spray edge buffer zone at the outset of vegetation management works • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • Remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 6 months of targeted works • Works undertaken no less than quarterly to 2020	$ 11,400.00
	Buffer Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 370m^2 of low growing buffer revegetation undertaken at 4 plants/m^2 (as required) • Revegetation works commence following 12-24 moths of spray maintenance and bush regeneration works • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 5,843.60
Eb	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Establish spray edge buffer zone at the outset of vegetation management works • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • Remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 6 months of targeted works • Works undertaken no less than quarterly to 2020	$ 11,400.00
	Buffer Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 200m^2 of low growing buffer revegetation undertaken at 4 plants/m^2 (as required) • Revegetation works commence following 12-24 months of spray maintenance and bush regeneration works • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 4,096.00
Ec	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • ≥75% of remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • ≥75% of remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 12 months of targeted works • Works undertaken no less than quarterly to 2020	$ 41,800.00
	Buffer Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 800m^2 of low growing buffer revegetation undertaken at 4 plants/m^2 (as required) • Revegetation works completed 24-36 months from the commencement of vegetation management actions • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works	As outlined adjacent.	$ 43,370.00
Ed	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • ≥80% of remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • ≥80% of remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • ≥80% of remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 12 months of targeted works • Works undertaken no less than quarterly to 2020	$ 38,500.00
	Ecological Burns	Waverley Council engaged Bush Regeneration Contractor	Undertake ecological burns as required ensuring the following conditions are met; • Prepare site and undertake burns as outlined in Fire Management Plan • Required approvals sought by Bushfire Consultant (not BR Contractor)	• Commence planning at the outset of this Action Plan • Undertake burns following 12 months of vegetation management works associated with this Plan	$ 3,400.00
Various	Stormwater / Wastewater Mgmt.	Various	Implement actions outlined in Stormwater Management Plan (to be prepared)	• As outlined in SMP	Undetermined
All areas	Ecological Monitoring	Waverley Council engaged Vegetation Management Consultant	Undertake regular monitoring visits to ensure bush regeneration works are progressing within the scope of this Action Plan and the specific project contract. • Establish fixed photo monitoring points within each remnant • Establish fixed quadrat or transect survey locations to assess weed cover abundance and native regeneration • Provide a report on the findings to Waverley Council	Monitoring events to occur at regular intervals to 2020. • Monitoring surveys and reports to be undertaken annually and provided to Council	$ 13,200.00
n/a	Project Admin	Bush Regeneration Contractor	n/a	Throughout Project	$ 2,520.00
				TOTAL	**$ 175,529.60**

Hugh Bamford Reserve
Biodiversity Action Plan 2014-20

Map No: BAP_06
Prepared for: Waverley Council
Prepared by: C Wharfe - TEC
Date: May 2014
Plan Status: FINAL

Bushland Remnant
- H1a
- H1b
- H1c
- H2a
- H2b

Bushfire Management
- APZ Pruning

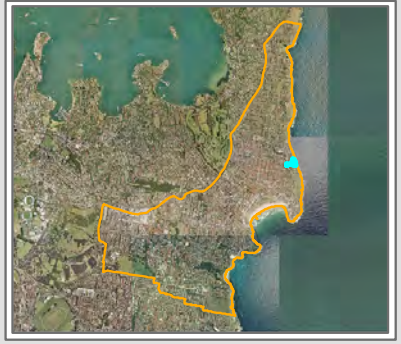
Revegetation
- Pri'ty 1 - Stg 1
- Pri'ty 1 - Stg 2
- Priority 2

Vegetation Condition
- Good
- Fair
- Poor
- Very Poor

0 12.5 25 50 Meters

N

Data Source:
Total Earth Care
Sydney Bush Regen Company
c/o Waverely Council
NearMap



Bushfire Management

Management Tasks: Asset Protection Zone (APZ) Establishment

- Creation of a defendable space between the bushland remnant and 50 Wentworth Street via vegetation clearing as per the following pattern outline din NSW RFS Guidelines for Asset Protection Zones (NSW RFS 2003);
  - Remove noxious and environmental weeds first
  - Remove highly flammable species such as species within the genera *Melaleuca* and *Leptospermum*
  - Remove trees approaching senescence
  - Remove trees and shrubs less than 3 metres in height
  - Remove significant native species
  - Remove habitat bearing, and nectar feed trees last

Management Task: Prepare and Implement Fire Management Plan

- Engage experience Consultant to prepare a Bushfire Management Plan focussing on the Sea-cliff Scrub vegetation in H1a,c
- Construct control lies and defendable space surrounding residential properties, create control lines within bushland patches, create burn piles / ground fuel, undertake burns

Revegetation – Priority 1 Area

Management Tasks: Stabilise and Revegetate

- Removal of exotic species on degraded slope (as illustrated adjacent), retain large trees for removal at a later date.
- Install terracing and native leaf mulch across the length of the slope.
- Allow initial flush of exotic seeds to germinate, treat, and install plants.
- Install plants at 4 plants/m^2.
- Water-in and maintain to establishment

Revegetation – Priority 2 Area

Management Tasks: Stabilise and Revegetate

- Repeat process as with Priority 1 Area
- To be undertaken following successful establishment of plantings and no sooner than 24 moths from installation of plantings within Priority 1 Area.

All revegetation work should use plant material grown from locally sourced seed as outlined in the Appendix Report – Waverley Biodiversity Action Plans Report (TEC 2014).

total earth care

H1a – Sea-cliff Scrub

Management Actions: Bush Regeneration

Management Tasks:

- Consolidation of previously worked areas, continued bush regeneration works targeting re-occurring exotics, ecologically damaging species and exotic seedlings.
- Progression of works from consolidated areas into areas of lower condition.
- Edge maintenance/definition and establishment of spray buffer between remnant and surrounding turfed areas.
- Targeted control of noxious weeds and Waverley Weed Action Plan 2014 – Priority 1 Species on cliff-tops using static safety ropes.
- Undertake ecological pile burns as outlined in an approved Fire Management Plan.

H1b – Sea-cliff Heath

Management Actions: Bush Regeneration / Targeted Weed Control

Management Tasks:

- Consolidation of previously worked areas, continued bush regeneration works targeting re-occurring exotics, ecologically damaging species and exotic seedlings.
- Progression of works from consolidated areas into areas of lower condition.
- Targeted control of noxious weeds and Waverley Weed Action Plan 2014 – Priority 1 Species on cliff-tops using static safety ropes.

H1c – Sea-cliff Scrub

Management Actions: Bush Regeneration

Management Tasks:

- Target weeding of exotic species persisting within remnant vegetation
- Edge maintenance/definition and establishment of spray buffer between remnant and surrounding turfed areas.
- Undertake vegetation thinning to establish APZ between remnant vegetation and adjacent private property.
- Undertake ecological pile burns as outlined in an approved Fire Management Plan.

H2a – Sandstone Moist Heath

Management Actions: Bush Regeneration

Management Tasks:

- Consolidation of previously worked areas, continued bush regeneration works targeting re-occurring exotics, ecologically damaging species and exotic seedlings.
- Progression of works from consolidated areas into areas of lower condition upslope and north towards H2b.
- Edge maintenance/definition between remnant and surrounding weedy areas, maintenance and expansion of sediment fence boundary.
- Targeted maintenance work to protect locally uncommon Moist Heath species eg. *Gahnia sp. Callistemon spp.* and *Banksia ericifolia*

H2b – Sandstone Moist Heath

Management Actions: Bush Regeneration

Management Tasks:

- Edge maintenance/definition between remnant and surrounding weedy areas.
- Bush regeneration works initially targeting noxious ecologically damaging exotic species.
- Consolidation of treated areas with a progression into areas of lower condition upslope and south towards H2a.
- Targeted maintenance work to protect locally uncommon Moist Heath species eg. *Gahnia sp. Adiantum aethiopicum.* and *Banksia ericifolia*

Should ecological burns be unable to proceed, alternatives are outlined in the Appendix Report (TEC 2014)

HUGH BAMFORD RESERVE Biodiversity Action Plan 2014 - 2020

Remnant Description

Remnant native vegetation at Hugh Bamford Reserve occurs in two (2) distinct areas, as Sea-cliff Scrub and Heath between the sea-cliffs and the residential properties on Wentworth Street and as two patches of Moist Heath on the south-west facing cliff-line between the Reserve's fields and Military Road in North Bondi.

The remnant between the sea-cliffs and Wentworth Street (H1a,b,c) is much larger, encompassing approximately 4450m^2, compared to roughly 80m^2 along Military Road (H2a,b). Vegetation condition in H1 ranges from Very Poor to Good (SBR 2010), although a large portion of the remnant is in Good condition as a result of bush regeneration activities regularly undertaken by a local bushcare group.

Threatening processes acting upon the vegetation remnants include prolonged lack of fire, leading to over-mature vegetation and a lack of diversity, weed infestation, and stormwater / run-off impacts on the Moist Heath vegetation along Military Road.

Within the core areas of vegetation where bush regeneration works have been undertaken native floristic diversity is high, compared with the vegetation closer to the residential properties where a few mature canopy species dominate above and exotic understorey. Targeted weed control is required on the sea-cliffs where Bitou Bush (Class 3 Noxious species; Priority 1 Weed – Waverley Weed Action Plan) occurs at a moderate abundance and requires treatment using static safety lines.

The majority of the native remnant vegetation will be improved to Good Condition following bush regeneration and ecological burning outlined in this Biodiversity Action Plan.

H1a – Large patch of Sea-cliff Scrub within which the core vegetation has undergone bush regeneration works improving the condition of the vegetation to Good (SBR 2010). The northern end of the patch supports mature native shrubs with little diversity or regeneration in the ground-layer. Further south floristic diversity is increased although exotic species occur at higher abundances in areas where bush regeneration works have not been as undertaken as regularly.

Edge definition is required at the northern and southern ends of the patch where turf grasses from the playing fields and residential APZ are encroaching on the remnant and establishing beneath the native canopy.

Ecological pile burns are required throughout, but are to be initially concentrated in the northern portion of the remnant to stimulate regeneration of native species and increase successional diversity.

H1b – Sea-cliff Heath on, and down the cliff-face below the Scrubby vegetation of H1a. Vegetation condition is generally lower than the adjacent bushland due to the location of the works on the edge of the cliffs and the obvious safety issues involved with treatment of the exotic vegetation. Professional contractors are to be engaged to undertake or oversee cliff-line weed control works utilising static safety lines.

H1c – Over-mature, low diversity scrub vegetation dominated by Coastal Tree-tree *Leptospermum laevegatum* with occasional *Monotoca elliptica,* and *Acacia longifolia,* over a ground-layer of exotic grasses, *Ehrharta erecta* and Kikuyu, with infrequent *Lomandra longifolia*.

Ecological burns are recommended within the remnant to promote regeneration, increase successional and structural diversity and reduce exotic species occurrence. The vegetation is continuous to the fence-line of 50 Wentworth Street and clearing is required to establish a fire break (APZ) between the bushland and the residential property. It is recommended that the vegetation between the extent of the remnant (as mapped over-leaf SBR 2010) and the property fence is removed to facilitate this break.

This vegetation clearance should be undertaken whether or not ecological burning is to go ahead to protect the property from potential uncontrolled fire.

H2a – Patch of diverse Sandstone Moist Heath near the base of the low cliff / slope from the western section of Hugh Bamford Reserve. Bush regeneration works have been undertaken within the remnant vegetation and native species dominate in areas were works have occurred. East (upslope) of the remnant a highly weed infested and degraded batter threatens the survival of the native vegetation through weed invasion and propagule input via run-off. A sediment fence has been installed at the extent of the regeneration works to help prevent weed invasion from above.

Exotic species occurring within and surrounding the remnant vegetation include Morning Glory, Pennywort, Paspalum, Asparagus Fern, Crofton Weed, Mirror Bush, Lantana, Coral Trees and Phoenix Palms.

H2b – Another, smaller patch of Moist Heath Vegetation occurring approximately 20m to the north of patch H2a and is essentially an extension of the native vegetation, isolated by infestations of exotic species. Weed species similar to those outlined above for H2a threaten the longevity of H2b, and works should be undertaken to mitigate these threatening processes.

Bush regeneration works should be undertaken outwards from H2b and progress south towards H2a, with an overarching goal of connecting the 2 patches of native vegetation.

Vegetation Communities (SBR 2010):

Sea-cliff Scrub

Tending closed scrubby community with >10 to 100% canopy FPC, characteristic species include *Melaleuca armillaris, Melaleuca nodosa* and *Leptospermum laevegatum*. The community distributed within 50m of sea-cliffs on sand lenses on sandstone.

Sea-cliff Heath

Open to closed low growing community with <10 to <70% canopy FPC, characteristic species include *Baeckea imbricata, Banksia ericifolia, Melaleuca armillaris, Melaleuca nodosa, Westringia fruticosa*. Community distributed within 50m of sea-cliffs on skeletal sands to sand lenses on sandstone, drainage is often impeded.

Sandstone Moist Heath

An open low growing assemblage of sun-loving moisture tolerant species with a characteristic canopy layer PFC of >10 to <30% cover. *Banksia ericifolia, Callistemon citrinus* and *Callistemon linearis* are commonly recorded shrub/canopy species, and the vegetation is known to occur >50m from sea-cliffs on sandstone slopes and ledges with shallow skeletal sand and impeded drainage.

SEPP 19 Bushland

Hugh Bamford Reserve remnant vegetation contributes the largest patch of SEPP 19 Bushland in Urban Areas vegetation in the LGA (SBR 2010).

Waverley Council is obliged to protect and preserve the bushland because of its value as part of natural heritage, its aesthetic value and its value as a recreational, educational and scientific resource, and must consider impacts upon it when assessing all relevant Development Applications.

Remnant Significance

Approximately 50% of the bushland surveyed by SBR in 2010 was assessed as in Good Condition, this was one of the largest patches on bushland in such condition and is likely to have increased since the time of survey as a result of ongoing management works.

Nine (9) of the 34 indigenous plant species recoded within the remnant (SBR 2010) are considered rare in the Council Area, those being *Banksia marginata, Banksia serrata, Billardiera scandens, Callistemon citrinus, Callistemon linearis, Lambertia formosa, Parsonsia straminea, Pimelea linifolia* and *Platysace lanceolata.*

The 2 small patches of Sandstone Moist Heath are 2 of only five (5) patches in the LGA.

Remnant Condition (SBR 2010)

	Remnant Condition 2010 (SBR 2010)				
	V. Poor	**Poor**	**Fair**	**Good**	**TOTAL**
Area (m^2)	1588	1550	-	1392	4530
Area (%)	35%	34%	0%	31%	100%

Area Likely to Reach "Good" Condition by 2020

R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020	R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020
H1a.1	1392	Good	1392	H1c.1	595	Poor	595
H1a.2	620	Poor	620	H1c.2	8	Poor	8
H1a.3	23	V Poor	23	H1c.3	252	V Poor	150
H1a.4	957	V Poor	700	H2a	75	V Poor	75
H1b.1	327	Poor	327	H2b	4	V Poor	4
H1b.2	276	V Poor	0	-	-	-	-

Area Good Condition 2010: 31% Area Good Condition 2020: 86% (3894m^2)

Flora / Fauna Habitats

The diverse bushland in high ecological condition occurring at Hugh Bamford Reserve supports a range of high quality habitats for both native flora and fauna species. Dense native (and exotic) undergrowth interspersed with exposed sandstone and low-growing groundcovers provides foraging, shelter and basking habitats for native skinks and small birds. Open and closed shrubby and taller vegetation provides perching and nesting opportunities for small to medium sized native birds, and nectar producing species occur as a food resource.

Permanently moist cliff-soak areas within and surrounding the moist heath vegetation supports habitat, of low-moderate quality, for native frogs.

The majority of the soils within the H1 remnant are considered to be original and provide unique habitat on cliff-tops and upper cliff-faces for native flora species considered rare elsewhere across the LGA.

Remnant Restoration Goals & Associated Tasks

Bush regeneration works are to continue within patches where works are currently being undertaken, with consolidation of higher quality areas followed by progression of works into lower quality bushland.

In order to improve the ecological quality of the Cliff-top Scrub bushland community and improve diversity, and reduce weed occurrence across the Reserve, burning is highly recommended.

Preparation of the site for potential burns should be undertaken by a professional bush regeneration contractor by constructing fire breaks around and burn piles throughout the bushland'

Due to the small nature of the area pile burns are most suited and would be undertaken in a mosaic pattern. Fuel for the piles should be sourced from vegetation present at the site (woody exotics and limbs of overabundant natives), piled and allowed to dry out completely to facilitate a hot burn. Piles should be placed in areas where a seedbank is likely to be present and remain viable, and the soil is not waterlogged.

All works associated with ecological burning should be guided by an approved Fire Management Plan prepared by a qualified and experienced Consultant, and the fire undertaken by an experienced contractor of the Fire Brigade. Alternative options are outlined in the Appendix Report (TEC 2014) should burning not proceed.

Vegetation clearance to provide a firebreak for 50 Wentworth St, should be undertaken as per the guidelines for APZ establishment outlined in the RFS Document Planning for Bushfire Protection (2006).

Remnant patch H1b supports infestations of Bitou Bush, a Noxious Weed in the LGA. Regular (minimum quarterly) treatments of the weed by professional ropes contractors are required until the infestation is sufficiently controlled.

Priority 1 Buffer Revegetation works are to be undertaken in 2 stages, separated by no less than 18 months from final installation of tubestock in the Stage 1 area. Works are to be Type 2 Buffer Revegetation works whereby a more diverse range of species are installed to establish a heathland buffer similar to that of the remnant vegetation.

Flora Species (SBR 2010)

Genus species	Common Name	Genus species	Common Name	Genus species	Common Name
Adiantum aethiopicum	Common Maidenhair	*Gonocarpus teucrioides*	Raspwort	*Deyeuxia quadriseta*	
Carpobrotus glaucescens	Pigface	*Westringia fruticosa*	Coastal Rosemary	*Dichelachne crinita*	Longhair Plumegrass
Tetragonia tetragonioides	New Zealand Spinach	*Cassytha sp*		*Entolasia marginata*	Bordered Panic
Platysace lanceolata	Shrubby Platysace	*Lobelia anceps*		*Eragrostis brownii*	Brown's Lovegrass
Parsonsia straminea	Common Silkpod	*Lomandra longifolia*	Spiny-headed Mat-rush	*Lachnagrostis filiformis*	
Cotula australis	Common Cotula	*Baeckea imbricata*		*Microlaena stipoides*	Weeping Grass
Olearia tomentosa	Toothed Daisy-bush	*Callistemon citrinus*	Crimson Bottlebrush	*Paspalidium distans*	
Commelina cyanea	Scurvy Weed	*Callistemon linearis*	Narrow-leaved Bottlebrush	*Banksia ericifolia* subsp *ericifolia*	Heath-leaved Banksia
Dichondra repens	Kidney Weed	*Kunzea ambigua*	Tick Bush	*Banksia marginata*	Silver Banksia
Crassula sieberiana	Australian Stonecrop	*Leptospermum laevigatum*	Coast Teatree	*Banksia serrata*	Old-man Banksia
Cyperus polystachyos		*Melaleuca armillaris*	Bracelet Honey-myrtle	*Grevillea speciosa*	Red Spider Flower
Ficinia nodosa	Knobby Club-rush	*Melaleuca nodosa*		*Hakea teretifolia*	Needlebush
Lepidosperma (concavum?)		*Oxalis perennans*		*Lambertia formosa*	Mountain Devil
Monotoca elliptica	Tree Broom-heath	*Dianella caerulea*	Blue Flax-lily	*Persoonia lanceolata*	Lance Leaf Geebung
Dillwynia retorta		*Dianella congesta*		*Smilax glyciphylla*	Sweet Sarsaparilla
Acacia longifolia subsp *longifolia*	Sydney Golden Wattle	*Dianella revoluta*	Paroo Lily	*Lasiopetalum ferrugineum*	
Acacia suaveolens	Sweet Wattle	*Billardiera scandens*	Hairy Apple Berry	*Samolus repens*	Creeping Bookweed
Gleichenia dicarpa	Pouched Coral Fern	*Pittosporum undulatum*	Sweet Pittosporum	*Pimelea linifolia* subsp *linifolia*	Slender Rice Flower

Fauna Species (AMBS 2011)

Class	Genus species	Common Name	Class	Genus species	Common Name
Aves	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	Aves	*Anthochaera carunculata*	Red Wattlebird
Aves	*Strepera graculina*	Pied Currawong	Aves	*Acridotheres tristis*	Common Myna
Aves	*Cacatua galerita*	Sulphur-crested Cockatoo	Aves	*Sturnus vulgaris*	Common Starling
Aves	*Streptopelia chinensis*	Spotted Turtle-Dove	Aves	*Zosterops lateralis*	Silvereye
Aves	*Corvus coronoides*	Australian Raven	Mammalia	*Mormopterus sp.*	Mastiff-bat
Aves	*Eudynamys orientalis*	Pacific Koel	Mammalia	*Chalinolobus gouldii*	Gould's Wattled Bat
Aves	*Grallina cyanoleuca*	Magpie-lark	Reptilia	*Cryptoblepharus virgatus*	Cream-striped Shinning-skink
Aves	*Rhipidura leucophrys*	Willie Wagtail	Reptilia	*Lampropholis delicata*	Dark-flecked Garden Sunskink
Aves	*Hirundo neoxena*	Welcome Swallow	Reptilia	*Lampropholis guichenoti*	Pale-flecked Garden Sunskink
Aves	*Malurus cyaneus*	Superb Fairy-wren	Reptilia	*Saiphos equalis*	Three-toed Skink

Recommended Revegetation Species (B-Buffer only; R-Remnant only; BR-Buffer & Remnant)

Family	Genus species	Common Name	Family	Genus species	Common Name
Acacia longifolia **(BR)**	Sydney Golden Wattle	Dillwynia glaberrima **(R)**		*Lasiopetalum ferrugineum* **(R)**	
Acacia ulicifolia **(BR)**	Prickly Moses	*Entolasia marginata* **(BR)**	Bordered Panic	*Leptospermum laevigatum* **(BR)**	Coast Teatree
Baeckea imbricata **(BR)**		*Epacris longiflora* **(BR)**	Fuchsia Heath	*Leptospermum polygalifolium* **(BR)**	Yellow Tea-tree
Banksia serrata **(BR)**	Old-man Banksia	*Ficinia nodosa* **(BR)**	Knobby Club-rush	*Lomandra longifolia* **(BR)**	Spiny-headed Mat-rush
Baumea rubiginosa **(BR)**		*Glochidion ferdinandi* **(B)**	Cheese Tree	*Melaleuca armillaris* **(BR)**	Bracelet Honey-myrtle
Callistemon citrinus **(BR)**	Crimson Bottlebrush	*Grevillea speciosa* **(BR)**	Red Spider Flower	*Melaleuca nodosa* **(BR)**	
Callistemon linearis **(BR)**		*Hakea teretifolia* **(BR)**	Needlebush	*Microlaena stipoides* **(B)**	Weeping Grass
Dianella caerulea **(B)**	Blue Flax-lily	*Imperata cylindrical* **(B)**	Blady Grass	*Monotoca elliptica* **(BR)**	Tree Broom-heath
Dianella congesta **(BR)**		*Juncus usitatus* **(B)**	Common Rush	*Pittosporum undulatum* **(B)**	Sweet Pittosporum
Dichelachne crinita **(BR)**	Longhair Plumegrass	*Kunzea ambigua* **(B)**	Tick Bush	*Westringia fruticosa* **(B)**	Coastal Rosemary

Type 1 Revegetation – Low diversity graminoid dominant buffer revegetation
Type 2 Revegetation – Higher diversity, multiple plant forms buffer / non-buffer revegetation
See Appendix Report (TEC 2014) for details

Recommendations for Future Biodiversity Actions and Means of Achieving EAP3 Objectives

- Vegetation Condition Mapping is to be updated in 2015 with consideration given to the re-classification of remnants' 'Condition' as outlined in the Appendix Report – Waverley BAPs (TEC 2014). Update of mapping in 2015 will assess progress of restoration works towards the EAP3 targets and should be repeated every 24 months to 2019, followed by final assessment at 2020.
- Burning may not go ahead at Hugh Bamford Reserve and alternative means for stimulating seeding emergence may be required. See Appendix Report – Waverley BAPs (TEC 2014)
- Priority 2 Buffer Revegetation hold considerably lower ecological value for the protection and regeneration of the vegetation remnants at Hugh Bamford Reserve. Revegetation works within this area should not proceed if the resources required to complete the project will divert funding from higher priority, more beneficial works elsewhere on site.

HUGH BAMFORD Biodiversity Action Plan - Actions Table

Remnant Code	Management Action	Responsibility	Performance Criteria	Timing	Total Cost of Mgmt Action (ex GST) See spreadsheet for more info and breakdown
H1a	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged to augment bushcare works and site works undertaken on a regular basis • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • Remnant condition to be assessed as Good at 2020 Condition Mapping update • Ecological burns undertaken within H1a.4 as outlined in an approved Fire Management Plan	Bush regeneration works to progress regularly to 2020. • Contractor works undertaken at least monthly for initial 12 months of targeted works • Contractor works undertaken no less than quarterly to 2020	$ 51,100.00
H1b	Bush Regeneration / Targeted Weed Treatments	Waverley Council engaged Bush Regeneration Contractor	Regular weed control to suppress exotic species within the remnant. • Contractor engaged to undertake cliff-top weed control with the use of static line safety ropes • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • ≥50% of remnant condition to be assessed as Good at 2020 Condition Mapping update	Weed treatment works to progress regularly to 2020. • Works undertaken at least monthly for initial 6 months of targeted works • Works undertaken no less than quarterly to 2020	$ 22,560.00
H1c	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Remnant condition to be assessed as Fair (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • Remnant condition to be assessed as Good at 2020 Condition Mapping update • Fire breaks (APZ) established between vegetation and 50 Wentworth Street • Ecological burns undertaken within H1c as outlined in an approved Fire Management Plan	Bush regeneration works to progress regularly to 2020. • Contractor works undertaken at least monthly for initial 6 months of targeted works • Contractor works undertaken no less than quarterly to 2020	$ 11,080.00
H2a	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • Remnant condition to be assessed as Good at 2020 Condition Mapping update • Area of native vegetation to be expanded to meet H2b	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 12 months of targeted works • Works undertaken no less than quarterly to 2020	$ 23,680.00
	Buffer Revegetation – Stage 1	Waverley Council engaged Bush Regeneration Contractor	Approximately 1200m^2 of buffer revegetation undertaken at 4 plants/m^2 (as required) • Revegetation works completed in stages over 0-24 months from the commencement of vegetation management actions • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 43,950.00
	Buffer Revegetation – Stage 2	Waverley Council engaged Bush Regeneration Contractor	Approximately 1000m^2 of buffer revegetation undertaken at 4 plants/m^2 (as required) • Revegetation works completed in stages over 0-24 months from the commencement of vegetation management actions • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 36,860.00
H2b	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • Remnant condition to be assessed as Good at 2020 Condition Mapping update • Area of native vegetation to be expanded to meet H2a	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 12 months of targeted works • Works undertaken no less than quarterly to 2020	$ 23,680.00
Various	Ecological Burns	Waverley Council engaged Bush Regeneration Contractor	Undertake ecological burns as required ensuring the following conditions are met; • Prepare site and undertake burns as outlined in Fire Management Plan • Required approvals sought by Bushfire Consultant (not BR Contractor)	• Commence planning at the outset of this Action Plan • Undertake burns following 12 months of vegetation management works associated with this Plan	$ 3,400.00
	Coral Tree Removal	Waverley Council engaged Arboricultural Contractor	Remove Coral Trees adjacent to patch H2a if deemed necessary	• As deemed necessary	$ 2,000.00
	Priority 2 Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 1400m^2 of buffer revegetation undertaken at 4 plants/m^2 (as required) • Revegetation works commence no sooner than 24 months from completion of Priority 1 Revegetation works • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 44,952.00
All areas	Ecological Monitoring	Waverley Council engaged Vegetation Management Consultant	Undertake regular monitoring visits to ensure bush regeneration works are progressing within the scope of this Action Plan and the specific project contract. • Establish fixed photo monitoring points within each remnant • Establish fixed quadrat or transect survey locations to assess weed cover abundance and native regeneration • Provide a report on the findings to Waverley Council	Monitoring events to occur at regular intervals to 2020. • Monitoring surveys and reports to be undertaken annually and provided to Council	$ 13,200.00
n/a	Project Admin	Bush Regeneration Contractor	n/a	Throughout Project	$ 2,520.00
				TOTAL	**$ 278,982.00**

Loombah Road Cliffs
Biodiversity Action Plan 2014-20

Map No: BAP_07
Prepared for: Waverley Council
Prepared by: C Wharfe - TEC
Date: May 2014
Plan Status: FINAL

Vegetation Condition (SBR 2010)

- Good
- Fair
- Poor
- Very Poor
- A. terminalis (Approx.)
- Stormwater Inflow
- Desired Flow
- Current Storm Event Flow (estimated)

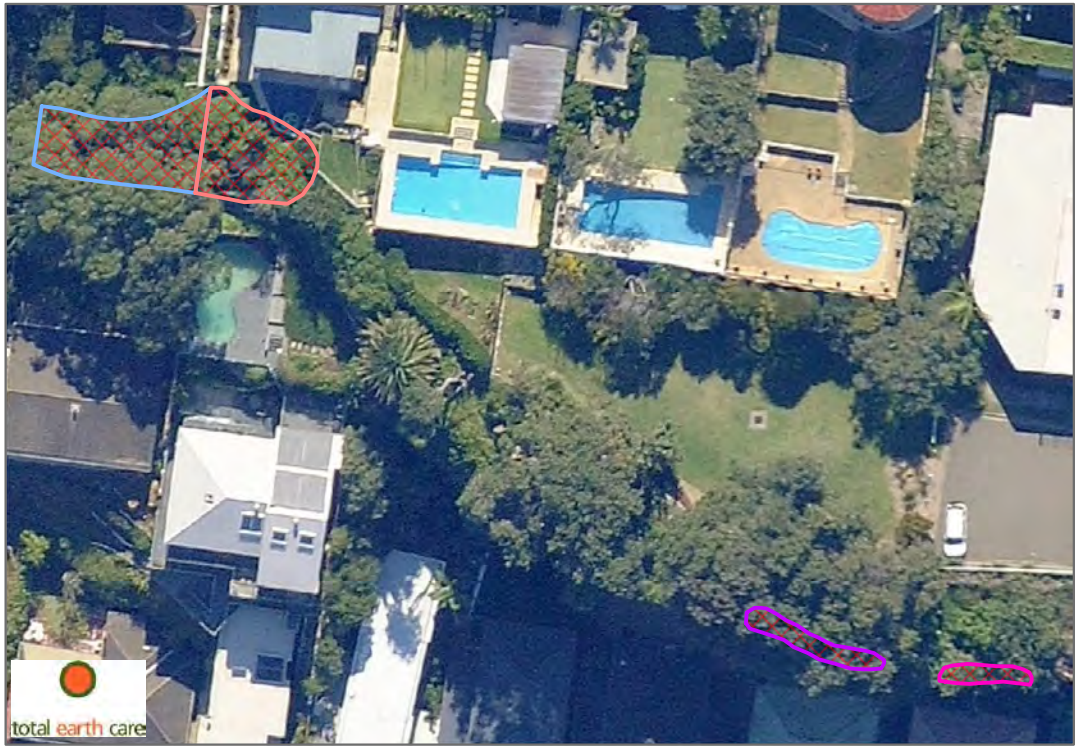
Bushland Remnant

- L1a
- L1b
- L1c
- L14
- L16
- L18
- L25a
- L25b
- L27a
- L27b
- L134
- L136

0 5 10 20 Meters
Approx.

N

Data Source:
Total Earth Care
Sydney Bush Regen Company
c/o Waverely Council
NearMap



L1a, L25a & L27a – Sandstone Dry Scrub

Management Actions: Bush Regeneration

Management Tasks:

- Targeted weed removal of vines and highly fecund exotic species, followed by exotic groundcover species
- Static rope lines may be required to ensure contractor safety, installation of anchor points may be appropriate as the site is not accessed by the public
- Actions required to mitigate waterlogged soils upslope (L1b, L25b, L27b & L18) may be required within these patches.

L1b, L25b, L27b & L18 – Low Woodland / Forest. Vegetation Condition

Management Actions: Stormwater / Run-off Mitigation

Management Tasks:

- Prevent stormwater from flowing south through remnant vegetation (towards *A. terminalis*)
- Redirect urban stormwater flow with long-term solution
- Ensure run-off from residential irrigation system does not enter remnant vegetation or soils further waterlogging the substrate
- Install terracing / erosion control across the length of all steep and erodible slopes and increase cover in bare areas with brush matting of native material sourced from around the site

Management Actions: Bush Regeneration

Management Tasks:

- Bush regeneration works to continue, moving from areas of higher to lower condition
- Target weed removal of Madeira Vine, Morning Glory, Crofton Weed and Mistflower
- Monitor and manage *Acacia terminalis* specimens
- Expose sandstone benches across site by removing non-remnant (run-off / sedimentation) soils
- Staged reduction in canopy cover. Exotic species removed first, followed by over-abundant native trees (Chese Tree, Sweet Pittosperum), to allow more light to forest floor
- Revegetation and pile burns in areas where natural regeneration is not successful following 12-24 months work in currently un-worked areas.
  - Should burns be unable to proceed, alternatives are outlined in the Appendix Report (TEC 2014)

L1c – Sandstone Dry Scrub

Management Actions: Bush Regeneration

Management Tasks:

- Regular bush regeneration works to reduce weed occurrence

L14 & L16 – Low Woodland / Forest

Management Actions: Targeted Weed Treatments

Management Tasks:

- Establish access to the vegetation patches to assess the remnant and undertake weed treatments
- Regular weed control works targeting most ecologically damaging species
- Remnants unlikely to ever reach Good Condition, and should be managed so the remnant is not "Lost"

L134 & L136 – Sandstone Moist Heath

Management Actions: Targeted Weed Treatments

Management Tasks:

- Establish access to the vegetation patches to assess the natives and undertake weed treatments
- Regular weed control works targeting most ecologically damaging species
- Remnants unlikely to ever reach Good Condition, and should be managed so the remnant is not "Lost"

LOOMBAH ROAD CLIFFS Biodiversity Action Plan 2014 - 2020

Remnant Description

Loombah Road Cliffs support one of the largest areas of remnant vegetation in Waverley and is comprised of 5 separate patches spread over approximately 200m (linear) of cliff-tops, cliff-face and sloping land on the border between North Bondi and Dover Heights.

The vegetation supported by the Loombah Road site is one of the most floristically diverse areas in the LGA with a total of 36 native species and 3 vegetation communities recorded by SBR (2010). Negative pressures impacting on the ecological health of the vegetation include uncontained urban stormwater, run-off from neighbouring properties and gardens, over-shading, prolonged absence of fire, weeds and previous dumping of construction fill material.

Approximately 42% of the remnant vegetation on the Loombah Road Cliffs occurs within Private Lots and the landholders are to be consulted prior to undertaken works within these patches (L14, L16, L18, L25a&b, L27a&b, L134, L136).

Bush regeneration works have been undertaken within the largest group of remnants (L1a,b L25a,b L27a,b) and have resulted in positive outcomes in the form of regenerating native herbs and groundcovers, and increase in the number of individuals of the *Acacia terminalis* subsp *terminalis* population (currently 1 senescing adult and 4 juvenile plants). Works priorities include mitigation of negative pressures on the vegetation, and promoting increased native species diversity in the Woodland vegetation community.

It is expected that with ongoing bush regeneration and environmental management works approximately half of the site's remnant vegetation will reach the EAP3 desired threshold of Good Vegetation Condition by 2020. The remaining vegetation will require ongoing management and targeted weed control.

L1a, L25a & L27a – Remnant vegetation includes cliff-top and cliff-face scrubby species occupying the most open portion of the site. Species diversity is high with a number of species present found at few other locations across the LGA. Native vegetation is impacted by exotic species upslope of the cliff-line and persisting amongst the cliff-top vegetation. This disturbance vector is amplified by the run-off from a private vegetable garden and the influx of uncontained urban stormwater outflanking the main channel during storm events. Increased stormwater / run-off appears to have resulted in a permanently damp substrate.

Exotic species present within the remnant include Lantana, Cassia (*Senna pendula glabrata*), Asparagus Fern, and Morning Glory (*Ipomoea indica*).

L1b, L25b, L27b, L18 – A relatively large patch of native vegetation dominated by canopy trees with little native understorey. Native diversity in all strata is low and negative impacts include urban stormwater, residential run-off, waterlogged edaphic conditions, over-shading by canopy species, presence of non-remnant substrates (run-off / sedimentation / fill dumping), exotic species infestations and a lack of fire.

The remnants supports the only extant population of *Acacia terminallis* subsp *terminallis* (Endangered – TSC & EPBC Acts) in the Waverley LGA.

Exotic species present within the remnant include Cottoneaster, Giant Strelitzia, Bangalow Palm, Fishbone Fern, Crofton Weed, Mistflower, Asparagus Fern, Tradescantia, Morning Glory and Madeira Vine. Over abundant native vegetation includes Cheese Trees and Sweet Pittosporum.

L1c – Remnant exists as a mature *Kunzea ambigua* on a rock-shelf with an adjacent patch of *Commelina cyanea*. There are little to no impacts associated with weed infestation or run-off, although the small size of the patch leads to pressures on continued survival.

L14 & L16 – Remnants occur as heavily weed infested patches of native vegetation surrounded on all sides by more areas of disturbed / weed infested vegetation and residential development. Access is currently unavailable due to heavily vegetated cliffs above and surrounding the remnant.

Weeds present include Lantana, Green Cestrum (*Cestrum parqui*) and Morning glory.

L134 & L136 – Remnants exist as small occurrences of native species on heavily weed infested cliff-tops. Access is a significant issue due to the presence of permanent fencing and the height of the cliffs. Ladders to access the vegetation over the fence are required and static rope lines anchored to the fence are required for works to be undertaken.

Weeds present include Crofton Weed, exotic grasses, vines and other woody weeds.

Vegetation Communities (SBR 2010):

Sandstone Dry Scrub

Dense low growing dry vegetation dominated by sclerophyllous shrubs, characteristic PFC of >10 to 100% cover. Characteristic species noted as *Kunzea ambigua*, also present at Loombah Road Cliffs are a number of *Callistemon, Banksia, Epacris* and *Hakea* species. Community occurs >50m from sea-cliffs on sandstone slopes and ledges, supported by sandy lenses on sandstone.

Low Woodland / Forest

An open to closed tall treed community dominated by shade tolerant species below a canopy of *Glochidion ferdinandi* and *Pittosporum undulatum* with a PFC of >10 to 100% cover. These taller vegetation communities occur >50m from the sea-cliffs and sandstone slopes and ledges, growing sandy soil on sandstone.

Sandstone Moist Heath

An open low growing assemblage of sun-loving moisture tolerant species with a characteristic canopy layer PFC of >10 to <30% cover. *Banksia ericifolia, Callistemon citrinus* and *Callistemon linearis* are commonly recorded shrub/canopy species, and the vegetation is known to occur >50m from sea-cliffs on sandstone slopes and ledges with shallow skeletal sand and impeded drainage.

SEPP 19 Bushland

No remnant vegetation on the Waverley Cemetery Cliffs is considered SEPP 19 Bushland (SBR 2010)

Remnant Significance

Loombah Road Cliffs supports the only currently known population of *Acacia terminalis* subsp. *terminalis* in the Waverley Council Area. *A. terminalis* subsp *terminalis* is listed as Endangered on both the NSW *Threatened Species Conservation Act 1995* and the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*.

Loombah Road Cliffs also support >80% of the Low Woodland / Forest community across the LGA, it is the 4th most native species rich group of remnants in the LGA, supports *Lomatia silaifolia* and *Pteridium esculentum* found nowhere else in the Council Area, and at >1000m² the vegetation is well above the median for all Waverley Remnants (SBR 2010)

Remnant Condition (SBR 2010)

	Remnant Condition 2010 (SBR 2010)				
	V. Poor	Poor	Fair	Good	TOTAL
Area (m²)	925	106	-	-	1034
Area (%)	89%	11%	0%	0%	100%

Area Likely to Reach "Good" Condition by 2020

R'nant Code	Area (m²)	2010 Cond'n	Area (m²) Good 2020	R'nant Code	Area (m²)	2010 Cond'n	Area (m²) Good 2020
L1a	37	Poor	37	L25a	41	Poor	41
L1b	506	V Poor	250	L25b	23	V Poor	23
L1c	25	V Poor	25	L27a	30	Poor	30
L14	73	V Poor	0	L27b	176	V Poor	80
L16	87	V Poor	0	L134	21	V Poor	0
L18	4	V Poor	0	L136	11	Poor	0

Area Good Condition 2010: 0% Area Good Condition 2020: 47% (486m²)

Flora / Fauna Habitats

Fauna habitat supported by the Loombah Road remnants consists of nesting habitat in the taller trees for native birds and arboreal mammals, found in few other areas of remnant vegetation within Waverley. Dense understorey vegetation provides shelter for skinks and geckos, although basking opportunities are currently limited. Dry Scrub and Moist Heath vegetation on cliff-tops provide foraging opportunities for transient nectivorous birds.

Flora habitat is somewhat unique, in a local context, as a result of the slope and south-westerly aspect of the western portion of the site. There are a range of sandstone based soil structures present as a growing medium on slopes, in gullies and on cliff-tops. The floristic diversity of the site illustrates the range and overall high quality of the original flora habitat supported by the site. This quality habitat is likely to be, at least partially, restored following the implementation of the prescribed vegetation management actions.

Remnant Restoration Goals & Associated Tasks

L1a, L25a & L27a – Ecological restoration works are to target species based on the likelihood of ecological damage if they persist or increase in abundance. Vines and highly fecund species are most likely to negatively impact on the remnant vegetation, followed by dense groundcover species that prevent native recruitment form the seedbank.

L1b, L25b, L27b, L18 – Highest priority works include the alleviation of the impacts caused by the stormwater flowing through the remnant vegetation during storm events, and the run-off resulting from the residential vegie patch and sprinkler system via channel definition, terracing / stabilisation works, and removal of the residential encroachment.

During bush regeneration works exotic vines and highly-fecund woody weeds are to be treated as high priority activities and soil scarification should be undertaken to promote germination in areas where weed cover has been significantly reduced.

To increase light to the forest floor, weed species present in the canopy, and any dense exotic thickets are to be removed as highest priority. Overabundant natives (Cheese Tree, Pittosporum) are then to be removed to further increase light penetration. This is to be done in a planned and methodical manner with one canopy gap (approx. 1-4m² in size) created per year in areas of potential regeneration and where access is available for maintenance.

Should regeneration of native species persist at low levels following 12-24 months of works in previously un-managed areas, revegetation and/or a mosaic pattern of pile burns are recommended.

In order to kick-start the regeneration / restoration process at the Loombah Road remnants, an ecological burn would ideally be undertaken. Due to the small nature of the site, pile burns are most suited and would be undertaken across the remnants in a mosaic pattern.

Burns should only be undertaken following drying out of the site following successful implementation of stormwater mitigation works, and works to increase light availability for germinating seedlings.

Fuel for the piles should be sourced from vegetation present at the site (woody exotics and limbs of overabundant natives), piled and left to dry out completely to facilitate a hot burn. Piles should be placed in areas where a seedbank is likely to be present and remain viable, and the soil is no longer waterlogged. Consideration should be given to felling a large Cheese Tree and burning the ground beneath (using the tree as fuel).

All works associated with ecological burning should be done so under the guidance of an approved Fire Management Plan prepared by a qualified and experienced Consultant, and the fire undertaken by an experienced contractor of the Fire Brigade. Alternative options are outlined in the Appendix Report (TEC 2014) should burning not proceed.

Should burning not proceed alternative methods for assisted seedbank germination are outlined in the Appendix Report (TEC 2014).

Revegetation may be the most feasible opportunity to restore the heath of the community in areas where no regeneration has occurred. Patches of dense understorey shrubs should be installed over the site in areas where resilience is lowest, with occasional tree species interspersed to provide diversity in the canopy.

All revegetation work should use plant material grown from locally sourced seed as outlined in the Appendix Report – Waverley Biodiversity Action Plans Report (TEC 2014).

Stormwater Works

Present on the northern boundary of the site is an ephemeral drainage line fed by a Ø600mm stormwater pipe. Deposition of sediment, organic matter, inorganic rubbish etc. within the drainage line has occurred over time, reducing the volume of the main channel. During high rainfall events, the channel capacity is exceeded and a new overland flow paths have formed currently impacting on the adjacent remnant.

The priority is to eliminate this overland flow and contain runoff in the main channel to arrest the erosion, sedimentation, water-logging and increases in nutrients / weed seeds impacting on the remnant vegetation.

This can be achieved by increasing channel volume by, for example, removing excess sediment and vegetative material and debris, and/or removal of channel substrate material (ie. increase the depth of the channel). Alternatively the bank height could be increased, using excavated site material or by placement of materials such as coir logs or terralock bags to create a bund.

Areas where past channel breaches have resulted in scouring of the substrate are to be repaired such that the soil is returned to a more natural profile. Soil levelling, brush matting and potential revegetation are to be undertaken to prevent future overland flow / surface run-off exacerbating the scours.

Flora Species (SBR 2010)

Genus species	Common Name	Genus species	Common Name	Genus species	Common Name
Xanthosia pilosa	Woolly Xanthosia	*Sticherus flabellatus*	Shiny Fan Fern	*Austrodanthonia* sp	
Commelina cyanea	Scurvy Weed	*Juncus (usitatus* or *continuus)*		*Dichelachne crinita*	Longhair Plumegrass
Dichondra repens	Kidney Weed	*Cassytha sp*		*Entolasia marginata*	Bordered Panic
Cyathea cooperi	Straw Treefern	*Lobelia anceps*		*Lachnagrostis filiformis*	
Gahnia (sieberiana?)	Red-fruit Saw-sedge	*Lomandra longifolia*	Spiny-headed Mat-rush	*Microlaena stipoides*	Weeping Grass
Histiopteris incisa	Bat's Wing Fern	*Stephania japonica* var *discolor*	Snake Vine	*Paspalidium distans*	
Pteridium esculentum	Common Bracken	*Callistemon citrinus*	Crimson Bottlebrush	*Banksia oblongifolia*	Fern-leaved Banksia
Epacris longiflora	Fuchsia Heath	*Kunzea ambigua*	Tick Bush	*Hakea teretifolia*	Needlebush
Glochidion ferdinandi	Cheese Tree	*Leptospermum polygalifolium*	Yellow Tea-tree	*Lomatia silaifolia*	Crinkle Bush
Homalanthus populifolius	Bleeding Heart	*Melaleuca armillaris*	Bracelet Honey-myrtle	*Lepyrodia scariosa*	
Acacia longifolia ssp longifolia	Sydney Golden Wattle	*Dianella caerulea*	Blue Flax-lily	*Opercularia aspera*	Coarse Stinkweed
Acacia terminalis subsp *terminalis*	Sunshine Wattle	*Pittosporum undulatum*	Sweet Pittosporum	*Smilax glyciphylla*	Sweet Sarsaparilla
Gleichenia dicarpa	Pouched Coral Fern	*Aristida warburgii*			

No Fauna records exist for the Loombah Road Cliffs remnant.

Recommended Revegetation Species (B-Buffer only; R-Remnant only; BR-Buffer & Remnant)

Family	Genus species	Common Name	Family	Genus species	Common Name
Acacia longifolia **(BR)**	Sydney Golden Wattle	*Dichondra repens* **(BR)**	Kidney Weed	*Leptospermum polygalifolium* **(BR)**	Yellow Tea-tree
Aristida warburgii **(BR)**		*Epacris longiflora* **(BR)**	Fuchsia Heath	*Lomandra longifolia* **(BR)**	Spiny-headed Mat-rush
Banksia marginata **(BR)**	Silver Banksia	*Ficinia nodosa* **(BR)**	Knobby Club-rush	*Lomatia silaifolia* **(BR)**	Crinkle Bush
Banksia serrate **(BR)**	Old-man Banksia	*Glochidion ferdinandi* **(BR)**	Cheese Tree	*Microlaena stipoides* **(BR)**	Weeping Grass
Bossiaea heterophylla **(BR)**	Variable Bossiaea	*Hakea teretifolia* **(BR)**	Needlebush	*Monotoca elliptica* **(BR)**	Tree Broom-heath
Breynia oblongifolia **(BR)**	Coffee Bush	*Hibbertia fasciculata* **(BR)**		*Oplismenus aemulus* **(BR)**	Oplismenus
Callistemon citrinus **(BR)**	Crimson Bottlebrush	*Homalanthus populifolius* **(BR)**	Bleeding Heart	*Pandorea pandorana* **(BR)**	Wonga Wonga Vine
Callistemon linearis **(BR)**		*Imperata cylindrical* **(BR)**	Blady Grass	*Parsonsia straminea* **(BR)**	Common Silkpod
Centella asiatica **(BR)**	Indian Pennywort	*Kunzea ambigua* **(BR)**	Tick Bush	*Pittosporum undulatum* **(BR)**	Sweet Pittosporum
Commelina cyanea **(BR)**	Scurvy Weed	*Lambertia formosa* **(BR)**	Mountain Devil	*Smilax glyciphylla* **(BR)**	Sweet Sarsaparilla
Dianella caerulea **(BR)**	Blue Flax-lily	*Lasiopetalum ferrugineum* **(BR)**		*Stephania japonica* var *discolour* **(BR)**	Snake Vine

Type 1 Buffer Revegetation – Low diversity graminoid dominant buffer revegetation
Type 2 Buffer Revegetation – Higher diversity, multiple plant forms buffer / non-buffer revegetation
See Appendix Report (TEC 2014) for details

Recommendations for Future Biodiversity Actions and Means of Achieving EAP3 Objectives

- Vegetation Condition Mapping is to be updated in 2015 with consideration given to the re-classification of remnants' 'Condition' as outlined in the Appendix Report – Waverley BAPs (TEC 2014). Update of mapping in 2015 will assess progress of restoration works towards the EAP3 targets and should be repeated every 24 months to 2019, followed by final assessment at 2020.
- Burning may not be appropriate at Loombah Road Cliffs and alternative means for stimulating seeding emergence may be required. See Appendix Report – Waverley BAPs (TEC 2014)
- In undertaking the stormwater impact mitigation works put forward above, this Action Plan will be contributing to EAP3 Targets of Minimising sediments and suspended solids in stormwater discharged into waterways, and Minimising nutrients in stormwater discharged into vegetation remnants, each by 2020.

LOOMBAH ROAD CLIFFS Biodiversity Action Plan - Actions Table

Remnant Code	Management Action	Responsibility	Performance Criteria	Timing	**Total Cost of Mgmt Action (ex GST)** See spreadsheet for more info and breakdown
L1a, L25a & L27a	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Remnant condition to be assessed as Fair (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 6 months of targeted works • Works undertaken no less than quarterly to 2020	$ 13,980.00
L1b, L25b, L27b, L18	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • ≥50% of remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • ≥50% of remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • ≥50% of remnant condition to be assessed as Good at 2020 Condition Mapping update • No unexpected loss of *A. terminalis* subsp *terminalis* specimens • Increase in light penetration through canopy	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 12 months of targeted works • Works undertaken no less than quarterly to 2020	$ 23,480.00
	Mitigate Residential Run-off	Waverley Council	Remove vegetable garden from within remnant and ensure run-off from irrigation system does not flow into remnant vegetation or soils.	From the outset of this Action Plan	n/a
	Stormwater Impact Mitigation Measures	Waverley Council (Contractor with environmental management experience to be engaged)	Re-instate main channel and ensure stormwater is contained during future bank full flow events; • Increase channel volume by removing in-stream sediment AND/OR construct bund along the eastern/southern edge of the drainage-line. • Remediation of scour damage caused by previous channel breaches. • No new rill/ gully erosion within the remnant vegetation following mitigation works.	To be undertaken within 3 months of commencement of works associated with this Action Plan.	$ 3,978.00
	Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 75-200m^2 of understorey revegetation undertaken at 4 plants/m^2 (as required) • Revegetation works completed within 18-30 months of commencement of vegetation management actions • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works	As outlined adjacent	$ 3,872.00
L1c	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Remnant condition to be assessed as Fair (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken no less than quarterly to 2020	$ 2,280.00
L14 & L16	Targeted Weed Treatments	Waverley Council engaged Bush Regeneration Contractor	Regular weed control to suppress exotic species within the remnant. • Establish safe reliable access to vegetation remnant • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair at 2020 Condition Mapping update	Weed treatment works to progress regularly to 2020. • Access established at the outset of this Action Plan • Works undertaken no less than quarterly to 2020	$ 9,600.00
L134 & L136	Targeted Weed Treatments	Waverley Council engaged Bush Regeneration Contractor	Regular weed control to suppress exotic species within the remnant. • Establish safe reliable access to vegetation remnant • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair at 2020 Condition Mapping update	Weed treatment works to progress regularly to 2020. • Access established at the outset of this Action Plan • Works undertaken no less than quarterly to 2020	$ 10,400.00
Various	Ecological Burns	Waverley Council engaged Bush Regeneration Contractor	Undertake ecological burns as required ensuring the following conditions are met; • Prepare site and undertake burns as outlined in Fire Management Plan • Required approvals sought by Bushfire Consultant (not BR Contractor)	• Commence planning at the outset of this Action Plan • Undertake burns following 18 months of vegetation management works associated with this Plan	$ 3,400.00
All areas	Ecological Monitoring	Waverley Council engaged Vegetation Management Consultant	Undertake regular monitoring visits to ensure bush regeneration works are progressing within the scope of this Action Plan and the specific project contract. • Establish fixed photo monitoring points within each remnant • Establish fixed quadrat or transect survey locations to assess weed cover abundance and native regeneration • Provide a report on the findings to Waverley Council	Monitoring events to occur at regular intervals to 2020. • Monitoring surveys and reports to be undertaken annually and provided to Council	$ 11,880.00
n/a	Project Admin	Bush Regeneration Contractor	n/a	Throughout Project	$ 2,520.00
				TOTAL	**$ 85,390.00**

Tamarama Marine Drive Remnant Biodiversity Action Plan 2014-20

Map No: BAP_08
Prepared for: Waverley Council
Prepared by: C Wharfe - TEC
Date: May 2014
Plan Status: FINAL

Bushland Remnant

- T1

Vegetation Condition (SRB 2010)

- Good
- Fair
- Poor
- Very Poor

Additional Management Actions

- Buffer Reveg - Priority 1 Stage 1
- Buffer Reveg - Priority 1 Stage 2
- Buffer Reveg - Priority 2
- Targeted Weed Control

0 12.5 25 50 Meters

N

Data Source:
Total Earth Care
Sydney Bush Regen Company
c/o Waverely Council
NearMap

T1.1, T1.2, T1.3 – Sea-cliff Heath

Management Actions: Bush Regeneration

Management Tasks:

- Consolidation of previously worked areas, continued bush regeneration works targeting re-occurring exotics, ecologically damaging species and non-indigenous native seedlings.
- Progression of works from consolidated areas into areas of lower condition. Initially targeting noxious and vine weeds, followed by highly fecund woody weeds and smothering groundcovers, then secondary treatments, shrubs and all exotic and non-indigenous native seedlings.
- Consolidation of newly treated areas prior to progression into adjacent areas of low condition.
- Culling of mature *Banksia integrifolia, Melaleuca quinquenervia* (non-indigenous natives) only after the surrounding bushland has been assessed as in Fair (or better) condition.
- Undertake ecological pile burns as outlined in an approved Fire Management Plan.

T1.4 – Sea-cliff Heath

Management Actions: Bush Regeneration

Management Tasks:

- Targeted removal of noxious and vine weeds as high priority.
- Establish defined edge along the western and southern boundary of the remnant along the line where native plants are replaced by the c. Lantana monoculture.
- Bush regeneration works as outlined above following successful restoration of adjacent areas to higher condition classes.
- Undertake ecological pile burns as outlined in an approved Fire Management Plan.

T1.1, T1.2, T1.3, T1.4 – Sea-cliff Heath

Management Actions: Stormwater / Run-off Mitigation

Management Tasks: Implement Mitigation Measures

- Locate areas where uncontained stormwater is entering the remnant and implement mitigation measures.
- Maintain installed run-off mitigation measures as required.

Supplementary planting may be required within the Tamarama Marine Dr. vegetation remnants should regeneration success be poor following at least 18 months of vegetation management works.

Should ecological burns be unable to proceed, alternatives are outlined in the Appendix Report (TEC 2014)

Investigation is required into stormwater / swimming pool-water (wastewater) inputs into the vegetation remnant, and undertake mitigation as required.

Targeted Weed Control – Vegetation Edge

Management Tasks: Targeted Weed Control

- Removal of exotic species between remnant and Tamarama Park / Tamarama Marine Drive
- Removal of exotic species between Woloroi Crescent and the remnant needs to ensure that sufficient fauna habitat is in place at all times.
- Target noxious, vine and highly fecund weeds as highest priority.
- Remove all non-indigenous native seedlings (*Banksia integrifolia, Melaleuca quinquenervia, Lopostemon confertus*).
- Remove mature *Banksia integrifolia* and *Melaleuca quinquenervia* only after the surrounding bushland has been assessed as in Fair (or better) condition.

Revegetation – Priority 1 Area

Management Tasks: Stabilise and Revegetate

- Removal of exotic species between Wolaroi Cres and remnant within the revegetation area (as illustrated adjacent).
- Install terracing and native leaf mulch across the length of the slope.
- Allow initial flush of exotic seeds to germinate, treat, and install plants.
- Install plants at 4 plants/m^2, ensuring low growing shrubs are placed along the upper slope to maintain views.
- Water-in and maintain to establishment

Revegetation – Priority 2 Area

Management Tasks: Stabilise and Revegetate

- Repeat process as with Priority 1 Area
- To be undertaken following successful establishment of plantings and no sooner than 24 moths from installation of plantings within Priority 1 Area.

All revegetation work should use plant material grown from locally sourced seed as outlined in the Appendix Report – Waverley Biodiversity Action Plans Report (TEC 2014).

total earth care

TAMARAMA MARINE DRIVE REMNANT Biodiversity Action Plan 2014 - 2020

Remnant Description

The Tamarama Marine Drive remnant occurs directly west of Tamarama Beach and is one of the largest and most floristically diverse patches of native vegetation in the LGA. Native species diversity is apparent in all strata and vegetation forms with a number of species present either rare on not recorded in the rest of the Council area.

Bush regeneration works have been undertaken within the remnant and improved the condition of the patch's core. The native vegetation is however surrounded to the west and south by heavily weed infested disturbed batters providing a constant input of exotic weeds.

Patches of remnant vegetation occur along the cliff-tops north and south of Tamarama Beach, and to the north of the Tamarama Marine Drive remnant within Tamarama Park, resulting in relative connectivity of remnant vegetation in the area for pollinators and the exchange of genetic material.

Threats to the vegetation include planting of non-indigenous native species adjacent (and possibly within) the remnant vegetation, past dumping of fill, stormwater run-off, a prolonged absence of fire and weed invasion (SBR 2010).

Aside from being a large and diverse remnant the vegetation holds conservation significance in the fact that it contributes significantly to Waverley Council's SEPP 19 bushland.

It is expected that with ongoing bush regeneration and environmental management works the majority, if not all of the bushland remnant will reach the desired threshold of Good Vegetation Condition by 2020.

T1.1, T1.2, T1.3 – The core vegetation of the Sea-cliff Heath remnant supports a range of native species and occurs at Fair to Poor Condition (SBR 2010). Native species dominate in areas where bush regeneration works have been undertaken and plants in all strata such as *Gleichenia dicarpa, Bauera rubioides, Baeckea imbricata, Westringea fruticosa, Billardiera scandens* and *Glochidion ferdinandi* occur generally as mature specimens.

In areas yet to undergo ecological restoration works exotic species occur at high densities at all layers with vine, shrubs / trees and groundcover weeds common.

Exotic species present within the vegetation include Morning Glory and Coastal Morning Glory, Lantana, Cassia (*Senna pendula glabrata*), NZ Christmas Bush, Mirror Bush, Asparagus Fern and Gazania.

Non-indigenous native species also occur within the remnant with *Banksia integrifolia* and *Melaleuca quinquenervia* over-abundant and occurring as a weeds.

T1.4 – The bushland edge generally occurs at a much lower vegetation condition than the core with high levels of weed infestation consisting generally of vine and ground cover species.

The poor condition of this vegetation is the result of a high edge to core ratio resulting in impacts on the remnant from Tamarama Marine Drive and anthropogenic influences to the east, landscaped and turfed parkland at under various levels of maintenance to the north, and dense exotic weed infestations and urban stormwater run-off to the west and south.

The most abundant exotic species within this sub-patch include; Asparagus Fern, Morning Glory and Lantana.

Vegetation Communities (SBR 2010):

Sea-cliff Heath

Open to closed low growing community with <10 to <70% canopy FPC, characteristic species include *Baeckea imbricata, Banksia ericifolia, Melaleuca armillaris, Melaleuca nodosa, Westringia fruticosa*. Community distributed within 50m of sea-cliffs on skeletal sands to sand lenses on sandstone, drainage is often impeded.

SEPP 19 Bushland

At approximately 3000m^2 T1 comprises 30% of the SEPP 19 Bushland in Urban Areas vegetation within the entire LGA. (SBR 2010)

Waverley Council is obliged to protect and preserve the bushland because of its value as part of natural heritage, its aesthetic value and its value as a recreational, educational and scientific resource, and must consider impacts upon it when assessing all relevant Development Applications.

Remnant Significance

As outlined above the Tamarama Marine Drive remnant is one of the largest and most diverse patches of bushland within the Waverley Council Area. During the SBR 2010 floristic survey 28 indigenous plant species were recorded within the remnant, the 4th most of the 83 patches surveyed. Of these 28 species, 5 were considered rare in the Council Area; *Banksia marginata, Bauera rubioides, Lasiopetalum ferrugineum, Pandorea pandorana* and *Pultenaea linophylla* (SBR 2010).

The vegetation supports the largest patch of remnant native species within Tamarama Park and its conservation significance is increased by the connectivity to a relatively large amount of adjacent remnant and non-remnant bushland. This combined vegetation supports a large area of dense Heath / Woodland habitat in the locality.

Remnant Condition (SBR 2010)

	Remnant Condition 2010 (SBR 2010)				
	V. Poor	Poor	Fair	Good	TOTAL
Area (m^2)	1111	1306	447	-	2864
Area (%)	39%	46%	15%	0%	100%

Area Likely to Reach "Good" Condition by 2020

R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020	R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020
T1.1	447	Fair	447	T1.3	1268	Poor	1000
T1.2	38	Poor	38	T1.4	1111	V Poor	811

Area Good Condition 2010: 0% Area Good Condition 2020: 80% (2296m^2)

Flora / Fauna Habitats

Fauna habitat supported by the Tamarama Marine Drive remnant consists of dense native and exotic undergrowth suitable for foraging and shelter resources for small birds and reptiles. Nesting opportunities for passerine birds are also abundant. A number of sandstone benches occur thought the remnant surrounded on all sides by vegetation making them ideal basking sites for skinks and geckos. There are no trees present tall enough or with a dense enough crown to offer nesting habitat for larger native birds such as Kookaburras or Currawong.

Flora habitat is relatively abundant due to the size of the remnant although the dense infestations of exotic species especially in the ground-layer are preventing recruitment from the native seedbank. Following removal of smothering groundcovers and ecological restoration works to facilitate germination, it is expected that native flora species germination and establishment will be at encouraging levels.

Remnant Restoration Goals & Associated Tasks

T1.1, T1.2, T1.3 – Ecological restoration works are to target species based on the likelihood of ecological damage if they persist or increase in abundance. Vines and highly fecund species are most likely to negatively impact on the remnant vegetation, followed by dense groundcover species that prevent native recruitment form the seedbank.

Works should initially consolidate previously worked areas by further suppression of re-emerging exotic species, and then move into areas of lower quality.

In areas where weed removal has resulted in a lack of vegetation cover, soil scarification and brush matting with native plant material should be undertaken to facilitate germination, provide protection to seedlings and prevent erosion as a result of exposed soils.

T1.4 – It is the intension that bush regeneration works will progress into T1.4 as improvements are made within the remnants core. However, initial works are also to be undertaken to reduce the pressures inflicted by the ecologically damaging weed species present. Vine weeds smother canopy species and prevent light penetration to the heath floor and hence their removal is required as a priority. The area is also to be swept for noxious weeds such as Lantana and Asparagus Fern which should be supressed during regular works.

Establishing a maintenance edge between the native vegetation and the highly disturbed and weed infested slopes to the west and south is to be undertaken to facilitate definition of maintenance works and project areas.

Stormwater / Wastewater Impact Mitigation

Stormwater influx from roads above the vegetation remnant, adjacent properties and potentially residential swimming pools (wastewater) is impacting on the bushland patch by increasing waterlogging, erosion, nutrient load and increasing exotic propagate input. Investigation into these issues and implementation of mitigation measures is required to reduce negative impacts on remnant bushland.

Ecological Pile Burns

Prolonged absence of fire is a threat to the longevity of the bushland remnant at Tamarama Marine Drive and is required to reinstate successional processes in the over-mature bushland.

Due to the small nature of the site pile burns are most suited and would be undertaken across the remnants in a mosaic pattern. Fuel for the piles should be sourced from vegetation present at the site (woody exotics and limbs of overabundant natives), piled and allowed to dry out completely to facilitate a hot burn. Piles should be placed in areas where a native seedbank is likely to be present and remain viable, and the soil is not significantly waterlogged.

All works associated with ecological burning should be done so under the guidance of an approved Fire Management Plan prepared by a qualified and experienced Consultant, and the fire undertaken by an experienced contractor of the Fire Brigade. Alternative options are outlined in the Appendix Report (TEC 2014) should burning not proceed.

Revegetation

Revegetation is required surrounding the remnant vegetation off Tamarama Marine Drive and is to be undertaken as follows;

- Priority 1 Stage 1: Undertake Type 1 Buffer Revegetation 12-18 months from the commencement of vegetation management works
- Priority 1 Stage 2: Undertake Type 2 Buffer Revegetation 6-12 months from the completion of Stage 1 works
- Priority 2: Undertake Type 2 Buffer Revegetation 24 months from the completion of Priority 1 Stage 2 works

Revegetation may also be required within the remnant should passive regeneration works and ecological burning not result in sufficient increases in native species abundance and cover. See Appendix Report (TEC 2014) for details

Flora Species (SBR 2010)

Genus species	Common Name	Genus species	Common Name	Genus species	Common Name
Carpobrotus glaucescens	Pigface	*Glochidion ferdinandi*	Cheese Tree	*Pittosporum undulatum*	Sweet Pittosporum
Centella asiatica	Indian Pennywort	*Pultenaea linophylla*		*Deyeuxia quadriseta*	
Pandorea pandorana	Wonga Wonga Vine	*Acacia longifolia*	Sydney Golden Wattle	*Dichelachne crinita*	Longhair Plumegrass
Centrolepis fascicularis		*Gleichenia dicarpa*	Pouched Coral Fern	*Entolasia marginata*	Bordered Panic
Commelina cyanea	Scurvy Weed	*Westringia fruticosa*	Coastal Rosemary	*Eragrostis brownii*	Brown's Lovegrass
Cyathea cooperi	Straw Treefern	*Cassytha sp*		*Banksia ericifolia* subsp *ericifolia*	Heath-leaved Banksia
Baumea juncea		*Lobelia anceps*	Spiny-headed Mat-rush	*Banksia marginata*	Silver Banksia
Cyperus polystachyos		*Lomandra longifolia*	Hyssop Loosestrife	*Grevillea speciosa*	Red Spider Flower
Ficinia nodosa	Knobby Club-rush	*Lythrum hyssopifolia*		*Hakea gibbosa*	Needlebush
Lepidosperma (concavum?)		*Baeckea imbricata*		*Hakea teretifolia*	Needlebush
Histiopteris incisa	Bat's Wing Fern	*Melaleuca nodosa*		*Opercularia aspera*	Coarse Stinkweed
Monotoca elliptica	Tree Broom-heath	*Dianella congesta*		*Lasiopetalum ferrugineum*	

Fauna Species (Tamarama Park) (AMBS 2011)

Genus species	Common Name	Genus species	Common Name	Genus species	Common Name
Litoria dentata	Bleating Tree Frog	*Eudynamys orientalis*	Pacific Koel	*Trichosurus vulpecula*	Common Brushtail Possum
Litoria fallax	Eastern Dwarf Tree Frog	*Hirundo neoxena*	Welcome Swallow	*Pteropus poliocephalus*	Grey-headed Flying-fox
Dacelo novaeguineae	Laughing Kookaburra	*Malurus cyaneus*	Superb Fairy-wren	*Phyllurus platurus*	Broad-tailed Gecko
Cracticus torquatus	Grey Butcherbird	*Manorina melanocephala*	Noisy Miner	*Cryptoblepharus virgatus*	Cream-striped Shinning-skink
Gymnorhina tibicen	Australian Magpie	*Phylidonyris novaehollandiae*	New Holland Honeyeater	*Eulamprus quoyii*	Eastern Water-skink
Strepera graculina	Pied Currawong	*Passer domesticus*	House Sparrow	*Saiphos equalis*	Three-toed Skink
Cacatua sanguinea	Little Corella	*Podargus strigoides*	Tawny Frogmouth	*Saproscincus spectabilis*	Pale-lipped Shadeskink
Columba livia	Rock Dove	*Trichoglossus haematodus*	Rainbow Lorikeet	*Tiliqua scincoides*	Eastern Blue-tongue
Corvus coronoides	Australian Raven	*Mormopterus* sp.	mastiff-bat		

Recommended Revegetation Species (B-Buffer only; R-Remnant only; BR-Buffer & Remnant)

Family	Genus species	Common Name	Family	Genus species	Common Name
Acacia longifolia **(BR)**	Sydney Golden Wattle	Dillwynia retorta **(BR)**		Lomandra longifolia **(BR)**	Spiny-headed Mat-rush
Acacia suaveolens **(R)**	Sweet Wattle	Entolasia marginate **(B)**	Bordered Panic	Melaleuca armillaris **(BR)**	Bracelet Honey-myrtle
Austrostipa mollis **(BR)**		Epacris longiflora **(R)**	Fuchsia Heath	Melaleuca nodosa **(BR)**	
Baeckea imbricata **(BR)**		Ficinia nodosa **(BR)**	Knobby Club-rush	Microlaena stipoides **(B)**	Weeping Grass
Banksia ericifolia ssp ericifolia **(BR)**	Heath-leaved Banksia	Glochidion ferdinandi **(R)**	Cheese Tree	Monotoca elliptica **(BR)**	Tree Broom-heath
Banksia serrate **(R)**	Old-man Banksia	Hakea teretifolia **(R)**	Needlebush	Paspalidium distans **(B)**	
Baumea rubiginosa **(BR)**		Imperata cylindrical **(B)**	Blady Grass	Pimelea linifolia ssp linifolia **(R)**	Slender Rice Flower
Dianella caerulea **(B)**	Blue Flax-lily	Kunzea ambigua **(BR)**	Tick Bush	Westringia fruticosa **(BR)**	Coastal Rosemary
Dianella congesta **(B)**		Leptospermum squarrosum **(BR)**		Xanthosia pilosa **(R)**	Woolly Xanthosia
Dichelachne crinite **(B)**	Longhair Plumegrass	Leucopogon juniperinus **(BR)**	Prickly Beard-heath		

Type 1 Buffer Revegetation – Low diversity graminoid dominant buffer revegetation
Type 2 Buffer Revegetation – Higher diversity, multiple plant forms buffer / non-buffer revegetation
See Appendix Report (TEC 2014) for details

NB// Acacia longifolia is to be minimally planted and only in exposed locations where it will not grow tall, *Acacia sophorae* is a suitable alternative.

Recommendations for Future Biodiversity Actions and Means of Achieving EAP3 Objectives

- Vegetation Condition Mapping is to be updated in 2015 with consideration given to the re-classification of remnants' 'Condition' as outlined in the Appendix Report – Waverley BAPs (TEC 2014). Update of mapping in 2015 will assess progress of restoration works towards the EAP3 targets and should be repeated every 24 months to 2019, followed by final assessment at 2020.
- Burning may not be appropriate at Tamarama Marine Dr. and alternative means for stimulating seeding emergence may be required. See Appendix Report – Waverley BAPs (TEC 2014)
- In undertaking the revegetation surrounding the remnant and implementing stormwater mitigation measures this Action Plan is contributing to EAP3 Targets of Minimising sediments and suspended solids in stormwater discharged into waterways, and Minimising nutrients in stormwater discharged into vegetation remnants, each by 2020.

TAMARAMA MARINE DRIVE REMNANT Biodiversity Action Plan - Actions Table

Remnant Code	Management Action	Responsibility	Performance Criteria	Timing	**Total Cost of Mgmt Action (ex GST)** See spreadsheet for more info and breakdown
T1.1, T1.2, T1.3	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • ≥50% of remnant condition to be assessed as Fair (or better) during 1st Condition Mapping update (2015) • ≥50% of remnant condition to be assessed as Good during 2nd Condition Mapping update (2017) • ≥80% of remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 24 months of works outlined in this Action Plan • Works undertaken no less than quarterly to 2020	$ 63,440.00
T1.4	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair during 2nd Condition Mapping update (2017) • ≥80% of remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken no less than quarterly to 2020	$ 17,520.00
Vegetation Edge	Targeted Weed Treatments	Waverley Council engaged Bush Regeneration Contractor	Regular weed control to suppress exotic species within the remnant. • Vegetation condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair at 2020 Condition Mapping update	Weed treatment works to progress regularly to 2020. • Works undertaken no less than quarterly to 2020	$ 8,880.00
Revegetation **Priority 1 Stage 1 Area**	Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 500m^2 of batter revegetation undertaken at 4 plants/m^2 (as required) • Revegetation works completed within 12-18 months of commencement of vegetation management actions outlined in this Action Plan • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 14,826.00
Revegetation **Priority 1 Stage 2 Area**	Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 1000m^2 of batter revegetation undertaken at 4 plants/m^2 (as required) • Revegetation works completed within 12-18 months of commencement of vegetation management actions outlined in this Action Plan • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 32,320.00
Revegetation **Priority 2 Area**	Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 500m^2 of batter revegetation undertaken at 4 plants/m^2 (as required) • Revegetation works to commence 24 months from completion of Priority 1 Area. • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 19,480.00
Various	Coral Tree Removal	Waverley Council engaged Arboricultural Contractor	Remove Coral Trees adjacent to patch H2a if deemed necessary	• As deemed necessary	$ 2,000.00
	Ecological Burns	Waverley Council engaged Bush Regeneration Contractor	Undertake ecological burns as required ensuring the following conditions are met; • Prepare site and undertake burns as outlined in Fire Management Plan • Required approvals sought by Bushfire Consultant (not BR Contractor)	• Commence planning at the outset of this Action Plan • Undertake burns following 18 months of vegetation management works associated with this Plan	$ 3,400.00
	Supplementary Plantings	Waverley Council engaged Bush Regeneration Contractor	Install 400 native tubsestock within remnant vegetation if required as a result of low levels of natural regeneration following passive and active management works	• Following no less than 18 moths of vegetation management works	$ 4,648.00
	Stormwater / Wastewater Management	Waverley Council or engaged Contractor	Implement actions outlined in Stormwater Management Plan (to be prepared)	• As outlined in SMP	Undetermined
All areas	Ecological Monitoring	Waverley Council engaged Vegetation Management Consultant	Undertake regular monitoring visits to ensure bush regeneration works are progressing within the scope of this Action Plan and the specific project contract. • Establish fixed photo monitoring points within each remnant • Establish fixed quadrat or transect survey locations to assess weed cover abundance and native regeneration • Provide a report on the findings to Waverley Council	Monitoring events to occur at regular intervals to 2020. • Monitoring surveys and reports to be undertaken annually and provided to Council	
n/a	Project Admin	Bush Regeneration Contractor	n/a	Throughout Project	$ 2,520.00
				TOTAL	**$ 180,914.00**

Waverley Cemetery Cliffs
Biodiversity Action Plan 2014-20

Map No: BAP_09
Prepared for: Waverley Council
Prepared by: C Wharfe - TEC
Date: May 2014
Plan Status: FINAL

Bushland Remnant
- C1a
- C1b
- C2a
- C2b
- C2c

Revegetation
- Buffer Planting
- Existing Buffer

Vegetation Condition
- Good
- Fair
- Poor
- Very Poor

0 12.5 25 50 m
Approx.

N

Data Source:
Total Earth Care
Sydey Bush Regen Company
c/o Waverely Council
NearMap

C1a - Sea-cliff Sedgeland c) Ficinia nodosa.

Management Action: Bush Regeneration

Management Tasks:

- Continue Bush Regeneration works throughout remnant
- Definition of western edge of remnant required to delineate remnant from eroded gully.
- Maintenance weeding of existing adjacent buffer plantings

C1b - Sea-cliff Sedgeland c) Ficinia nodosa.

Management Action: Targeted Weed Treatments

Management Tasks:

- Targeted treatment and suppression of exotic species.
- Large scale weed removal and revegetation on the cliff-tops recommended to reduce future maintenance requirements.

C2a - Sea-cliff Heath.

Management Action: Bush Regeneration

Management Tasks:

- C2a.1 and C2a.2 Targeted removal of Pennywort encroaching from the adjacent remnant C2b.
- C2a.3 and C2a.4 Targeted treatment of Asparagus Fern and Pennywort.
- C2a.5 and C2a.6 Targeted removal of Pennywort, Asparagus Fern, NZ Christmas Bush, Montbertia and other herbaceous weeds.
- C2a.7 Continued bush regeneration works & Installation of erosion/sediment controls and dense sedge planting within and directly around the drainage line.

C2b - Sea-cliff Sedgeland b) Baumea juncea.

Management Action: Targeted Weed Treatments

Management Tasks:

- Establish and maintain an edge between the sedgeland and the heath vegetation.
- Suppression and reduction of Pennywort within remnant.

C2c - Sea-cliff Herbland b) Dianella congesta.

Management Action: Bush Regeneration

Management Tasks:

- Bush regeneration works targeting Couch Grass and Mirror Bush.
- Re-planting should not be undertaken within this small remnant patch.
- Maintenance weeding of existing adjacent buffer plantings

total earth care

WAVERLEY CEMETERY CLIFFS Biodiversity Action Plan 2014 - 2020

Remnant Descriptions

The site comprises of four patches of low growing heath and sedgeland remnant vegetation on the sea-cliff to the east of Waverley Cemetery. The remnants occur as isolated patches or 'islands' on the cliff-tops and are threatened by exotic species, lack of fire and anthropogenic influences. The vegetation is impacted upon by altered drainage and run-off patterns of the surrounding urban environment and the associated negative vectors of sedimentation, nutrification and weed propagule input.

Bush regeneration works have improved the vegetation condition in recent times, although exotic species still occur at high densities in a number of areas. Continued vegetation management works are likely to improve the condition of a significant portion of the remnant to Good by 2020.

C1a - Remnant exists as mixed native and exotic graminoids and shrubs on top of sandstone sea-cliffs between Waverley Cemetery and the Coastal Walkway (to the west) and the Tasman Sea (to the east).

Exotic species issues include Buffalo Grass, Carpet Grass, *Cyperus eragrostis*, NZ Christmas Bush, Norfolk Island Hibiscus, Mirror Bush, Asparagus Fern.

C1b - The remnant consists of *Ficinia nodosa* and Salt-water Couch on the cliff-face between Waverley Cemetery and the Tasman Sea.

Exotic species issues directly impacting on the remnant vegetation include Asparagus Fern, Buffalo Grass and Mirror Bush. Weed species impacting from cliffs above also include Lantana and vine weeds.

Cliff-top access issues apply to both C1a & C1b. Rope access is required for weed removal works within and above C1b. Static safety lines may be required for all cliff-top works.

C2a - The vegetation remnant occurs as closed and open heath dominated by shrubs or grasses/sedges with varying degrees of exotic species infestation. The remnant patch occurs on the cliff-top to the east of the Coastal Walkway towards the northern extent of the Cemetery.

Weed issues impacting on remnant patches C2a.1 - C2a.7 include Pennywort, NZ Christmas Bush, Asparagus Fern and Montbertia, the most abundant and most ecologically damaging of which is Pennywort.

C2b - The sedgeland remnant C2b is heavily infested with Pennywort to the point where the weed is considered intractable. Vegetation management works within the remnant are to focus on the prevention of the species further spreading into the adjacent higher condition patches.

C2c - A small patch of herbland dominated by *Dianella congesta* occurs to the west of the coastal walkway at the northern end of the Waverley Cemetery Site.

The vegetation is supported by remnant soils although the area is heavily infested with Couch Grass (*Cynodon dactylon*), Mirror Bush and Pennywort.

Vegetation Communities (SBR 2010):

Sea-cliff Sedgeland c) *Ficinia nodosa*

Low open vegetation community with <10 to <30% canopy PFC, characteristic species listed as *Ficinia nodosa* dominant with other sedges present. Community occurrence is within 20m of sea-cliffs on skeletal sands to sand lenses on sandstone, often on modified soil.

Sea-cliff Heath

Open to closed low growing community with <10 to <70% canopy FPC, characteristic species include *Baeckea imbricata, Banksia ericifolia, Melaleuca armillaris, Melaleuca nodosa, Westringia fruticosa*. Community distributed within 50m of sea-cliffs on skeletal sands to sand lenses on sandstone, drainage is often impeded.

Sea-cliff Sedgeland b) *Baumea juncea*

Low open to closed vegetation community with >10 to <70% canopy PFC, characteristic species listed as *Baumea juncea* dominant with other sedges present. Community occurrence is within 20m of sea-cliffs on sand lenses on sandstone, drainage is often impeded.

Sea-cliff Herbland b) *Dianella congesta*

Low tending to closed vegetation community with >30 to <70% canopy PFC, characteristic species listed as *Dianella congesta*. Community occurs within 10m of sea-cliffs on sand lenses on sandstone.

SEPP 19 Bushland

No remnant vegetation on the Waverley Cemetery Cliffs is considered SEPP 19 Bushland (SBR 2010)

Remnant Significance (SBR 2010)

Waverley Cemetery Cliffs support the 5th largest area of remnant vegetation on Council land, the 7th highest species richness of the 37 properties surveyed by SBR (2010), and 2 of the species recorded were recorded nowhere else within the LGA.

Sea-cliff Sedgeland b) *Baumea juncea* occurs at only 1 other location in the LGA, Sea-cliff Herbland b) *Dianella congesta* occurs at only 1 other location in the LGA.

Remnant Condition (SBR 2010)

	Remnant Condition 2010 (SBR 2010)				
	V. Poor	Poor	Fair	Good	TOTAL
Area (m^2)	1664	613	148	720	3145
Area (%)	53%	19%	5%	23%	100%

Area Likely to Reach "Good" Condition by 2020

R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020	R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020
C1a	1287	V Poor	1287	C2a.3	39	V Poor	39
C1b	253	V Poor	0	C2a.4	48	Poor	48
C2b	348	V Poor	0	C2a.5	148	Fair	148
C2c	85	V Poor	85	C2a.6	531	Good	531
C2a.1	189	Good	189	C2a.7	177	Poor	177
C2a.2	40	Poor	40	-	-	-	-

Area Good Condition 2010: 23% Area Good Condition 2020: 81% (2544m^2)

Flora / Fauna Habitats

As previously mentioned Waverley Cemetery Cliffs are one of the more floristically diverse vegetation patches within Waverley. Habitat exists for flora species in both moist and dry cliff-top areas supporting both low/open and taller/closed vegetation units. The combination of wet / dry / low / taller / open / closed habitats result in a diverse range of habitats for remnant native coastal species and increases the conservation significance of the remnant as a possible source of native seed uncommon elsewhere across the LGA.

This diverse flora habitat also provides for a range of habitats for most common native vertebrate fauna groups recorded within the LGA, Frogs, Reptiles and Birds (AMBS 2011). Large open rock platforms provide an abundance of basking and foraging areas for native skinks, ephemeral pools, damp sedgeland and heath and the stormwater drainage line provide potential breeding and foraging areas for frogs, and the dense heath vegetation provides perching and nesting opportunities for smaller passerine birds.

Remnant Restoration Goals & Associated Tasks

To reach 'Good' Vegetation Condition by 2020, restoration works within the Waverley Cemetery Cliffs remnants are to follow standard bush regeneration techniques, whereby exotic species are carefully and strategically removed from native vegetation, with a general progression from areas of higher ecological condition into more degraded areas.

Exotic species present at the Waverley Cemetery Cliffs vegetation remnant include species that will require a proportionately heavy investment of resources to suppress and potentially eradicate, most relevant of which is Pennywort *Hydrocotyle bonnariensis*.

If the remnant sub-patches listed above and overleaf are to reach 'Good' vegetation condition and contribute significantly to the EAP3 goal of 40% of remnants in Good Condition by 2020, significant input of resources is required.

C1a – Continued Bush regeneration will facilitate improvement in ecological condition and regenerate native species such as *Ficinia nodosa*, *Lobelia alata* and *Samolus repens*.

C1b - Targeted treatment and suppression of exotic species most likely to threaten the ongoing survival of the remnant is to be undertaken to prevent remnant from being lost.

Large scale weed removal and revegetation on the cliff-tops above the remnant is required to improve vegetation condition, ensure long-term survivorship of the community, and reduce the requirement for future maintenance resources.

C2a - Continuation of Bush Regeneration works are required within all sub-patches of C2a. The majority of the remnant heath vegetation can be restored to "Good" vegetation condition with the following targeted works successfully undertaken.

C2a.1 and C2a.2 Edge definition is required at the current extent of the Pennywort infestation and works are to concentrate on suppression and reduction of the species within the adjacent C2b sub-patch.

C2a.3 and C2a.4. Weeds present are not yet considered intractable, concentrated bush regeneration works will greatly reduce the occurrence of target species within these cliff-top patches.

Sub-patch C2a.7 is acting as a buffer between the highly disturbed and weed infested vegetation to the north and the rest of the remnant vegetation to the south. The northern extent of the patch is defined by a stormwater channel that during flood events is highly likely to introduce sediment, nutrients and pollutants into the remnant vegetation, works are required to mitigate these impacts.

Buffer zone planting is to be undertaken in this area whereby dense moisture tolerant graminoid species are installed to filter the sediment-laden run-off before it flows into the remnant vegetation.

Pennywort is to be contained within C2b and prevented from further spreading into remnant C2a as a matter of high priority. Pennywort is not yet well-established in C2a and concentrated works along the patch boundaries are required to prevent further encroachment.

A combination of physical and herbicide treatments is recommended to suppress the infestation, and a defined edge is to be established to which the Pennywort is to be continually suppressed.

C2b - Following successful treatment of the Pennywort within C2a, further ongoing suppression of the species will be required within C2b until such time as control can be gained and the species ceases to encroach on the adjacent vegetation.

Suppression and treatment of Pennywort may be achieved via direct application of Glyophosate herbicide to crushed leaves, foliar spray application of monocot selective herbicide such as Fluroxypyr (Starane), Metsulfuron (Brush-off), 2,4-D, Diquat, Triclopyr (Garlon), Imazamox, or Impazapyr, or potentially burning where soil is dry and shallow enough to burn the majority of the plants' underground root mass.

Chemical treatment options will require a current APVMA Off-label Permit for the treatment of Pennywort, if the species is not listed on the Product Label of the desired herbicide.

Establishment of dense heath vegetation may facilitate the suppression of Pennywort, although planting of shrubs is not currently recommended within remnant C2a (passive regeneration is the preferred restoration technique).

Fire may be a successful treatment technique for the suppression of Pennywort in areas of shallow soils, such as at the Waverley Cemetery Cliffs. Pennywort comprises a large volume of underground biomass capable of re-shooting if not completely killed, and the deeper the soils the less likely the underground biomass is of being completely killed off.

Fire is recommended at the Waverley Cemetery Cliffs to stimulate natural regeneration and kick-start the successional processes currently lacking in the over-mature vegetation remnant.

A site specific Fire Management Plan is to be prepared for the remnant considering the locational aspects of the vegetation (cliff-top access, and weather), the edaphic conditions (shallow, wet and dry soils), and the community factors (highly visible, heavily used public walkway) and well as the need for a mosaic pattern to ensure ongoing successional processes.

C2c - Bush regeneration will facilitate the establishment of other naturally occurring remnant herbland species *Ficinia nodosa*, *Lobelia alata* and *Samolus repens*.

Flora Species (SBR 2010)

Family	Genus species	Common Name	Family	Genus species	Common Name
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair	Lobeliaceae	*Lobelia anceps*	
Aizoaceae	*Carpobrotus glaucescens*	Pigface	Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush
Aizoaceae	*Tetragonia tetragonioides*	New Zealand Spinach	Myrtaceae	*Baeckea imbricata*	
Asteraceae	*Sonchus hydrophilus*	Native Sowthistle	Myrtaceae	*Melaleuca armillaris*	Bracelet Honey-myrtle
Centrolepidaceae	*Centrolepis fascicularis*		Myrtaceae	*Melaleuca nodosa*	
Centrolepidaceae	*Centrolepis strigosa ssp*		Oxalidaceae	*Oxalis thompsoniae*	
Commelinaceae	*Commelina cyanea*	Scurvy Weed	Phormiaceae	*Dianella congesta*	
Cyperaceae	*Baumea juncea*		Phormiaceae	*Dianella revoluta*	Paroo Lily
Cyperaceae	*Cyperus polystachyos*		Poaceae	*Dichelachne crinita*	Longhair Plumegrass
Cyperaceae	*Ficinia nodosa*	Knobby Club-rush	Poaceae	*Lachnagrostis billardierei*	
Cyperaceae	*Isolepis cernua*	Nodding Club-rush	Poaceae	*Lachnagrostis filiformis*	
Cyperaceae	*Schoenus brevifolius*		Poaceae	*Sporobolus virginicus*	Sand Couch
Droseraceae	*Drosera pygmaea*	Pygmy Sundew	Poaceae	*Zoysia macrantha*	Prickly Couch
Juncaceae	*Juncus kraussii*	Sea Rush	Ranunculaceae	*Ranunculus repens*	Creeping Buttercup
Juncaginaceae	*Triglochin striatum*	Streaked Arrowgrass	Selaginellaceae	*Selaginella uliginosa*	Swamp Selaginella
Lamiaceae	*Westringia fruticosa*	Coastal Rosemary	Typhaceae	*Typha orientalis*	Broadleaf Cumbungi
Lentibulariaceae	*Utricularia* sp.	Bladderwort			

No Fauna records exist for the Waverley Cemetery Cliffs remnant.

Recommended Revegetation Species (B-Buffer only; R-Remnant only; BR-Buffer & Remnant)

Family	Genus species	Common Name	Family	Genus species	Common Name
Acacia longifolia **(BR)**	Sydney Golden Wattle	*Dillwynia retorta* **(B)**		*Microlaena stipoides* **(B)**	Weeping Grass
Baeckea imbricata **(BR)**		*Ficinia nodosa* **(BR)**	Knobby Club-rush	*Monotoca elliptica* **(B)**	Tree Broom-heath
Baumea rubiginosa **(BR)**		*Imperata cylindrical* **(B)**	Blady Grass	*Paspalum vaginatum* **(R)**	Salt-water Couch
Carpobrotus glaucescens **(BR)**	Pigface	*Juncus kraussii* **(BR)**	Sea Rush	*Schoenus brevifolius* **(BR)**	
Dianella caerulea **(B)**	Blue Flax-lily	*Juncus usitatus* **(BR)**	Common Rush	*Sporobolus virginicus* **(BR)**	Sand Couch
Dianella congesta **(BR)**		*Kunzea ambigua* **(B)**	Tick Bush	*Tetragonia tetragonioides* **(R)**	New Zealand Spinach
Dianella revoluta **(BR)**	Paroo Lily	*Leptospermum laevigatum* **(B)**	Coast Teatree	*Westringia fruticosa* **(B)**	Coastal Rosemary
Dichelachne crinita **(B)**	Longhair Plumegrass	*Lomandra longifolia* **(BR)**	Spiny-headed Mat-rush	*Zoysia macrantha***(R)**	Prickly Couch

Type 1 Buffer Revegetation – Low diversity graminoid dominant buffer revegetation
Type 2 Buffer Revegetation – Higher diversity, multiple plant forms buffer / non-buffer revegetation
See Appendix Report (TEC 2014) for details

Recommendations for Future Biodiversity Actions and Means of Achieving EAP3 Objectives

- Vegetation Condition Mapping is to be updated in 2015 with consideration given to the re-classification of remnants' 'Condition' as outlined in the Appendix Report – Waverley BAPs (TEC 2014). Update of mapping in 2015 will assess progress of restoration works towards the EAP3 targets and should be repeated every 24 months to 2019, followed by final assessment at 2020.
- Weed removal and revegetation on the cliffs above C1b would result in a significant reduction in negative impacts on the remnant grasses and sedges at the base of the cliffs, and greatly improve the likelihood of the continued survival of the native vegetation.
- Weed removal and revegetation immediately north and west of C2a and C2c will also greatly reduce the impacts of exotic species encroachment on the remnant vegetation and reduce the likelihood of establishment of weeds not yet present within the remnant. Exotic species present adjacent to the remnant vegetation include Coastal Morning Glory (*Ipomoea cairica*), Palm Grass (*Seataria palifolia*) and Cassia (*Senna pendula glabrata*).
- Continued revegetation of the disturbed cliff-line to the north towards Calga Reserve will increase connectivity and habitat for native biodiversity, and reduce the negative impacts, and ongoing maintenance requirements associated with exotic species occurring in close proximity to remnant native vegetation of conservation significance.
- All revegetation works are to be undertaken using tubestock grown from locally collected seed as outlined in the Appendix Report – Waverley Biodiversity Action Plans Report (TEC 2014).

WAVERLEY CEMETERY CLIFFS Biodiversity Action Plan - Actions Table

Remnant Code	Management Action	Responsibility	Performance Criteria	Timing	Total Cost of Mgmt Action (ex GST) See spreadsheet for more info and breakdown
C1a	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Remnant condition to be assessed as Fair (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Good by 2nd Condition Mapping update (2017)	Bush regeneration works to progress regularly to 2020. • Works undertaken no less than quarterly to 2020	$ 8,760.00
C1b	Targeted Weed Treatments	Waverley Council engaged Bush Regeneration Contractor	Regular weed control to assert suppression over most ecologically damaging weeds present within the remnant. • Bush regeneration contractor with ropes experience engaged to undertake or oversee site works • Asparagus Fern, Buffalo Grass, Mirror Bush & any other ecologically damaging weed species treated at a minimum of once every 12 months to 2020	Weed treatment works to progress regularly to 2020. • Works undertaken no less than yearly to 2020	$ 8,760.00
	Buffer Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 600m^2 of low growing buffer revegetation undertaken at 4 plants/m^2 (as required) • Revegetation works to be undertaken following 24-36 months of management works associated with this Action Plan • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 22,608.00
C2a	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Pennywort suppressed as outlined above • Remnant condition to be assessed as Fair during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Good by 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken no less than monthly to 2016 • Works undertaken no less than quarterly to 2020	$ 51,100.00
	Buffer Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 80m^2 of moisture-tolerant buffer revegetation undertaken at 4-6 plants/m^2 (as required) • Revegetation works to be undertaken within 12 months of the commencement of works associated with this Action Plan • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 7,244.00
C2b	Targeted Weed Treatments	Waverley Council engaged Bush Regeneration Contractor	Regular weed control to assert suppression over most ecologically damaging weeds present within the remnant. • Pennywort to be prevented from encroaching into adjacent remnant patches • Remnant condition to be assessed as Poor during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair by 2020 Condition Mapping update	Weed treatment works to progress regularly to 2020. • Works undertaken no less than monthly to June 2015 (12 months) • Works undertaken no less than quarterly to 2020	$ 25,900.00
C2c	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair by 2nd Condition Mapping update (2017) • Remnant condition to be assessed as Good by 2020	Bush regeneration works to progress regularly to 2020. • Works undertaken no less than quarterly to 2020	$ 8,760.00
All areas	Ecological Monitoring	Waverley Council engaged Vegetation Management Consultant	Undertake regular monitoring visits to ensure bush regeneration works are progressing within the scope of this Action Plan and the specific project contract. • Establish fixed photo monitoring points within each remnant • Establish fixed quadrat or transect survey locations to assess weed cover abundance and native regeneration • Provide a report on the findings to Waverley Council	Monitoring events to occur at regular intervals to 2020. • Monitoring surveys and reports to be undertaken annually and provided to Council	$ 11,880.00
n/a	Project Admin	Bush Regeneration Contractor	n/a	Throughout Project	$ 2,520.00
				TOTAL	**$ 147,532.40**

Weonga, Rodney and Raleigh Res.
Biodiversity Action Plan 2014-20

Map No: BAP_10
Prepared for: Waverley Council
Prepared by: C Wharfe - TEC
Date: May 2014
Plan Status: FINAL

Bushland Remnant
- R1
- R2
- R3
- Z6
- Z7

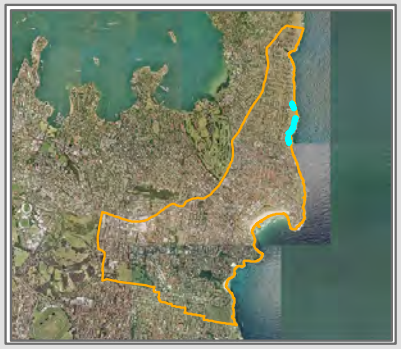
Revegetation
- Mosaic Plantings
- Buffer Plantings

Vegetation Condition
- Good
- Fair
- Poor
- Very Poor

0 15 30 60 Meters
Approx.

N

Data Source:
Total Earth Care
Sydney Bush Regen Company
c/o Waverely Council
NearMap



R1 – Sea-cliff Sedgeland c) Ficinia nodosa

Management Action: Bush Regeneration

Management Tasks:

- Establish maintenance edge between remnant vegetation and surrounding exotic vegetation.
- Regular herbicide treatment and hand removal of exotic species.

R2 – Sea-cliff Heath

Management Action: Bush Regeneration

Management Tasks:

- Consolidation of previously worked areas, continued bush regeneration works targeting re-occurring exotic species.
- Establishment of a spray buffer zone between the turf and the remnant vegetation.
- Progression of works from consolidated areas into areas of lower condition. Initially targeting noxious and vine weeds, followed by highly fecund woody weeds and smothering groundcovers, then secondary treatments and shrubs and all exotic seedlings.
- Static rope lines required to ensure contractor safety, anchoring lines from vehicles parked within adjacent turfed areas may be most suitable.

R3 – Sea-cliff Heath

Management Action: Bush Regeneration

Management Tasks:

- Establishment of a spray buffer zone between the turf and the remnant vegetation.
- Progression of works from consolidated areas into areas of lower condition. Initially targeting noxious and vine weeds, followed by highly fecund woody weeds and smothering groundcovers, then secondary treatments and shrubs and all exotic seedlings.
- Static rope lines required to ensure contractor safety, anchoring lines from vehicles parked within adjacent turfed areas may be most suitable.

Z6 – Sea-cliff Heath

Management Action: Bush Regeneration

Management Tasks:

- Consolidation of previously worked areas, continued bush regeneration works targeting re-occurring exotic species.
- Establishment of a spray buffer zone between the turf and the remnant vegetation.
- Progression of works from consolidated areas into areas of lower condition. Initially targeting noxious and vine weeds, followed by highly fecund woody weeds and smothering groundcovers, then secondary treatments and shrubs and all exotic seedlings.
- Static rope lines may be required to ensure contractor safety, anchoring lines from vehicles parked within adjacent turfed areas may be most suitable.

Z7 – Sea-cliff Heath

Management Action: Bush Regeneration

Management Tasks:

- Establishment of a spray buffer zone between the turf and the remnant vegetation.
- Consolidation of area of Good condition Heath vegetation followed by progression of Bush Regeneration works north through remnant.
- Progression of works from consolidated areas into areas of lower condition. Initially targeting noxious and vine weeds, followed by highly fecund woody weeds and smothering groundcovers, then secondary treatments and shrubs and all exotic seedlings.
- Consolidation of newly treated areas prior to progression into adjacent areas of low condition.
- Static rope lines may be required to ensure contractor safety, anchoring lines from vehicles parked within adjacent turfed areas may be most suitable.

Revegetation - Various

- Buffer revegetation established between remnant patches R2 & R3, and from R1 to north of Z7 as outlined adjacent
- Mosaic plantings to be installed between remnant patches Z6 and Z7 as outlined adjacent

Stormwater – Various

- Implement actions outlined in Stormwater Management Plan (to be prepared)

WEONGA, RODNEY & RALEIGH RESERVE Biodiversity Action Plan 2014 - 2020

Remnant Description

Remnant vegetation at Weonga, Rodeny and Raleigh Reserve exists as Sea-cliff Heath, with one small patch of Sedgeland, as a thin linear strip on top of the sea-cliffs adjacent to the Council Reserve that runs from Raleigh St to Weonga Rd, Dover Heights. Much of the 1600m^2 of remnant vegetation is on the cliff-face below the fence along the eastern edge of the Reserve (SBR 2010). Access is available to most areas of remnant vegetation but not all.

General vegetation condition is Very Poor with all remnant patches impacted heavily upon by exotic species incursions as well as threats associated with small isolated patches of vegetation. Remnant native plants occur generally as scattered shrubs and groundcovers perched between the Reserve fence and the edge of the cliff.

Two patches of Good Condition vegetation (one bordered by a patch of Poor) exist towards the centre of the site which have been assessed as SEPP19 vegetation, and bush regeneration works are currently being undertaken within the vegetation along the length of the Reserve. Patch R2 is of particular note as the most species rich patch of remnant vegetation surveyed during the SBR (2010) floristic survey.

Continued bush regeneration works may increase the vegetation condition of just under half of the bushland to Good by 2020, the remaining vegetation will require ongoing management and targeted weed control.

R1 – Small patch of ephemeral sedgeland supporting *Ficinia nodosa* and *Juncus pallidus* (considered rare in Waverley (SBR 2010)). Remnant sedgeland is surrounded by exotic species which dominate the ground shrub layers, with species such as Pennywort, Paspalum, *Cyperus eragrostis*, Coastal Morning Glory, Crofton Weed, Mirror Bush, NZ Christmas Bush and African Olive all common.

Weed control works are required if the remnant is to persist.

R2 – As mentioned above remnant R2 is the most floristically diverse single patch of vegetation in the LGA, with 38 indigenous species recorded and is also partly assessed as SEPP 19 bushland. An area of vegetation in Good condition exists on a lower rock-shelf in the northern portion of the remnant where vegetation management works have been undertaken in the past. The vegetation condition declines progressively up the cliff to the top, and towards the southern end of the patch with much of the area dominated by exotic species.

Exotic species most threatening to the survival of the remnant include vine species such as Morning Glory and Coastal Morning Glory, invasive shrubs such as Lantana and African Olive, and smothering ground covers such as Asparagus Fern.

R3 – A long linear patch of isolated remnant heath vegetation, separated from the adjacent R2 patch to the north by a degraded and weed infested section of cliff-line and bordered by residential development to the south. Native shrubs are interspersed with exotic shrubs and the dominant groundcover species are Asparagus Fern and exotic grasses.

Some areas of vegetation exist where native shrubs remain dominant and could be used as starting points for bush regeneration works to progress outwards from.

Z6 – Cliff-top heath vegetation with patchy infestations of exotic vines and shrubs, with exotic groundcovers present throughout. As with the rest of the vegetation at the Weonga, Rodney, Raleigh Reserve site, the remnant exists between the Reserve's eastern fence and the edge of the sea-cliffs.

Exotic species present within the vegetation include African Olive, Norfolk Island Hibiscus, Asparagus Fern, Pennywort, Pellitory, Buffalo Grass, Morning Glory and Arrowhead Vine (*Acetosa sagittata*).

Z7 – The majority of remnant vegetation that occurs within patch Z7 does so as scattered Coastal Tea-tree *Leptospermum laevigatum* and 1 or 2 other native shrub species across a highly weed infested open "grassland" dominated by Kikuyu, Coastal Morning Glory and Pampas Lilly-of–the-valley.

A small patch of higher quality, more floristically diverse, vegetation occurs at the southern end of the patch which supports a wider range of native heath species.

Other exotic species impacting on the native vegetation include Nasturtium, Pennywort, Pellitory, Canna Lilly, Pampas Grass, Mirror Bush and Phoenix Palm.

Vegetation Communities (SBR 2010):

Sea-cliff Heath

Open to closed low growing community with <10 to <70% canopy FPC, characteristic species include *Baeckea imbricata, Banksia ericifolia, Melaleuca armillaris, Melaleuca nodosa, Westringia fruticosa*. Community distributed within 50m of sea-cliffs on skeletal sands to sand lenses on sandstone, drainage is often impeded.

Sea-cliff Sedgeland c) *Ficinia nodosa*

Low open vegetation community with <10 to <30% canopy PFC, characteristic species listed as *Ficinia nodosa* dominant with other sedges present. Community occurrence is within 20m of sea-cliffs on skeletal sands to sand lenses on sandstone, often on modified soil.

SEPP 19 Bushland

Approximately 485m^2 of Weonga, Rodney Raleigh bushland is considered SEPP 19 Bushland in Urban Areas vegetation (SBR 2010).

Waverley Council is obliged to protect and preserve the bushland because of its value as part of natural heritage, its aesthetic value and its value as a recreational, educational and scientific resource, and must consider impacts upon it when assessing all relevant Development Applications.

Remnant Significance

Remnant vegetation at Weonga Rodney Raleigh Reserve is some of the most floristically diverse in the LGA. It supports the 2nd highest number of indigenous species of the sites surveyed by SBR (2010), 9 of the 40 species recorded are rare in the Council Area, and it contains the most floristically diverse single patch of remnant vegetation R2.

Species rare in the council area include *Grevillea speciosa* and *Senecio hispidulus* (no other occurrences), *Billardiera scandens, Pimelia linefolia* and *Leptocarpus tenax* (one other occurrence), *Arsitda sp., Austrodanthonia sp.* and *Olearia tomentosa* (two other occurrences).

Remnant Condition (SBR 2010)

	Remnant Condition 2010 (SBR 2010)				
	V. Poor	Poor	Fair	Good	TOTAL
Area (m^2)	2406	314	-	173	2893
Area (%)	83%	11%	0%	6%	100%

Area Likely to Reach "Good" Condition by 2020

R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020	R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020
R1	26	V Poor	0	R3	316	V Poor	150
R2.1	138	Good	138	Z6	501	V Poor	250
R2.2	314	Poor	150	Z7.1	35	Good	35
R2.3	805	V Poor	250	Z7.2	758	V Poor	250

Area Good Condition 2010: 6% Area Good Condition 2020: 42% (1220m^2)

Flora / Fauna Habitats

Fauna habitat supported by the remnant native vegetation at Weonga Rodney Raleigh Reserve generally consists of dense groundcover and understorey plants suitable for shelter and foraging for small birds and reptiles. Basking opportunities are limited within the remnant vegetation although they occur on scattered exposed sandstone between the remnant patches. Taller vegetation occurs adjacent to the R2 remnant which has the potential to support larger birds on possums, although this habitat exits within exotic vegetation, mainly Coral Trees.

Flora habitat is not considered diverse with the majority of remnant occupying a thin linear space on the cliff-tops. Some change in soil moisture levels occurs as a result of drainage patterns and sedgeland is supported in the centre of the site.

Remnant Restoration Goals & Associated Tasks

A spray buffer at least 1m wide within the Reserve lawn along the length of each vegetation remnant is to be established at the outset of management works to reduced encroachment of turf grasses into the native vegetation. This spray buffer is to be maintained by Council Parks Staff within the Reserve, and bush regeneration contractors within the remnant vegetation over the fence.

R1 – If improvements in ecological condition are to be made in remnant R1 exotic groundcovers are to be targeted to reduce the pressure they are currently exerting on native sedges. Definition of the remnant edge is required to facilitate reduction of exotic species within the native patch, and combination hand removal / herbicide spraying is to be undertaken within the remnant to increase the area available for native species occurrence.

If there is a significant increase in of native sedges removal of exotic shrubs should be undertaken and consideration of planting of native remnant plantings should be considered as replacements.

R2 - Methodical bush regeneration works utilising best practice techniques are to progress outwards from the area of Good condition, ensuring treated areas have reached secondary/maintenance stage prior to commencement of primary works in adjacent lower quality areas. Works should be compartmentalised and undertaken in manageable stages where maintenance of treated areas will remain achievable.

Target weeding of exotic species most damaging to the health of the remnant should also be undertaken across the entire remnant, highest priority are vine weeds, followed by invasive shrubs and groundcovers before less invasive exotic species are treated once the area has stabilised.

R3 – bush regeneration works progressing outwards from areas dominated by native shrubs should be undertaken in conjunction with target weeding of species most damaging to the health of the remnant vegetation.

Z6 – Staged removal of a grove of African Olive at the northern end of the remnant patch is required, and should be undertaken methodically over the first 6-18 months of vegetation management works.

Target weeding of vines and shrubs, combined with treatment of groundcover weeds likely to result in suppression and reduction should be undertaken, and intensive secondary works may be required to assess the likelihood of native regeneration.

Patchy revegetation should be considered should natural regeneration be unsuccessful.

Z7 – Initial works should progress outwards from patch of Good Condition vegetation towards the south of the remnant targeting species as per standard bush regeneration methodologies. A spray edge / buffer zone surrounding the higher quality native vegetation will be required to assist in management of maintenance works and ongoing secondary weeding will be required to assess regeneration potential of the patch.

Areas of native vegetation across the remnant should be targeted and undergo weed treatments affectively creating 'islands' of native species amongst the exotic groundcover vegetation. Works should progress outwards from native islands as far as regeneration of native species occurs, maintaining the edge of the works areas as spray edges.

Revegetation Type 1 Buffer Revegetation is recommended from south of R1 to north of Z7 along the steep turfed batter within the Rodney Reserve fence line, and through to the weed infested cliff-top on the eastern side of the fence. This work is recommended to be undertaken in 2 stages (inside and outside of the fence) due to the marked difference in the current exotic vegetation cover. On the cliff-top (outside the fence) dense infestations of Pampas Lily-of-the-Valley will required significant ongoing herbicide treatments prior to installation of tubestock.

Type 2 Buffer Revegetation is recommended between R2 and R3 along the weed infested cliff-top. Implementation of this work will be challenging due to the location of the works on the cliff-top and requirement for ropes works.

Mosaic Plantings are recommended between the northern extent of the Type 1 Buffer Revegetation and Z6. Approximately 4 'islands' totalling ~750m^2 should be sprayed out and revegetated in increase connectivity along the cliff-top. The infestation of *Buddleja sp.* Is to be removed and replanted as the northern most mosaic planting island.

Revegetation works are to progress as follows;

- Spray out all turf grass and exotic groundcovers within the nominated area.
- Install native leaf mulch to 75mm depth following successful kill of exotics (repeated secondary treatments likely to be required), and allow mulch to settle.
- Plant native groundcover species and occasional low-growing shrubs at a density of 4-6 plants/m^2.
- Water planting in, and as frequently as required to establishment.

All revegetation work should use plant material grown from locally sourced seed as outlined in the Appendix Report – Waverley Biodiversity Action Plans Report (TEC 2014).

Flora Species (SBR 2010)

Family	Genus species	Common Name	Family	Genus species	Common Name
Aizoaceae	*Carpobrotus glaucescens*	Pigface	Phormiaceae	*Dianella caerulea*	Blue Flax-lily
Apiaceae	*Xanthosia pilosa*	Woolly Xanthosia	Phormiaceae	*Dianella revoluta*	Paroo Lily
Asteraceae	*Olearia tomentosa*	Toothed Daisy-bush	Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry
Asteraceae	*Senecio hispidulus*	Hill Fireweed	Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum
Commelinaceae	*Commelina cyanea*	Scurvy Weed	Poaceae	*Aristida warburgii*	
Cunoniaceae	*Bauera rubioides*	River Rose	Poaceae	*Austrodanthonia* sp	
Cyperaceae	*Baumea juncea*		Poaceae	*Deyeuxia quadriseta*	
Cyperaceae	*Cyperus polystachyos*		Poaceae	*Dichelachne crinita*	Longhair Plumegrass
Cyperaceae	*Ficinia nodosa*	Knobby Club-rush	Poaceae	*Entolasia marginata*	Bordered Panic
Cyperaceae	*Lepidosperma (concavum?)*		Poaceae	*Eragrostis brownii*	Brown's Lovegrass
Cyperaceae	*Lepidosperma (concavum?)*		Poaceae	*Lachnagrostis billardierei*	
Dennstaedtiaceae	*Histiopteris incisa*	Bat's Wing Fern	Poaceae	*Lachnagrostis filiformis*	
Ericaceae	*Epacris longiflora*	Fuchsia Heath	Poaceae	*Zoysia macrantha*	Prickly Couch
Juncaceae	*Juncus pallidus*		Proteaceae	*Banksia ericifolia* subsp *ericifolia*	Heath-leaved Banksia
Lamiaceae	*Westringia fruticosa*	Coastal Rosemary	Proteaceae	*Grevillea speciosa*	Red Spider Flower
Lauraceae	*Cassytha sp*		Rubiaceae	*Opercularia aspera*	Coarse Stinkweed
Lobeliaceae	*Lobelia anceps*		Smilacaceae	*Smilax glyciphylla*	Sweet Sarsaparilla
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush	Theophrastaceae	*Samolus repens*	Creeping Bookweed
Myrtaceae	*Baeckea imbricata*		Thymelaeaceae	*Pimelea linifolia* subsp *linifolia*	Slender Rice Flower
Myrtaceae	*Melaleuca armillaris*	Bracelet Honey-myrtle	Typhaceae	*Typha orientalis*	Broadleaf Cumbungi
Myrtaceae	*Melaleuca nodosa*				

No Fauna records exist for the Weonga, Rodney, Raleigh Reserves remnant.

Recommended Revegetation Species (B-Buffer only; R-Remnant only; BR-Buffer & Remnant)

Family	Genus species	Common Name	Family	Genus species	Common Name
Acacia longifolia **(BR)**	Sydney Golden Wattle	*Epacris longiflora* **(R)**	Fuchsia Heath	*Leptospermum squarrosum* **(BR)**	
Acacia ulicifolia **(BR)**	Prickly Moses	*Ficinia nodosa* **(BR)**	Knobby Club-rush	*Leucopogon juniperinus* **(BR)**	Prickly Beard-heath
Austrodanthonia setacea **(BR)**		*Grevillea speciosa* **(BR)**	Red Spider Flower	*Lomandra longifolia* **(BR)**	Spiny-headed Mat-rush
Banksia ericifolia subsp *ericifolia* **(BR)**	Heath-leaved Banksia	*Hakea teretifolia* **(BR)**	Needlebush	*Melaleuca armillaris* **(BR)**	Bracelet Honey-myrtle
Banksia marginata **(BR)**	Silver Banksia	*Imperata cylindrical* **(B)**	Blady Grass	*Melaleuca nodosa* **(BR)**	
Baumea rubiginosa **(BR)**		*Juncus kraussii* **(BR)**	Sea Rush	*Microlaena stipoides* **(B)**	Weeping Grass
Bossiaea heterophylla **(R)**	Variable Bossiaea	*Juncus usitatus* **(BR)**	Common Rush	*Monotoca elliptica* **(BR)**	Tree Broom-heath
Dianella caerulea **(B)**	Blue Flax-lily	*Kunzea ambigua* **(R)**	Tick Bush	*Persoonia lanceolata* **(BR)**	Lance Leaf Geebung
Dichelachne crinita **(B)**	Longhair Plumegrass	*Lasiopetalum ferrugineum* **(R)**		*Pimelea linifolia* ssp *linifolia* **(R)**	Slender Rice Flower
Entolasia marginata **(B)**	Bordered Panic	*Leptospermum laevigatum* **(B)**	Coast Teatree	*Westringia fruticosa* **(BR)**	Coastal Rosemary

Type 1 Buffer Revegetation – Low diversity graminoid dominant buffer revegetation
Type 2 Buffer Revegetation – Higher diversity, multiple plant forms buffer / non-buffer revegetation
See Appendix Report (TEC 2014) for details

Recommendations for Future Biodiversity Actions and Means of Achieving EAP3 Objectives

- Vegetation Condition Mapping is to be updated in 2015 with consideration given to the re-classification of remnants' 'Condition' as outlined in the Appendix Report – Waverley BAPs (TEC 2014). Update of mapping in 2015 will assess progress of restoration works towards the EAP3 targets and should be repeated every 24 months to 2019, followed by final assessment at 2020.

WEONGA, RODNEY & RALEIGH RESERVE Biodiversity Action Plan - Actions Table

Remnant Code	Management Action	Responsibility	Performance Criteria	Timing	Total Cost of Mgmt Action (ex GST) See spreadsheet for more info and breakdown
R1	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Establish spray edge buffer zone at the outset of vegetation management works • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair (or better) at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 6 months of targeted works • Works undertaken no less than quarterly to 2020	$ 5,700.00
R2	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Establish spray edge buffer zone at the outset of vegetation management works • Undertake targeted weed control over entire remnant • ≥60% of remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • ≥60% of remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • ≥40% of remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 12 months of targeted works • Works undertaken no less than quarterly to 2020	$ 41,800.00
R3	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Establish spray edge buffer zone at the outset of vegetation management works • Undertake targeted weed control over entire remnant • ≥60% of remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • ≥75% of remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • ≥50% of remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 12 months of targeted works • Works undertaken no less than quarterly to 2020	$ 17,320.00
	Buffer Revegetation	Waverley Council engaged Bush Regeneration Contractor	Approximately 200m^2 of low growing buffer revegetation undertaken at 4 plants/m^2 • Revegetation works commence following 6-12 months of bush regeneration works • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 7,476.00
Z6	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Establish spray edge buffer zone at the outset of vegetation management works • ≥60% of remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • ≥75% of remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • ≥50% of remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 6 months of targeted works • Works undertaken no less than quarterly to 2020	$ 11,100.00
Z7	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Bush regeneration contractor engaged and site works undertaken on a regular basis • Establish spray edge buffer zone at the outset of vegetation management works • ≥50% of remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • ≥50% of remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • ≥30% of remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 6 months of targeted works • Works undertaken no less than quarterly to 2020	$ 14,700.00
	Buffer Revegetation A – Inside Reserve fence (west)	Waverley Council engaged Bush Regeneration Contractor	Approximately 1000m^2 of low growing buffer revegetation undertaken at 4 plants/m^2 • Revegetation works commence following 6-12 months of bush regeneration works • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 13,540.00
	Buffer Revegetation B – Outside Reserve fence (east)	Waverley Council engaged Bush Regeneration Contractor	Approximately 8000m^2 of low growing buffer revegetation undertaken at 4 plants/m^2 • Revegetation works commence following 6-12 months of bush regeneration works • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 24,970.00
Various	Mosaic Plantings	Waverley Council engaged Bush Regeneration Contractor	Approximately 750m^2 of low growing buffer revegetation undertaken at 4 plants/m^2 • Revegetation works commence following 6-12 months of bush regeneration works • Planting's survivorship at no less than 80% at 6 months from installation, and ongoing to completion of vegetation management works • Weed species FPC at no more than 5% within reveg area at 12 months, and ongoing to completion of vegetation management works	As outlined adjacent	$ 12,480.00
	Stormwater Management	Various	Implement actions outlined in Stormwater Management Plan (to be prepared)	• As outlined in SMP	Undetermined
All areas	Ecological Monitoring	Waverley Council engaged Vegetation Management Consultant	Undertake regular monitoring visits to ensure bush regeneration works are progressing within the scope of this Action Plan and the specific project contract. • Establish fixed photo monitoring points within each remnant • Establish fixed quadrat or transect survey locations to assess weed cover abundance and native regeneration • Provide a report on the findings to Waverley Council	Monitoring events to occur at regular intervals to 2020. • Monitoring surveys and reports to be undertaken annually and provided to Council	$ 13,200.00
n/a	Project Admin	Bush Regeneration Contractor	n/a	Throughout Project	$ 2,520.00
				TOTAL	**$ 164,806.00**

York Road Remnant
Biodiversity Action Plan 2014-20

Map No: BAP_09
Prepared for: Waverley Council
Prepared by: C Wharfe - TEC
Date: May 2014
Plan Status: FINAL

Bushland Remnant

Y2

Land Tenure & Management

Lot Boundaries

Vegetation Condition (SRB 2010)

Good

Fair

Poor

Very Poor

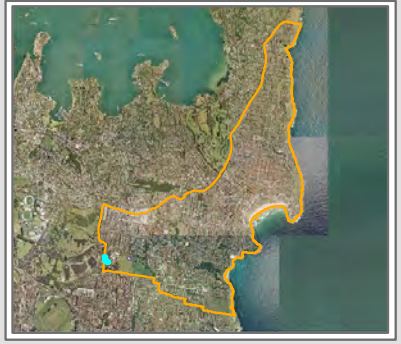
Revegetation / Weed Control

Buffer

0 10 20 40 Meters

N

Data Source:
Total Earth Care
Sydney Bush Regen Company
c/o Waverely Council
NearMap



Revegetation / Targeted Weed Control – Buffer Zone across York Road

Management Tasks: Weed Removal and Revegetate

- Priority 1 Works
  - Successful spray treatment of African Lovegrass
  - Slash treated Lovegrass and removal of biomass
  - Install native leaf mulch to 75mm depth
  - Continue to re-treat Lovegrass germinating from seed
- Priority 2 Works
  - Revegetate area to Buffer Revegetation standards with species un-characteristic of ESBS
  - Maintain plantings to establishment, undertake ongoing maintenance works
- Priority 3 Works
  - Remove all *Acacia glaucescens* trees and replace with local remnant species un-characteristic of ESBS

Unauthorised Access to ESBS Remnant Mitigation

Management Tasks: Fence Erection & Alternative Pathway Establishment subject to Council consultation with Centennial Park & Moore Park Trust and Moriah College

- Install permanent fencing along the road edge and at each end of the Remnant to restrict unauthorised access.
- Provide alternative public access to compensate for the removal of walkway through the threatened vegetation.

total earth care

Y2.1 – Eastern Suburbs Banksia Scrub

Management Actions: Bush Regeneration

Management Tasks:

- Restrict public access through Remnant following stakeholder consultation
- Undertake regular bush regeneration works within the remnant vegetation targeting all exotic species utilising best practice techniques.
- Use soil scarification and brush matting techniques to stimulate regeneration
- Collect seed within adjacent ESBS and spread throughout Y2 Remnant.
- Remove non-ESBS native species from within Remnant.
- Maintain Remnant as a buffer zone to protect the large ESBS patch to the east.
- Undertake ecological burns (or alternative)

Y2.1 – Eastern Suburbs Banksia Scrub

Management Actions: Bush Regeneration

Management Tasks:

- Restrict public access through Remnant following stakeholder consultation
- Undertake regular bush regeneration works within the remnant vegetation targeting all exotic species utilising best practice techniques.
- Use soil scarification and brush matting techniques to stimulate regeneration
- Collect seed within adjacent ESBS and spread throughout Y2 Remnant.
- Remove non-ESBS native species from within Remnant.
- Maintain Remnant as a buffer zone to protect the large ESBS patch to the east.
- Undertake ecological burns (or alternative)

Should ecological burns be unable to proceed, alternatives are outlined in the Appendix Report (TEC 2014)

YORK ROAD REMNANT Biodiversity Action Plan 2014 - 2020

Remnant Description

Eastern Suburbs Banksia Scrub (ESBS) remnant vegetation exists adjacent to York Road, Queens Park with a total area of occupancy of over 11,000m^2. The vast majority of this bushland occurs within land owned and managed by Moriah College (patch Y1), and thus this Biodiversity Action Plan only outlines management actions for the 521m^2 of ESBS under Council management (Patch Y2).

Council managed ESBS occurs within the York Road verge between the 2m high (approx.) chain-link Moriah College security fence and York Road. It occurs as two (2) quite distinct patches differentiated by vegetation cover, the northern patch (Y2.1) is a closed scrubland with over-mature and over-abundant Coastal Tea-tree *Leptospermum laevigatum*, and the southern patch (Y2.2) is lower, more open and disturbed dominated by regenerating *Acacia longifolia, Leptosermum laevigatum* and *Monotoca elliptica.*

Threats to the ESBS remnant include increased edge effects, weed invasion, unrestricted access, lack of fire and overabundance of over-mature canopy species.

ESBS within Moriah College is floristically diverse and fully structured although is also impacted upon by lack of fire and weed invasion.

ESBS is a Threatened Ecological Community listed as Endangered on both the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). It is described as a predominantly sclerophyllous heath or scrub community although, depending on site topography and hydrology, some remnants contain small patches of woodland, low forest or limited wetter areas. Common species include *Banksia aemula*, *B. ericifolia*, *B. serrata*, *Eriostemon australasius*, *Lepidosperma laterale*, *Leptospermum laevigatum*, *Monotoca elliptica* and *Xanthorrhoea resinifera*. The community once occupied around 5,300 hectares of land between North Head and Botany Bay in Sydney's eastern suburbs. Surviving stands totalling approximately 146 hectares have been recorded from the local government areas of Botany, Randwick, Waverley, and Manly (OEH 2014). Estimates are now around 145Ha less than 3% of its original occupancy.

Y2.1 – the northern portion of the York Road remnant vegetation exists as a patch of Banksia Scrub with low floristic and successional diversity, dominated by mature Coastal Tea-tree. Such is the dominance of the Tea-trees that the canopy is closed and there is little growth in the ground-layer and understorey.

Acacia longifolia is present on the edge of the vegetation and regenerating *Monotoca elliptica, Eragrostis brownii* and *Dichelachne crinita* are present in open areas towards Y2.2.

Major threats to the vegetation remnant occur in the form of unrestricted access from the public walking through the bush (under the high canopy), which is resulting in soil compaction, suppression of germination/regeneration and invasion of exotic species.

Adjacent to the remnant vegetation, on the western side of York Road, a large patch of African Lovegrass (*Eragrostis curvula*) exists providing a constant source of exotic propagules which is a further negative impact on the remnant vegetation.

Y2.2 – The southern section of the vegetation remnant lacks the mature canopy species present adjacent and is dominated by re-growth canopy species and regenerating native shrubs and groundcovers. Regeneration of native shrubs may be from the soil stored seedbank are as a result of seed-rain from the adjacent vegetation.

The southern portion of the remnant is also impact upon by public access, weed invasion (especially African Lovegrass and *Acacia glaucescens* from across York Road), prolonged absence of fire and incidence of illegal dumping.

Vegetation Communities (SBR 2010):

Eastern Suburbs Banksia Scrub

Open to closed scrubby community with a canopy species FPC of >10 to <70%. Characteristic canopy species include *Acaica longifolia, Banksia serrata, Leptospermum laevigatum* and *Monotoca elliptica*. Community is distributed inland from the coastline on deep Aeolian sands.

SEPP 19 Bushland

None of the vegetation comprising the York Road Remnant is considered SEPP 19 bushland.

Remnant Significance

ESBS present as the York Road Remnant is the only occurrence of a Threatened Ecological Community on Council managed lands, and one of only three (3) patches in the LGA. ESBS hold considerable conservation significance due to it greatly reduced and restricted distribution. Patches Y1 and Y2 occur on 2 of approximately only 25 properties anywhere in existence (SBR 2010).

When considering the contiguous adjacent bushland within the Moriah College property the remnant is by far the largest in the LGA over 50% larger than the 2nd largest. The patches support the 4th most floristically diverse vegetation surveyed by SBR (2010), and 14 of the 35 indigenous species are considered rare in the Council Area.

Remnant Condition (SBR 2010)

	Remnant Condition 2010 (SBR 2010)				
	V. Poor	**Poor**	**Fair**	**Good**	**TOTAL**
Area (m^2)	240	-	281	-	521
Area (%)	46%	0%	54%	0%	100%

Area Likely to Reach "Good" Condition by 2020

R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020	R'nant Code	Area (m^2)	2010 Cond'n	Area (m^2) Good 2020
Y1.1	240	V Poor	240	Y2.2	281	Fair	281

Area Good Condition 2010: 0% Area Good Condition 2020: 100% (521m^2)

Flora / Fauna Habitats

Fauna habitat with the York Road Remnant is considered to be of low value due to the lack of species and structural diversity, the occurrence of the remnant adjacent to a busy road and frequent access by the public. Perching and foraging habitat is available to small birds and some basking and shelter habitat is available for skinks and geckos.

Within the adjacent Y1 remnant habitat resources are much more diverse as a result of the healthy, fully-structured scrubland with both dense and open canopy and understorey vegetation throughout.

Flora habitat is unique in the fact that it is part of a very restricted available niche within which the threatened community can grow. Protection of the habitat is of upmost importance to facilitate the survival of the remnant vegetation and provide opportunities for increases in area of occupancy of ESBS.

Remnant Restoration Goals & Associated Tasks

Due to the varying tenure of this contiguous patch of threatened bushland Waverley Council, Moriah College and the Centennial Parklands Trust are to undertake consultation and come to an combined agreement on how to proceed with management actions.

Bush regeneration works are required within the remnant bushland to protect and enhance the vegetation and facilitate the survival of the threatened community. The major issue facing the York Road remnant is unrestricted public access, which is listed by the NSW Office of Environment and Heritage (OEH) as a threat to the community.

Input of resources and funding into bush regeneration works and weed control are being undermined by public access trampling regenerating seedlings, compacting the soil and creating paths and bring weed seed back into the vegetation where it is being removed from.

Restriction of access can be achieved through erection of permanent fencing along the road edge and at each end of the remnant. This will result in the pedestrians requiring an alternative route between the 2 Moriah College Gates.

Until such time as a fence is installed it is recommended that the current signage is updated to reaffirm the rare and threatened nature of the vegetation and the restriction of access along the nature strip area.

The second major issue impacting on the survival and ecological health of the threatened community is the presence of African Lovegrass within the opposite road verge across York Road. The large crop of mature Lovegrass beneath non-indigenous *Acacia glaucescens* provides a constant source of exotic propagules that are germinating within the Y2 remnant and spreading into the larger higher quality Y1 remnant.

OEH also lists "Invasion by weed species (particularly Bitou Bush, Lantana and African Love Grass)" as a threat to ESBS and "Invasion of native plant communities by exotic perennial grasses" is a Key Threatened Process listed on the TSC Act.

As such removal of the African Lovegrass is to be undertaken as a matter of priority. Herbicide treatment, slashing and biomass removal followed by mulching is to be undertaken, followed by replanting if required. The *A. glaucescens* trees are also moving across York Road, with a number of seedlings present at the time of survey for this BAP. Removal of these trees should also be considered.

Any revegetation works undertaken as Buffer Revegetation within the York Road verge (western side) are to be done so with non-invasive species, non-characteristic of ESBS. This is to ensure the ESBS vegetation will remain distinguishable and genetically integral should the buffer plants disperse into the Y2 remnant. Should this dispersal occur in the future buffer planting seedlings are to be selectively removed from the ESBS remnant. See Appendix Report (TEC 2014) for more details.

In order to kick-start the regeneration / restoration process at the York Road remnants, and restore successional diversity an ecological burn would ideally be undertaken. Due to the small nature of the site, pile burns are most suited and would be undertaken across the remnants in a mosaic pattern.

Fuel for the piles should be sourced from vegetation present at the site or adjacent in Y1 (woody exotics and limbs of overabundant natives), piled and left to dry out completely to facilitate a hot burn. Piles should be placed in areas where a seedbank is likely to be present and remain viable, and the soil is not waterlogged.

All works associated with ecological burning should be done so under the guidance of an approved Fire Management Plan prepared by a qualified and experienced Consultant, and the fire undertaken by an experienced contractor of the Fire Brigade. Alternative options are outlined in the Appendix Report (TEC 2014) should burning not proceed.

Revegetation No planting is to be undertaken within the York Road remnant unless the tubestock are grown from seed collected from within the adjacent ESBS bushland, or another patch of ESBS bushland. Collection and propagation of seeds from within the bushland will require a Section 91 Licence (under TSC Act) to collect and propagate seed from within a threatened community.

Flora Species (SBR 2010) Y2 and adjacent Y1.

Genus species	Common Name	Genus species	Common Name	Genus species	Common Name
Xanthosia pilosa	Woolly Xanthosia	*Bossiaea heterophylla*	Variable Bossiaea	*Dianella caerulea*	Blue Flax-lily
Xanthosia tridentata	Rock Xanthosia	*Bossiaea scolopendria*		*Dianella revoluta*	Paroo Lily
Cotula australis	Common Cotula	*Dillwynia glaberrima*		*Aristida warburgii*	
Wahlenbergia gracilis	Sprawling Bluebell	*Dillwynia retorta*		*Austrostipa mollis*	
Commelina cyanea	Scurvy Weed	*Acacia longifolia* subsp *longifolia*	Sydney Golden Wattle	*Dichelachne crinita*	Longhair Plumegrass
Dichondra repens	Kidney Weed	*Acacia suaveolens*	Sweet Wattle	*Eragrostis brownii*	Brown's Lovegrass
Ficinia nodosa	Knobby Club-rush	*Acacia ulicifolia*	Prickly Moses	*Microlaena stipoides*	Weeping Grass
Hibbertia fasciculata		*Lomandra glauca*	Pale Mat-rush	*Oplismenus aemulus*	Oplismenus
Astroloma pinifolium	Pine Heath	*Lomandra longifolia*	Spiny-headed Mat-rush	*Banksia serrata*	Old-man Banksia
Leucopogon ericoides	Pink Beard-heath	*Kunzea ambigua*	Tick Bush	*Persoonia lanceolata*	Lance Leaf Geebung
Monotoca elliptica	Tree Broom-heath	*Leptospermum laevigatum*	Coast Teatree	*Hybanthus monopetalus*	Slender Violet-bush
Micrantheum ericoides					

Fauna Species (AMBS 2011)

Genus species	Common Name	Genus species	Common Name	Genus species	Common Name
Cracticus torquatus	Grey Butcherbird	*Scythrops novaehollandiae*	Channel-billed Cuckoo	*Phylidonyris novaehollandiae*	New Holland Honeyeater
Strepera graculina	Pied Currawong	*Grallina cyanoleuca*	Magpie-lark	*Trichoglossus haematodus*	Rainbow Lorikeet
Cacatua galerita	Sulphur-crested Cockatoo	*Rhipidura leucophrys*	Willie Wagtail	*Acridotheres tristis*	Common Myna
Cacatua sanguinea	Little Corella	*Hirundo neoxena*	Welcome Swallow	*Threskiornis molucca*	Australian White Ibis
Columba livia	Rock Dove	*Malurus cyaneus*	Superb Fairy-wren	*Pteropus poliocephalus*	Grey-headed Flying-fox
Streptopelia chinensis	Spotted Turtle-Dove	*Anthochaera carunculata*	Red Wattlebird	*Cryptoblepharus virgatus*	Cream-striped Shinning-skink
Corvus coronoides	Australian Raven	*Anthochaera chrysoptera*	Little Wattlebird	*Lampropholis delicata*	Dark-flecked Garden Sunskink
Eudynamys orientalis	Pacific Koel	*Manorina melanocephala*	Noisy Miner	*Lampropholis guichenoti*	Pale-flecked Garden Sunskink

Recommended Revegetation Species (NON-ESBS BUFFER REVEG ONLY)

Genus species	Common Name	Growth Form	Genus species	Common Name	Growth Form
Acacia decurrens	Black Wattle	Tree	*Dodonaea triquetra*	Large-leaf Hop-bush	Shrub
Acacia floribunda	White Sally Wattle	Tree	*Microlaena stipoides*	Weeping Grass	Grass
Acacia parramattensis	Sydney Green Wattle	Tree	*Poa affinis*	Poa	Grass
Casuarina glauca	Swamp Oak	Tree	*Poa labillardierei*	Tussock Grass	Grass
Dianella caerulea	Blue Flax-lily	Groundcover	*Westringia fruticosa*	Coastal Rosemary	Shrub

Species listed above are not characteristic of ESBS vegetation and densely planting out the buffer area with ONLY these species will allow for active removal of seedlings should seed disperse across York Road and germinate in the remnant vegetation in the future.

Recommendations for Future Biodiversity Actions and Means of Achieving EAP3 Objectives

- Vegetation Condition Mapping is to be updated in 2015 with consideration given to the re-classification of remnants' 'Condition' as outlined in the Appendix Report – Waverley BAPs (TEC 2014). Update of mapping in 2015 will assess progress of restoration works towards the EAP3 targets and should be repeated every 24 months to 2019, followed by final assessment at 2020.
- Burning may not be appropriate at York Road and alternative means for stimulating seeding emergence may be required. See Appendix Report – Waverley BAPs (TEC 2014)

YORK ROAD REMNANT Biodiversity Action Plan - Actions Table

Remnant Code	Management Action	Responsibility	Performance Criteria	Timing	**Total Cost of Mgmt Action (ex GST)** See spreadsheet for more info and breakdown
Y2	Restriction of Public Access	Waverley Council	• Erect fencing surrounding remnant vegetation • Provide public with alternative access path (not costed)	As outline adjacent	$ 16,830.00
	Bush Regeneration	Waverley Council engaged Bush Regeneration Contractor	Exotic species treated utilising best practice bush regeneration techniques. • Remnant condition to be assessed as Poor (or better) during 1st Condition Mapping update (2015) • Remnant condition to be assessed as Fair (or better) during 2nd Condition Mapping update (2017) • Remnant condition to be assessed as Good at 2020 Condition Mapping update	Bush regeneration works to progress regularly to 2020. • Works undertaken at least monthly for initial 12 months of targeted works • Works undertaken no less than quarterly to 2020	$ 25,550.00
Adjacent York Road Verge	Buffer Revegetation / Targeted Weed Control	Waverley Council engaged Bush Regeneration Contractor	Targeted weed control and staged revegetation to remove African Lovegrass and *Acacia glaucescens* • Spray treatment of African Lovegrass within 1 month of commencement of works outlined in this BAP • Slash and removal of biomass, Installation of native leaf mulch • Regular follow-up treatments. • No mature Lovegrass present at 6 months and ongoing to completion of vegetation management works. • Understorey revegetation as required • Removal of *A. glaucascens* and replacement with indigenous species • Plants installed to be un-characteristic of ESBS vegetation	As outlined adjacent, revegetation undertaken as required.	$ 27,515.00
Various	Ecological Burns	Waverley Council engaged Bush Regeneration Contractor	Undertake ecological burns as required ensuring the following conditions are met; • Fire Management Plan prepared by suitable contractor • Acquire approvals • Prepare site and undertake burns as outlined in Fire Management Plan	• Commence planning at the outset of this Action Plan • Undertake burns following 12-18 months of vegetation management works associated with this Plan	$ 3,400.00
All areas	Ecological Monitoring	Waverley Council engaged Vegetation Management Consultant	Undertake regular monitoring visits to ensure bush regeneration works are progressing within the scope of this Action Plan and the specific project contract. • Establish fixed photo monitoring points within each remnant • Establish fixed quadrat or transect survey locations to assess weed cover abundance and native regeneration • Provide a report on the findings to Waverley Council	Monitoring events to occur at regular intervals to 2020. • Monitoring surveys and reports to be undertaken annually and provided to Counci	$ 11,660.00
n/a	Project Admin	Bush Regeneration Contractor	n/a	Throughout Project	$ 2,520.00
				TOTAL	**$ 87,475.00**