APPENDIX A DRAFT CONCEPT PLAN

Gumara St

Marida St

Dooligah Ave

Burragulung St

Munda St

Joongah St

Holmes St

Lomandra Pl

Tallow Pl

Argyle Cres

Henning Ave

Community Centre

Wetland

Picnic Area

10m

New pathway into REP from Department of Housing area to allow pedestrian access

New sealed pathway along Burragulung St and Dooligah Ave, for improved residential access to REP

Improvements to ESBS lookout structure

Investigate main REP map sign to enhance entry and revegetate site with local provenance plant species as ESBS demonstration site

Implement bushland management priorities for protection and management of significant ESBS vegetation in this area adjacent to Munda Street

ESBS demonstration site, subject to further investigations and approvals

Investigate low impact new unsealed path as part of loop trail

Utilise existing concrete path as part of loop pathway

Separate draft Community Centre PoM to address adjacent open space and connection to REP

Relocation of WIRES facility into clearing adjacent to RCC fence line

Modify lookout for improved usability and site integration

2m pathway completes trail loop, connecting Community Centre and southern part of REP

Undertake wetland strategy to inform future management

Revegetate open space areas with local provenance indigenous species

Interpretive signage

Improve existing lookout for usability, seating and enjoyment of wetland

Investigate potential location for public toilet facilities subject to investigation and detailed design

Investigate a small lookout option with spectacular views over REP and surrounding areas subject to approvals and community feedback

Investigate potential alignment of low impact gated unsealed walking track through ESBS for use on interpretive tours

Investigate weed fence to prevent seed migration down slope into valuable ESBS areas

Retain two existing shelters and BBQ facilities

Retain existing open green space area

Planting of ESBS species in picnic area

Provide 'dog poo' bags at entry to dog-on-lead areas

Modify existing lookout to improve views to the wetland

Investigate selective removal of dead trees from wetland

Maintain 6m wide APZ Fuel Free Zone

Maintain 4m wide APZ Fuel Reduction Zone

Retain gate for APZ access

Retain existing fence around bushland areas as part of site management

Improvement of large under utilised open space on Joongah Street to south of REP wetland, providing improved public amenity, passive recreation and appreciation of wetland environment. Works include ESBS habitat plantings and sculptural landscape feature consistent with the natural values of the site. Subject to investigation and detailed design

LEGEND

- REP area
- Existing wetland (varying water levels)
- Proposed shared cycle / footpaths
- Proposed unsealed track
- Lookouts to be improved
- Areas of revegetation
- Key views
- Bushland including areas of Eastern Suburbs Banksia Scrub (ESBS)
- Maintain 4m wide Fuel Reduction Zone (Fuel Reduced Areas) (Outer Protection Zone) of the APZ
- Maintain 6m wide APZ Fuel Free Zone (Inner Protection Zone) of the APZ

THOMPSON BERRILL LANDSCAPE DESIGN P/L
PO BOX 665 MANLY NSW 2095 T: 61299776444 E: info@tbld.com.au

Randwick City Council
a sense of community

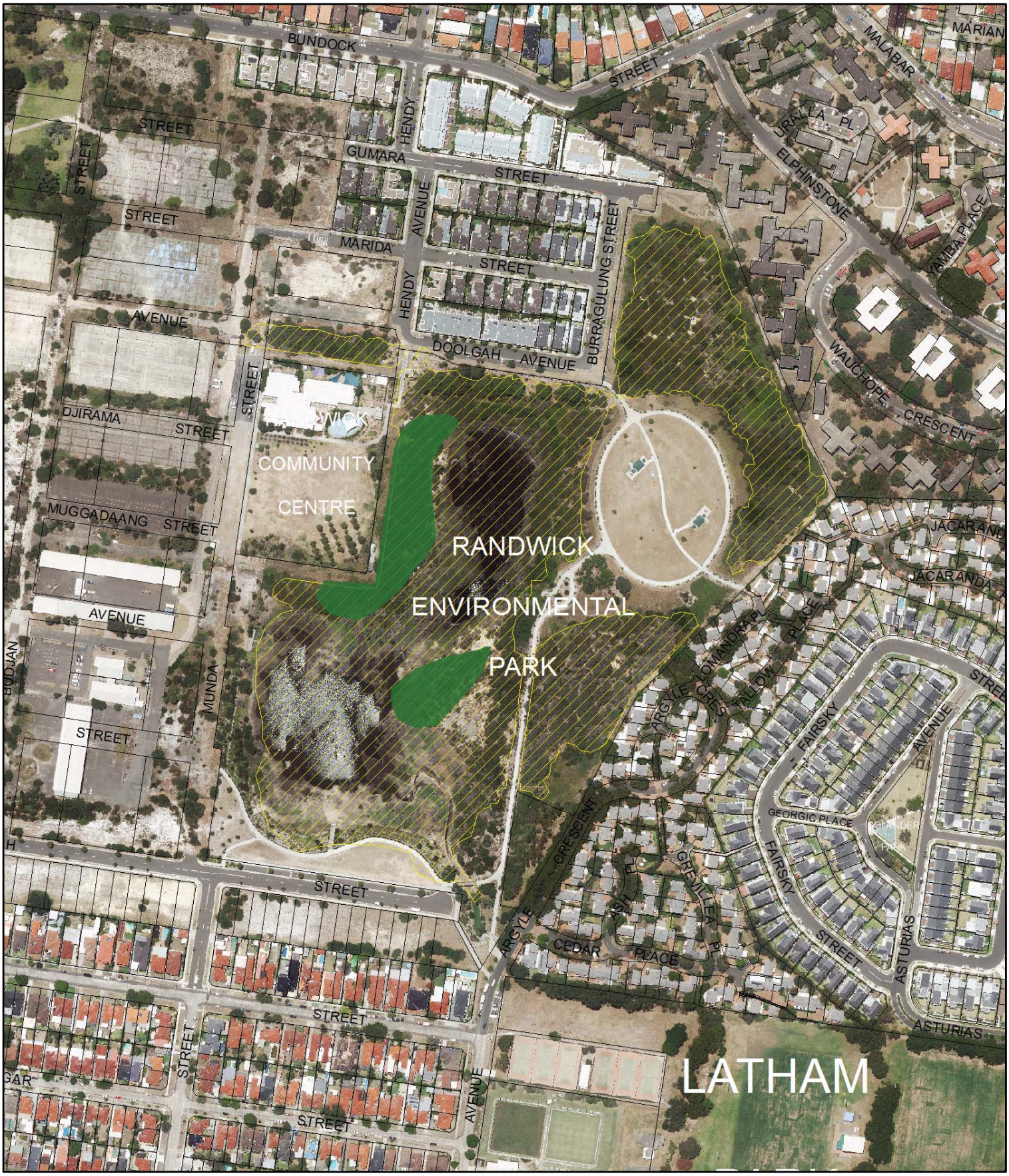
CONCEPT DESIGN

RANDWICK ENVIRONMENT PARK

PLAN OF MANAGEMENT 2015

REP_CD_01_V6
MARCH 2015
SCALE 1:1000 @ A1
0 10 20 30 50 m

APPENDIX B1 RCC VEGETATION MAPPING



Legend

- Acacia terminalis ssp. terminalis (RCC 2012)
- Remnant vegetation (RCC 2003)

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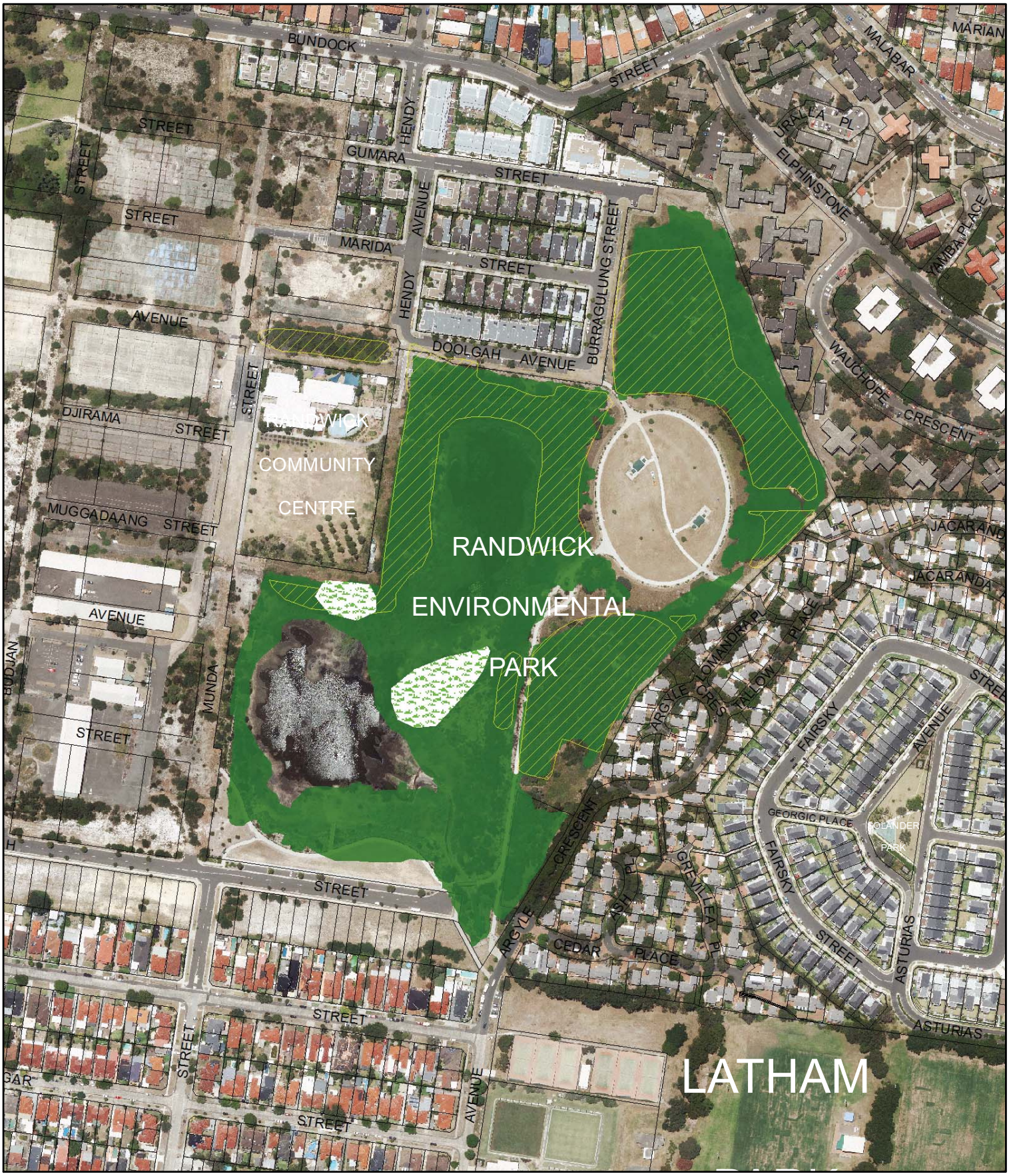
N

0 25 50 100 150 200
Metres

APPENDIX B2 NSW GOVERNMENT VEGETATION MAPPING



Legend

- Acacia terminalis (Recovery Plan 2010)
- CMA Mapping (2013)
- ESBS (Recovery Plan 2004)

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N

0 25 50 100 150 200
Metres

APPENDIX C DRAFT FIRE MANAGEMENT PLAN

total earth care

Bushfire Management Plan

Randwick Environment Park

Total Earth Care Pty Ltd
February 2013

total earth care

Bushfire Management Plan

Randwick Environment Park

Date of Issue: 12 February 2013

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Revision/Version No.	B	Date of revision	11/02/2013
Prepared by:	R Blackall		
Prepared for:	Randwick City Council		
TEC Job No.	C2874-TBLD		

37 Irrawong Road
North Narrabeen NSW 2101
Telephone 02 9913 1432
Facsimile 02 9913 1434
admin@totalearthcare.com.au
bushregen@totalearthcare.com.au
www.totalearthcare.com.au
ABN: 14 043 484 770
consulting@totalearthcare.com.au
envirorehab@totalearthcare.com.au

Bushfire Management Plan
Randwick Environment Park

Table of Contents

1 Introduction

This Plan is a review and update of the 2002 *Draft Randwick Environmental Park Fire Management Plan* prepared by *AVK Environmental Management*. This Plan will be used to assist in the revision of the Plan of Management for Randwick Environment Park (REP) currently in preparation. This revised and updated Fire Management Plan for Randwick Environment Park has been prepared for Randwick City Council by Total Earth Care Pty Ltd.

The updated Plan differs from the previous Plan in that the development of the REP and adjoining infrastructure had not commenced in 2002, and has now been either completed (Community Centre and residential development to the north) or development applications for adjoining developments have considered asset protection in the form of sufficient setbacks as part of the subdivision conditions of consent.

The previous Plan highlighted that the main assets at risk from a bush fire are the existing residential flat buildings and town houses to the east of REP, and this is still the case. The maintenance of an asset protection zone along the eastern interface, as well as some recommendations for the maintenance and improvement of the environmental assets within the Park are the highest priority recommendations of this Plan.

1.1 Background

Randwick Environment Park is located on a section of a former Defence Land site located in the suburb of Randwick. The Randwick Barracks, owned by the Commonwealth of Australia, formerly occupied a total of 68.6 hectares (ha). Defence has scaled back its operations, and they now currently occupy approximately 20 hectares in the north-western portion of the site. The 49 ha of surplus Commonwealth land is undergoing a change of land use, including staged developments for private residential housing, the completed Randwick community centre, a sports field and parkland. Thirteen hectares of the site was transferred to Council in 2010 for use by the community. This area, known as Randwick Environment Park, is located on the eastern third of a former Defence Land site and is the subject site for this Plan.

1.2 Aim and Scope

The aims of this Plan are to:

- minimise the risk of adverse impact of bush fires on life, property and the environment;
- address the requirements of the relevant State and Commonwealth environmental planning and conservation legislation;
- Manage fuel to reduce the rate of spread and minimise the potential for the spread of bushfires within or from the stands of native vegetation;
- provide fire management strategies for the stands of native vegetation that are to be retained within the site over a five year period;
- reduce the occurrence of human caused unplanned fires and suppress unplanned fires in all stands of native vegetation;
- prevent the extinction, through inappropriate fire regimes, of native plant species that occur naturally within the stands of native vegetation, including those species characteristic of the endangered ecological community Eastern Suburbs Banksia Scrub (ESBS); and
- promote the regeneration of native bushland on the site, particularly where ESBS and populations of the threatened plant species *Acacia terminalis* subsp. *terminalis* have been previously mapped.

1.3 Description of the Site

The Randwick Environment Park (REP) is a 13.1 hectare park containing bushland, including vegetation of national conservation significance, an ephemeral wetland and open space areas (GHD 2008). The REP adjoins the Randwick Community Centre, and is easily accessible from the open space area near the community centre. Formed walkways allow public access through the site and to the oval and picnic shelters and barbeques, with tracks and several viewing areas located to focus visitors attention to the bushland and wetland zones.

Since dedication to Council bushland restoration works have been ongoing, with activities being completed by volunteer bushcare workers, Randwick City Council (Council) staff and/or Contractors. The bushland restoration works are intended to include restoration of heavily vegetated areas containing Eastern Suburbs Banksia Scrub (ESBS) and populations of *A terminalis* subsp. *terminalis.* ESBS is an endangered ecological community listed under the NSW Threatened Species Conservation Act 1995 and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (GHD 2008). *A terminalis* subsp. *Terminalis is* listed as endangered under the NSW Threatened Species Conservation Act 1995 and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

Potential contamination was and still is an issue following the Defence Department vacating the site, however due to its protected status, potentially damaging contamination investigations and/or remediation works were not carried out in areas where ESBS is located (GHD 2008). The site is highly likely to contain bonded asbestos materials, and this should be considered when planning and undertaking management recommendations within this FMP.

1.3.1 Location and land tenure

Randwick Environment Park is located in the suburb of Randwick within the Randwick local government area (Map 1). The site is zoned Environmental Protection - Natural Heritage Areas under the *Randwick Local Environment Plan 1998*. The objectives of this Zone include amongst other things the protection, conservation and improvement of natural heritage areas and habitat corridors, sustainable management, and to enable public access and passive recreation. To note is that bushfire hazard reduction does not require development consent within this zone.

REP is surrounded by a mixture of land use types. The Randwick Community Centre directly adjoins the Park, and is located on the western boundary. Land proposed for future residential development occurs further to the west and south. A newer residential development is located to the north of the Park, while older existing residential developments are located to the east of the Park (Figures 1-3).

1.3.2 Climate and bush fire season

The site is located on the eastern seaboard of Sydney and experiences a warm temperate climate, with local variations in rainfall and temperature based on its coastal location. The Summer-Autumn season is generally warm and wet whilst the Winter-Spring season is cool and dry.

Mean annual rainfall recorded for the locality is 1084.2mm (records from 1930 to 2012), with mean daily maximum temperatures varying from a high of 26.5^0C in January through to a low of 17.0^0C in July based on data collected at the Sydney Airport weather station (Bureau of Meteorology 2012).

During the summer, north-easterly and easterly winds predominate, bringing moist humid conditions. Winter winds are from the west and south, resulting in dry to moist conditions. Historically the combination of drought conditions, high temperatures, low relative humidity and at times strong north-westerly winds result in the most extreme fire weather. This is most likely to occur in this region in the months of November, December and January.

1.3.3 History of bush fire frequency and ignition cause

No records of previous fires were available in 2002 (*AVK Environmental Management 2002*), and no evidence of fires was observed at that time or from recent site inspections. The exception to this was a small fire, approximately less than 500m^2, illegally lit recently in the far northern corner of the site between Gumara St and Elphinstone Rd. This fire burnt within an area of mainly exotic grassland, and was quickly extinguished.

The current extent and density of vegetation within the site is increased in the recent past, as the site contained cleared land that extended over a larger area when the site was occupied by the army. This fact, combined with increased public access only being recently available, have meant that the likelihood of fires was previously reduced (*AVK Environmental Management 2002*).

All stands of bushland within REP are isolated from larger areas, with the intervening land comprising built up areas within the surrounding suburbs. Given the fragmented distribution of the bushland within the site and isolation from other bushland areas it is likely that any fire activity would be the result of either direct lighting, with a lower potential for spotting from an existing fire within Botany Bay NP and other bushland remnants located several kilometres to the south.

Fire records from Botany Bay NP indicate that unplanned bushfires (wildfires) within the area are predominantly caused by arson (DEC 2002).

2 Legislative Framework

2.1 Rural Fires Act 1997

The *NSW Rural Fires Act 1997* (RF Act) provides for the prevention, mitigation and suppression of fires within rural fire districts, for the protection of persons and property and for the protection of the environment.

Under Part 4 Division 1 of the RF Act “it is the duty of a public authority (in this case Council[1]) to take the notified steps and any other practicable steps to prevent the occurrence of bush fires on, and to minimise the danger of the spread of a bush fire on or from, any land vested in or under its control or management”.

[1] Under the *Rural Fires Act 1997* a ‘public authority’ is defined as:
(a) any public or local authority constituted by or under an Act other than this Act, or
(b) any Government Department, or
(c) a statutory body representing the Crown, or
(d) a State owned corporation, or
(e) any person prescribed by the regulations as a public authority.

2.2 Bush Fire Environmental Assessment Code (RFS 2006)

The purpose of the Bush Fire Environmental Assessment Code („the code') is to provide environmental assessment for use by issuing authorities in determining applications for Bush Fire Hazard Reduction Certificates on Bush Fire Prone land (this is an area mapped within the relevant Local Government Area as detailed in a Bush Fire Risk Management Plan). The Code applies to Asset Protection Zones (APZ), Strategic Fire Advantage Zones (SFAZ) for residential buildings and other significant buildings, and Land Management Units (LMU), all of which are identified in local Bush Fire Risk Management Plans. An APZ is a fuel reduced area around assets or groups of assets which are adjacent to bush fire hazards. A SFAZ is land that is mapped or described as such in a Bush Fire Risk Management Plan. SFAZ's provide strategically located fuel reduced areas. LMUs should be managed so as to provide optimum fire frequencies required for the maintenance of biodiversity (RFS 2006).

Different Hazard Reduction (HR) activities are assessed under the Code including manual clearing, pruning of vegetation, prescribed burning, construction of control lines and pile burning. Different parts of the Code address each of these activities separately. Part 4 of the Code specifically relates to mechanical hazard reduction and the pruning of trees. Part 5 of the Code specifically relates to hazard reduction using a prescribed burn, pile burn or construction of control lines. By undergoing the process of the Code and Bush Fire HR Certificate, all environmental assessment requirements are fulfilled and no other environmental assessment is required. This will be determined by the certifying authority. Randwick City Council are the certifying authority and may certify bush fire hazard reduction works consistent with the Code in any land that is vested in or under their control (RFS 2006).

The Code does not apply to land not mapped as Bush Fire Prone, as well as various activities including bush regeneration/ecological burns including pile burning of weeds, and broad area burns.

2.3 Fire Brigades Act 1989

The *NSW Fire Brigades Act 1989* (FB Act) relates to the protection of persons and property from fire. Under Part 1, Section 5 of the FB Act, the NSW Fire Brigade (NSWFB) has the responsibility for the control of fires within fire districts. NSWFB are to have regard to the principles of ecologically sustainable development.

Randwick Environment Park falls within the Area Command Metropolitan South and Zone Office Metropolitan South 2 – Georges River, with the closest fire stations being located at Maroubra and Randwick.

Furthermore under Part 3, Division 1, Section 13 (2) of the Act "an officer in charge of fire brigades is, as far as practical, to carry into effect any plan of operations in force under Section 52 of the RF Act in relation to the place where the fire occurs".

2.4 Threatened Species Conservation Act 1995

The *NSW Threatened Species Conservation Act 1995* (TSC Act) provides for the protection of all threatened species, populations and ecological communities against key threatening processes. Under Schedule 1, Part 3 of the TSC Act, ESBS is listed as an "endangered ecological community".

A Recovery Plan (NPWS 2004) for ESBS has been prepared pursuant to the requirements of the TSC Act and of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). One of the key threatening processes of potential relevance to ESBS, as listed on Schedule 3 of the TSC Act

and within the Recovery Plan, is “high frequency fire resulting in the disruption of life cycle processes and loss of vegetation structure and composition”. The reinstatement of appropriate fire regimes (where possible) should be a priority when developing management strategies for sites that contain ESBS (DEC 2004).

The Department of Environment, Climate Change and Water (NSW) has prepared a Recovery Plan for *Acacia terminalis subsp. terminalis* (Sunshine Wattle) in 2010. *Acacia terminalis* subsp. *terminalis* is listed as endangered on the EPBC Act, and endangered on the NSW TSC Act. Although plants are killed by fire, they have been recorded sprouting from the base. Seed viability is high and recruitment occurs mainly after fire, however inappropriate fire regimes may also threaten persistence at some locations (DECCW 2010).

Furthermore under Section 91 of the TSC Act a licence is required to “harm or pick threatened species, populations or ecological communities or damage habitat”. Fire management activities are included under this section of the Act and as such, may require approval from the OEH.

2.5 National Parks & Wildlife Act 1974

The *NSW National Parks and Wildlife Act 1974* (NPW Act) provides for the conservation and protection of land reserved under the Act, threatened species, populations and ecological communities and their habitats, Aboriginal objects and places and non-Aboriginal buildings and places on land reserved under the Act.

In relation to the site the NPW Act provides for the protection of ESBS and thus requires that a scientific licence under Section 132C of the Act be obtained to harm or pick any plant. These actions are necessary to undertake activities such as seed collection and translocation within stands of ESBS.

The NPW Act also provides for the NPWS to assist land managers in developing fire management practices to conserve biodiversity and cultural heritage.

2.6 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act identifies and provides protection for “matters of national environmental significance” within Australia. ESBS is listed as an endangered ecological community and *A terminalis* subsp. *terminalis* an endangered species and are therefore matters of national environmental significance, as defined under the Act.

3 Identifying and Assessing the Bush Fire Risk

3.1 Communication and Consultation

Effective fire protection and fire management for an area relies on close cooperation between the various land management agencies, local government authorities, local fire services and the landholders they protect. Due to the urban context of the site and surrounding areas a degree of community involvement and cooperation in fire management on and adjacent to the site is appropriate. Accordingly Council should employ a programme of community education that covers topics including fire awareness, hazard reduction, property protection and arson detection. Communication regarding these issues could be disseminated via information leaflets prepared

regarding REP (AVK Environmental Management 2002), or permanent or temporary signage within the Park.

The Randwick LGA is not part of the NSW Rural Fire Service (RFS) area of operations, with the closest RFS District being Sutherland to the south. As stated, REP is within a NSW Fire Brigades Zone, and this revised Plan has been reviewed and endorsed by the NSW Fire Brigades Bushland & Urban Interface Officer. Ongoing liaison and consultation with NSW Fire Brigades regarding the implementation of certain aspects of this Plan should continue.

3.2 Identifying the Bush Fire Risk

As part of the development and revision of this Fire Management Plan, identification and assessment of the bush fire risk can inform the range of proposed bush fire management measures. Often these measures are aimed at a reduction in the assessed level of risk, however no matter what treatment is applied a residual amount of risk always remains. While REP is a relatively small area, a risk assessment approach of identifying important community assets considered at risk from bush fire within and adjoining REP is warranted. Once the assets are identified, then assessment of the likelihood and consequence of a bush fire impacting upon these assets can occur. The next step in the process is then to develop suitable risk treatment actions and prioritise these for implementation.

3.2.1 Assets

The assets located within and adjoining REP that are potentially at risk from fire can be divided into four asset types.

<u>Human settlement</u>

Residential areas including the urban bushland interface areas include:

- dwellings along Argyle Crescent and Lomandra Place;
- flats along Elphinston Road and Wauchope Crescent;
- Randwick Community Centre;
- Dwellings on Dooligah Ave and Burragulung Streets; and
- Proposed blocks on the western side of Munda Street and southern side of Joonga St.

Figure 1 Property Assets in Lomandra Place adjoining REP

Figure 2 Property Assets adjoining REP to the north

Economic

Infrastructure within the REP includes:

- Internal and external fencing;
- Timber wetland viewing platforms;
- Timber bridge;
- Timber furniture such as seats, picnic tables and shelters;
- Signage; and
- Other facilities, including organic gardens and the Wires Bird Rehabilitation enclosure.

Figure 3 Open Space adjoining Randwick Community Centre

Figure 4 Wetland Viewing Platform

Environmental

Environmental assets within REP include:

- Threatened species (*Acacia terminalis subsp terminalis*) and the approx 3.74 hectare area of Eastern Suburbs Banksia Scrub endangered ecological community;
- Other locally important flora and fauna species, especially those sensitive to fire.

Figure 5 Eastern Suburbs Banksia Scrub

Cultural

Cultural assets are a fourth type of asset, however no Aboriginal places and items of significance or non-indigenous heritage places or items have been identified in the REP (AVK Environmental Management 2002).

Factors contributing to bushfire risk include vegetation, slope, aspect, weather conditions and proximity of hazards to assets (the further away an asset is located from a bushfire hazard, the less likely it is to be damaged or destroyed by the bushfire).

See map 3 for the location of the main assets to be treated under this BFMP.

3.2.2 Assessing the Bush Fire Risk

The consequence of a bush fire is the outcome or impact of a bush fire event. The consequence of a bush fire may range from minor, moderate, major and catastrophic. Once determined the consequence is used in conjunction with the likelihood rating in determining overall risk.

The likelihood of bushfire risk is defined as the chance of a bushfire igniting, spreading and causing damage to life and property and assets of value (including ecological) to the community. In assessing and determining a likelihood rating, considerations include whether or not fires frequently occur, and if they do ignite would it spread and reach assets. Possible likelihood ratings used in a risk assessment process can include unlikely, possible, likely and almost certain.

3.2.3 Identifying the level of risk

Once the likelihood rating and consequence have been considered, the risk level can be determined using the table below. There are five risk levels: insignificant; minor; moderate, major and extreme.

Table 1 Bushfire Risk Classification[2]

Level of Risk	Criteria
Extreme	Life Risk Only – populated areas where the combination of threat and vulnerability expose a community to a significant likelihood of fatalities and major injuries. Property – not applicable to the extreme category. Environment – extinction of native species.
Major	Life – less likely to be fatalities or major injuries due to the presence of attributes which afford some protection. Property – exclusive and widespread loss of property. Major impact across a large part of the community and region. Long term external assistance required to recover. Environment – irreversible damage to the environment.
Moderate	Life – loss of life or major injury highly unlikely. Medical/hospital treatment may be required. Property – localised damage to property. Short term external assistance required to recover. Environment – long term damage to the environment over a landscape scale.
Minor	Life - minor injuries only - first aid treatment. No major injuries or fatalities likely. Property – short term damage to individual assets. No external assistance required to recover. Environmental – short term, localised damage to the environment.
Insignificant	Life – no injuries or fatalities likely. Property – inconsequential or no damage to property. Little or no disruption to the community. Environmental – minor impact on the environment.

[2] Derived from Baulkham Hills Bushfire Risk Management Committee (1999) *Bushfire Risk Management Plan.*

3.2.4 Evaluating the Bush Fire Risk

The risk to property assets from a bush fire hazard varies depending upon several factors, with fire behaviour influenced by fuel (vegetation) type and slope as well as other weather factors such as wind speed and humidity. The separation distances between the hazard and the asset also determines the level of risk. While most of the REP is located on relatively flat ground, slope increases up to approximately 15 degrees under the hazard near the eastern boundary (AVK Environmental Management 2002). The intensity and rate of spread of fires burning upslope is known to increase with increasing slope. This increases the level of risk to these properties, and along with limited separation distances between the vegetation and the building lines also influences the level of risk.

In the context of fire management, vegetation communities can be broadly categorised into fuel types. An understanding of the implication of how vegetation types affect fuel characteristics is essential to quantifying the fire risk. It provides a valid basis for the determination of appropriate fuel modification treatments that can be implemented to achieve fire management objectives to protect life and property and conserve biodiversity.

The majority of the bushland within REP can be broadly described as a tall heath vegetation type. It comprises highly flammable canopy and understorey species including: Tick Bush *Kunzea ambigua, Allocasuarina distyla,* Ball Honeymyrtle *Melaleuca nodosa,* Old Man Banksia *Banksia serrata* and Heath-leaved Banksia *Banksia ericifolia* var. *ericifolia*, along with some extensive coverage by weed species such as *Lantana camara*. Approximately 3.74 hectares of the site is mapped as the endangered ecological community Eastern Suburbs Banksia Scrub.

Research has found that the structure of surface fine fuels is more closely related to the type of fire behaviour than the surface fine fuel load (McCarthy 2000). The *Overall Fuel Hazard Guide* (NPWS 2002) uses an approach that assesses the entire fuel complex, especially bark and elevated fuels, rather than just the surface fine fuel loads. Using this methodology, the surface fine fuel hazard rating within REP, while variable, has been assessed as High. When considering bark hazard, the site does not contain many stringy bark trees, and therefore bark hazard is considered to be on average Moderate. Elevated fuels are Very High, with heath vegetation having high fuel continuity both horizontally and vertically that promotes the spread of fire, a high proportion of dead material and very fine foliage and twigs. In combination, the assessed levels of bark, elevated and surface fine fuels give an Overall Fuel Hazard rating of Very High.

The levels of bushfire risk applicable to REP, based on a consideration of Likelihood and Consequence is set out below. The risk to assets has been split into the three classes identified above, namely human settlement, economic and environmental assets. The list of assets has been adapted from Table 1 of the 2002 draft Plan (AVK Environmental Management 2002), with the identified environmental assets added to the table. For REP, the risk rating based on the consequence and likelihood ratings for the identified assets types has been assessed and a risk level assigned based on the table above.

With respect to likelihood, while the long term fire history is largely unknown, no recent fires have been recorded and it has therefore been assumed that fires do not frequently occur within REP. It is only those assets located upslope from the hazard (the eastern boundary) that are likely to be impacted if a fire was to ignite.

Table 1 Assets with and adjoining Randwick Environment Park

Human settlement

Asset at Risk	Level of Risk	Comments and Recommendations
Dwellings along Argyle Crescent and Lomandra Place	Moderate to High	These properties adjoining REP are located upslope of high hazard vegetation and are likely to be vulnerable to impact of a bush fire if one was to ignite. Suitability of reduced APZ (10m) along eastern boundary should be confirmed with NSW Fire Brigades. Consideration of impact to the existing ESBS EEC should be considered in this area. The 10 metre wide Asset Protection Zone negotiated with NSW Fire Brigades as part of the draft 2002 Plan should be maintained as a minimum (see Section 4.1). The APZ was recently slashed in accordance with the current agreed setbacks from the property boundary. Trimming of elevated vegetation back to the 10 metre set back is also required. The APZ should be maintained annually prior to the fire season commencing, and inspected regularly to ensure fuel loads are kept to a minimum and setbacks maintained. Undertake hazard reduction works (mechanical and/or burning) within the bushland remnants to reduce the level of risk of a fire impacting on the adjoining dwellings.
Residential Flat buildings along Elphinston Road and Wauhope Crescent	Moderate to High	As above
Randwick Community Centre	Minor	Good setbacks that are managed as parkland exist around the Community Centre Building, and direct impacts to life and property are considered to be Minor. Closest bushland is to north, however a 10m wide mown area located on level ground separates the facade from the hazard and is considered to be adequate in this area as the REP. The bushland area to the north between the Community Centre and Dooligah Ave is very narrow thereby reducing fire run towards the structure thereby reducing the level of risk. The setback, while adequate, should be maintained via mowing, with elevated fuels trimmed back to the fence line to maintain separation distances.

Dwellings on Dooligah Ave and Burragulung Streets	Insignificant to Minor	The subdivision in this area has been designed with the roads acting as perimeter roads, providing good setbacks between the hazard and the property assets. While direct flame contact is unlikely in this area, impacts to property during a bush fire event could still occur from embers and smoke. The 2002 Plan recommended construction of these dwellings to Level 1 (BAL 19) under AS 3959, or otherwise a 30 metre setback. The level of construction could not be assessed, so the construction levels should be reviewed by Council and the adequacy of existing setbacks adjusted if necessary.
Proposed blocks on western side of Munda St and southern side of Jongah St	Insignificant	The subdivision in this area has been designed with the roads acting as perimeter roads, providing good setbacks between the hazard and the property assets. Direct flame contact is unlikely and minor impacts from embers and smoke possible.

Economic

Asset at Risk	Level of Risk	Comments and Recommendations
Internal and external fencing;	Minor	Timber fencing and plastic coated chain link fence vulnerable to damage during a fire event. Ensure all fencing protected during any planned fire event
Timber wetland viewing platforms	Minor	Located in a lower hazard area on western side of REP away from larger bushland remnants Ensure platform protected during any planned fire event Maintain a suitable cleared area around to platform to reduce the potential for damage during a fire event
Timber bridge	Minor	Located in low hazard area on south-eastern side of REP away from larger bushland remnants Ensure bridge protected during any planned fire event Maintain suitable cleared area around bridge to reduce potential for damage during a fire event

Timber furniture such as seats, picnic tables and shelters;	Insignificant to Minor	Furniture and associated structures are located within cleared areas and have limited potential to be damaged by fire. No specific recommendations
Interpretive Signage	Minor	Signage is located around the Park and therefore subject to different levels of risk Maintain a suitable cleared area around signage to reduce the potential for damage during a planned or wild fire event
Other facilities, including organic gardens and the Wires Bird Rehabilitation enclosure	Minor	These facilities are located on the edge of the Park adjoining the cleared parkland around the community centre. Ensure coordination with groups using these facilities to ensure no loss of property or impact to animals during a planned fire event. Maintain a cleared area around the facilities to reduce the potential for impact from a wild fire.

Environmental

Asset at Risk	Level of Risk	Comments and Recommendations
Threatened species and the Eastern Suburbs Banksia Scrub endangered ecological community;	Minor to Moderate	Depending upon the type of fire event and fire regime there is a potential for some long term damage to the environment over a landscape scale (REP). The structure and species composition of the endangered ESBS community may be impacted by fire, particularly a high fire frequency of less than 5 years. Vegetation community structure and species composition may be altered long term from a high fire frequency. The long fire interval is having a potential negative impact to this community. Undertake a series of prescribed burns within sections of ESBS, in accordance with the ESBS Recovery Plan, to reduce the level of overall fuel hazard, reducing the level of risk to life and property adjoining REP while improving or maintaining the ESBS community. A mosaic of prescribed burns of varying interval and intensity is recommended, with strong weed management focus pre and post burn. Monitor location of *Acacia terminalis subsp. terminalis* plants and assess whether to include within prescribed burn areas or protect from a planned fire event.

Other locally important flora and fauna species, especially those sensitive to fire.	Minor	Short term, localised damage to the environment may occur, however there is potential for some long-term damage to the recovery of fire sensitive species depending upon the fire regime within REP Consider fire sensitive species as part of any planned fire management activities

3.3.5 Prioritising Treatments

The highest level of risk is to the adjoining properties located to the east. There is a relatively high likelihood that if a fire was to ignite within REP it would spread and cause damage to life and property assets adjoining. An additional consequence is the impact to the ESBS vegetation community and other vulnerable or locally significant species, if the fire was to occur outside of the recommended fire regime for this community. Plant species and many vegetation communities have minimum fire thresholds which are the shortest inter-fire interval needed to avoid any localised declines or losses of species as a result of too frequent fire.

The previous Plan recommended that a 10m APZ be created along the eastern boundary and the ongoing management of this area by slashing and trimming back the vegetation should remain the priority for management of bush fire risk at REP. Hazard reduction work could occur within the bushland remnants, either via mechanical clearing and/or hazard reduction/prescribed burning. Consideration of the impact to the ESBS and *Acacia terminalis* threatened biodiversity values within REP, including fire thresholds, fire intensity and pre and post fire weed management are paramount in the implementation of this type of fire management action.

Additional fire management measures while important are relatively minor, with the APZ to the north of the community centre the next priority. Setbacks to the other adjoining developments are generally sufficient, with inclusion of perimeter roads as part of the subdivision layouts providing sufficient asset protection. The clearing of vegetation around other built structures, such as fences, chairs bridges etc should occur as part of normal maintenance activities, although these are the lowest priority as these structures can be replaced at a relatively low cost.

4 Treating the Risk

The purpose of risk treatments is to reduce the likelihood and/or harmful consequences of bush fire to the community and environment, through a process of selecting and implementing risk treatment options that modify the characteristics of the hazard, the community or the environment.

4.1 Bush Fire Management Zones

Based on the results of the bushfire risk assessment the REP site has been divided into three different fire management zones for which specific fire management objectives and strategies have been developed. The types of bushfire management zones identified in this Plan are described below and shown on Map 3 Appendix A.

4.1.1 Asset Protection Zone

An APZ is a buffer zone located between bushland and a dwelling (or some other defined value at risk). The APZ aims to reduce heat radiation and direct flame contact (two of the three causes of bush fire damage). It is also an area where airborne embers (the third cause) can fall with minimal opportunity to create further outbreaks. This zone can be broken down into two further zones, the inner and outer protection area, however only an inner protection zone is recommended for REP.

The Fuel Free Zone (Inner protection area) encompasses an area that is primarily almost free of combustible fuels. It is designed to be grassy areas, car parks, roads, concrete areas, track or trails. It does not imply the wholesale removal of all existing trees and isolated shrubs. However the fuel free zone requires ongoing maintenance to reduce the fuels to a minimum state of growth so as to reduce the potential for ignitions and to eliminate the carriage of intense fire. The presence of a few shrubs or trees in the IPA is acceptable provided that they do not touch or overhang buildings; do not form a continuous canopy; are not species that retain dead material or deposit excessive quantities of ground fuel in a short period or in a danger period; and are located far enough away from the house so that they will not ignite the house by direct flame contact or radiant heat emission.

The APZs recommended within this plan are located along the boundary of the site, with the most important located along the eastern boundary and to the north of the Community Centre. Other APZs occur along other boundaries and fence lines around the Park to varying degrees, and are often complemented by APZs on the adjoining land.

Figure 6 Typical 10m APZ on eastern boundary

Figure 7 APZ to the north of the Community Centre

4.1.2 Strategic Fire Management Zone

Strategic Fire Management Zones (SFMZ) provide strategic areas of fire protection which will reduce the speed and intensity of bushfire and reduce the potential for spot fire development whilst still maintaining fire regimes within the biodiversity thresholds. A SFMZ is recommended to be located on the upper slopes of the site near the eastern boundary, the aim of which will be to complement the APZ as the reduced APZ width proposed does not provide adequate separation distances under all potential fire event scenarios. The SFMZ will provide strategically located fuel reduced areas to reduce the vulnerability of built assets which are susceptible to fire, while also being managed to ensure the maintenance of the ESBS EEC. The area would be a Fuel Reduced Zone with thinning of the vegetation designed to aid in reducing the carriage and spread of fire and thus potential intensity or heat radiation from the flames.

Sweet pittosporum (*Pittosporum undulatum*) and cheese tree (*Glochidion ferdinandi*) are examples of native flora that can out-compete regenerating Eastern Suburbs Banksia Scrub species, and these species could be selectively removed along with weed species within this zone (DECC 2009). The vegetation thinning for risk reduction purposes can occur via thinning, removal of vegetation, clearing or burning.

The slopes within the Park adjoining the Wauchope and Argyle Crescent interfaces is variable, and therefore the potential for erosion should be carefully managed as part of any hazard reduction works as the slope under the vegetation increases. The retention of a high percentage of ground cover (vegetation, twigs, leaf litter, mulch or rocks) is essential to limit the potential for erosion on the steeper sections of the recommended fire management zones. A permanent ground cover such as short grass should be established within the APZ, accompanied by careful retention and increase of the percentage coverage of the ground layer within the SFMZ.

Figure 8 Section of proposed SFMZ adjoining APZ showing steep slopes and weed invasion

4.1.3 Land Management Zones

A Land Management Zone (LMZ) is designed to meet relevant land management objectives in areas where APZs or SFAZs are not appropriate. This can include hazard reduction and prescribed ecological burns that are recommended within areas of remnant bushland, including the ESBS EEC.

Figure 9 Section of proposed LMZ showing dense stands of ESBS with property assets beyond

4.2 Hazard Reduction

Major threats to the flora and fauna of the site may include:

- a wildfire event burning all or part of the remaining stands of vegetation;
- inappropriate fire regimes for threatened species, populations or communities (ie ESBS Ecological community), threatened plant species and local fauna;
- post fire weed recruitment (in particular invasion of Lantana *Lantana camara*);
- predation of regenerating seedlings by rabbits; and
- exposure of ground surface and top soils, causing soil erosion and potential asbestos contamination issues.

The fragmented areas of bushland within the sites provide limited resources for the survival of fauna. While fire may be a direct cause of death to animals through heat, the greatest effect is caused by changes to habitat and the availability of food, shelter and breeding sites.

It is necessary to maintain a diversity of vegetation cover and structure to conserve viable animal populations. Thus it is important that any individual fire, or combination of fires within a short period of time, should not completely burn the local extent of any vegetation community. Generally any broad scale fire event is to be avoided.

Given the incomplete fire records for the sites, a precautionary approach to the use of fire as a management tool will be adopted in this plan. It may be more appropriate that a combination of fire and weed removal techniques be used within the site to enhance the regeneration of native flora species and maintain local populations of fauna. The bush regeneration program that is in place should continue, however the management of this program should complement the bush fire risk treatment activities.

Fuel management objectives to achieve adequate fire protection generally aim to reduce accumulated fuel loads and create vertical separation, particularly of the fine fuels (less than 10mm diameter).

4.3 Fire Thresholds

Fire is recognised as an important factor in many different habitats in Australia (Gill *et al.* 1981). The maintenance of species diversity and variations in vegetation structure requires variability in fire regimes (Keith & Bradstock 1994; Bradstock *et al.* 1995). Important components of fire regimes include intensity, frequency and season.

DEC uses the concept of "biodiversity thresholds" to aid the development of fire management prescriptions for various vegetation communities. Biodiversity thresholds are the fire regime required to maintain biodiversity at an acceptable level. The management objective is to vary the conditions under which prescribed burning takes place (ie frequency, intensity and season) within the suggested threshold limits for each vegetation community in order to maximise the structural and floristic diversity of the resulting vegetation and age class.

The aim of fire management for conservation is to minimise the loss of species from sites by maintaining fire frequencies for each vegetation community and threatened species within their biodiversity thresholds. A prescribed burn frequency of 10-15 years would reduce the continuity of vertical fuel arrangement between understorey and canopy vegetation, reducing the potential of crown fire development on low to moderate fire danger days. The exclusion of fire for longer periods, as is currently the case, will support the development of a continuous vertical fuel arrangement and increase the risk of crown fires in lower fire danger conditions.

The biodiversity thresholds for ESBS and Coastal Sandstone Heath are the same, due to their similar structure and composition, and are as follows (DEC 2004):

- Successive fires at intervals of less than eight years should be avoided;
- Successive fires at intervals of more than 15 years should be avoided; and
- Fire exclusion for a period of more than 30 years should be avoided.

The regular burning of ESBS at frequencies near the lower end of the above parameters (i.e. every 8 to 10 years) should be avoided, as this may impact upon the seedling recruitment of component species with a long primary juvenile period (eg *Banksia serrata*). If the frequency is too low, native flora such as coastal tea tree (*Leptospermum laevigatum*) can become dominant and thereby reduce biodiversity levels as can be seen in sections of REP. Similarly prolonged periods without fire (>15 years) can simplify the floristic composition and vegetation structure of the ESBS community (DEC 2004). The remnant bushland appears to not have been burnt for well in excess of 15 years and subsequently should be burnt as soon as possible. In completing the burning across the whole site it is also recognised that a mosaic pattern of burning is required to maintain sheltering, nesting and foraging habitat for fauna species.

Prescribed burns undertaken within the site should be within the above listed parameters. Prescribed burns undertaken on existing stands of vegetation will involve only a portion of any one bushland stand so that a mosaic of different age groups is created, with moderate burns preferred. This need to avoid burning all of a bushland stand at any one time may require that some parts of that stand are allowed to go beyond the biodiversity thresholds temporarily. Weed management is also required prior to any burns, with effective follow up weeding also planned post burn so the area burnt at any one time needs to be carefully considered.

Before burning, woody weeds should be „cut and painted' and placed into piles of different sizes throughout the prescribed burn area and left to dry (DECC 2009). Weed piles produce a moderately hot fire so different sizes will provide some variability in the range of species that may germinate.

Little is known of the effects of season on burns in heathlands. „Cool season' burns (ie in autumn or winter) often result in

- poor seed regeneration, from the plants being burnt whilst in flower;
- immature fruit from a reduced seed release due to lower intensity fires;
- greater mortality of released seed due to higher soil temp over the following summer; and
- increased seed predation on seed released from protective fruit onto the exposed soil surface.

Further to this, the intensity of the prescribed burn needs to be such that suitable heating of the soil has taken place. To ensure this approximately 6-20 tonnes/ha of fine fuel needs to be consumed.

Acacia terminalis subsp. *terminalis* is an erect shrub to 5m tall. This species has been recorded in scrub and dry sclerophyll woodland between Botany Bay and the northern shore of Port Jackson. It occurs at two sites within the Randwick LGA, including a few plants recorded within REP. The species prefers moist ground in heath and woodland on sandstone in coastal Sydney, however the plants within REP occupy deep aeolian dune sands, and this is thought to possibly be the result of human related soil movement (pers comm. D Hirschfield in DECCW 2010).

A.t.terminalis has a persistent soil seedbank which may last up to 50 years and high seed viability. *A.t.terminalis* is a fire sensitive obligate seeder -plants are killed by high intensity fire and don't normally resprout after fire (DECCW 2010). Germination occurs mainly after fire and a >60^{o}C is required for maximum germination, and therefore moderate intensity burns are recommended while the use of low intensity burns may lead to population declines. However lower intensity may be prudent at sites with shallow soils to avoid killing seeds at all depths within the soil seedbank profile.

A minimum fire-free interval of 6-12 years is appropriate, thereby providing enough time between fires to allow seedlings to mature and sufficiently replenish the seedbank. The maximum fire free period is unknown, but is estimated at 20 years based on the life of the species. Seasonality is not as important due to the longevity of the seedbank, with late summer and autumn fires preferred so temperatures required are reached and growing conditions after the fire are more favourable (DECCW 2010).

5 Fire Management Issues

For all proposed burning activities the following issues should be considered as part of the planning process and before a hazard reduction or ecological burn is conducted:

5.1 Alternatives to Hazard Reduction Burning

There are many non-burning methods employable as alternatives to hazard reduction burning. Alternatives such as mechanical clearing, and the pruning of trees are also considered Hazard Reduction activities for which environmental assessment is undertaken under the Code. These activities can be important for maintaining ecological fire regimes for certain species and communities, and for reducing adverse environmental effects as a product of bush fire. This type of hazard reduction is also applicable to the steep slopes near the eastern boundary and within the SFMZ.

5.2 Fire Awareness and Education

Due to the urban context of the LGA a high degree of community involvement and cooperation in fire management is appropriate. Accordingly the Council should employ a programme of community education that covers topics including fire awareness, property protection and arson detection.

5.3 Procedures for fire events

A database of neighbour contact details for areas to be burnt should be compiled and stored at the Council chambers. This database can be used to notify neighbours of prescribed burning activities and during wildfire emergencies within the area.

5.4 Fire Detection

Detection of a wildfire as early as possible is critical to ensuring rapid and effective response by fire suppression resources and minimisation of environmental and economic damage. The Emergency Services should be alerted immediately of any fires by dialling “000”.

5.5 Fire Suppression

Wildfire suppression will be achieved by the most suitable strategies taking into account the prevailing seasonal conditions and forecast weather, predicted fire behaviour, fire fighter safety, assets and values at risk and the impact of strategies on biodiversity, cultural heritage and the social and economic environment.

The priorities for wildfire suppression are:

- the safety of all incident personnel;
- the effective protection of human life and community assets;
- the conservation of biodiversity;
- the conservation of cultural heritage; and
- the cost effectiveness of strategies.

Wherever possible existing built and natural fire advantages will be used instead of construction of new control lines. Where new control lines are required, wherever possible use of heavy earth moving equipment will be avoided. Hand tools, air blowers or slashers will be preferentially employed.

If fresh water is unavailable for direct attack the limited use of salt water is considered to be acceptable. Knowledge of the impacts of the use of salt water for fire suppression on vegetation is largely anecdotal but its repeated use in any one area is to be avoided.

The need for post-fire bushland rehabilitation should be assessed by a bushland management consultant. Issues to be assessed following a fire event include:

- animal welfare;
- soil stability;
- water quality in drainage lines;
- pest and weed species invasion;
- impact on native flora and fauna;
- impact on cultural heritage sites;
- damage to assets eg. roads, gates, buildings and signs;
- damage to neighbours assets eg. fencing;
- asbestos contamination; and
- need for post-fire monitoring.

5.6 Fire Access

Construction of access tracks is an important element in fire management. They provide safe access and egress by personnel involved in both prescribed burning and fire suppression operations.

Designated fire access tracks will require the removal of vegetation for a distance of 2m from track margins with removal recommended to mineral earth (exposing soil and rocks). This will provide fire fighters with safe access/egress under low fire danger conditions.

Access tracks established within the bushland areas will be non-permanent and allowed to grow over. As tracks can be a source of weed establishment, it is expected that weed growth be monitored and control measures implemented where necessary.

5.7 Water Supply

Provision and maintenance of adequate and strategically located water supply is an important element in fire control and may affect the success of fire suppression activities.

Any site for proposed burning should be adequately serviced with reticulated water supplies and fire extinguisher systems for fire suppression. Hydrants should be positioned in strategic locations and should be clearly marked.

5.8 Smoke Management

Section 133 of the *NSW Protection of the Environment Operations Act 1997* states that the Environmental Protection Authority has the power to declare a „no-burn period'. Liaison with the Authority, when planning a prescribed burn is essential.

The following will be assessed prior to carrying out a prescribed burn:

- burning to be carried out during times of low fuel moisture content to minimise smoke emissions. This may involve burning during drier period of the year where more resources have to be directed to containment strategies;
- neighbours and residents of sensitive areas within the air catchment are to be notified well in advance of prescribed burns and are requested to assist with removing accumulated debris;
- managers of hospitals and retirement villages within the area to be well informed of proposed burns and wildfires;
- debris is removed from bushland areas (eg, tyres, dumped rubbish etc) before burns are commenced;
- aggressive mop-up of fires is implemented to minimise the smouldering stage of suppression; and
- maintain a close liaison with the EPA and the Bureau of Meteorology.

6 Prescribed Burning

6.1 Planning a prescribed burn

Prescribed burning, aside from Hazard Reduction burns, can be used as a tool for regeneration of species and the control of many weed species. This type of burning can include both broad area burns, and pile burning.

Prescribed burning should be consistent with the fire regime recommendations for the vegetation types and recommended fire thresholds.

The following steps should be carried out when planning a prescribed burn:

- prepare plans and prescriptions for prescribed burning operations in bushland areas when minimum intervals exceed recommended fire thresholds.;
- implement burning operations in accordance with prepared prescriptions in order to achieve the stated fire management outcome, at the same time ensuring that the integrity of associated environmental factors are not compromised;
- prepare and conduct a monitoring protocol post-burn, recording changes in biodiversity, soils and weed invasion; and
- prepare and implement strategies that will mitigate any deleterious effects of the prescribed burn identified during monitoring activities.

6.2 Implementing a prescribed burn

Operational steps for prescribed burns (other than for the purposes of Hazard Reduction) shall include:

- submit application for proposed burn activity to Council;
- determine whether an Environmental Assessment under Part 5 of the *Environmental Planning and Assessment Act 1979* is required. Undertake the assessment in accordance with the general guidelines *'Is an EIS required'*. Particular issues include Phytophthora management protocols, weed management prior to the burn, and asbestos contamination.
- obtain approval to burn from the NSWFB and OEH (EPA licence under the POEO Regulation). Regional Manager should be contacted to gain this approval, which is the Sydney Manager – Local Government EPA;
- obtain assistance from the NSWFB and OEH. There are local NSWFB Stations in the Randwick LGA as discussed above in Section 3.3;
- provide neighbours with appropriate notice (24 hours) of intention to burn. This is usually achieved by a letterbox drop;
- brief all personnel on the area of the burn, burn perimeters, control lines, watering points etc;
- brief all personnel on their roles and responsibilities during the burn operations;
- brief all personnel involved in burning on the locations of ESBS EEC, threatened or significant species that are within or adjacent to the proposed burn boundary;
- keep behaviour of fire within controllable parameters. Avoid high intensity fires that consume tree canopies and ensure a mosaic of burnt and unburnt areas;
- protect large and hollow bearing trees as fauna habitat;
- restrict use of any heavy machinery to burn control lines or perimeters; and
- exclude the use of wetting or foaming agents within 20 metres of a watercourse or dam. Repeated use in an area is to be avoided. Avoid the use of retardants.

6.3 Post-fire Research and Monitoring

For burns conducted for ecological purposes, monitoring the responses of plant and animal communities to fire is essential to establish whether management criteria are being met. Council or a bushland management consultant should monitor burn sites for natural regeneration and note species type and numbers using marked quadrats in representative areas of vegetation.

Fire management practices should consider weed control after works, sedimentation and erosion control, sustainability value of remaining unburnt vegetation for fauna, effects of fire and smoke on residents, maintenance of biological diversity, soil contamination from asbestos, and the overall management effectiveness of the practice.

A weeding program should be established as a mandatory follow-up to any prescribed burn activity and as highly desirable following wildfire.

All fire events that occur within a site should be documented and mapped. Any additional information on past fire events that comes to light should be similarly recorded.

7 Management Actions Summary

The review of the 2002 Plan prepared by AVK Environmental Management included a management action summary table. Many of the actions within the table are still relevant to current fire management activities, and therefore the following table is based on the 2002 actions with additions and amendments as required. The table has been re-ordered from highest priority to lowest, and the column related to timing of the actions added.

Fire Management Objective	Recommended Action	Timing	Performance Indicators
Minimise the risk of wildfire damaging built assets in and surrounding the park	a) Implement the fire protection measures listed, including the establishment and maintenance of Asset Protection Zones along the eastern boundary and to the north of the Community Centre. b) NSW Fire Brigades to review the effectiveness of the Asset Protection zone of the eastern boundary. c) Ensure Asset Protection Zones and other fire protection measures within the park are well maintained in accordance with *Planning for Bushfire Protection* at all times.	a). Prior to and monthly during the fire season b). Annually C). Monthly	Fire protection measures in the park implemented and maintained. NSW Fire Brigade endorsement of the Asset Protection Zone of the eastern boundary obtained annually All tree branches over-hanging the APZ and eastern boundary are pruned or lopped back to the edge of the APZ. No built assets significantly impacted by fires originating in, or moving through, the park.
Minimise the risk of wildfires starting in the park	a) Bar-b-ques in the park to be gas or electric only b) Management burning in the park to be carried out by properly trained and equipped crews c) Implement a community education program to request residents near the park to report any smoke or suspicious persons on days of total fire bans	a). As required b). Pre-burn C) Annually	No wildfires started deliberately or by accident in the park. In the event of an unplanned fire undertake post fire inspection and eradication of weeds
Ensure that the appropriate fire regimes are applied to populations of threatened flora, fauna and plant communities in the park that require periodic fire for their long-term survival	a) Consult with the NPWS Threatened Species Unit when planning prescribed burns in the Eastern Suburbs Banksia Scrub. b) Avoid burning the whole of the area of Eastern Suburbs Banksia Scrub in the park in a single fire. c) Monitor the recovery of any areas of Eastern Suburbs park due to fire. Banksia Scrub burnt by wildfires or prescribed burns.	As required pre and post burns	All prescribed burns carried out according to the requirements of threatened plant communities. No decline in the structure or floristics of the Eastern Suburbs Banksia Scrub in the park due to fire No decline in *A. T. terminalis* population

Fire Management Objective	Recommended Action	Timing	Performance Indicators
Implement a mosaic burning program in selected indigenous plant communities to maintain and enhance existing habitat diversity, and reduce overall fuel loads in bushland areas.	a) Carry out prescribed burning according to the fire management plan. b) Regularly revise burning prescriptions to ensure they incorporate the most recent information on the fire ecology of flora, fauna and plant communities of conservation value in the park.	Implement annual burn program based on any updated prescriptions	Mosaic of burnt fire management units maintained. No decline in the populations or distribution of threatened species. No decline in the area or distribution of plant communities of conservation value
Control unwanted plant species through coordinating fire management and weed control activities.	a) Treat any weeds in areas to be burnt under this fire management plan at least two months before prescribed burning, and at regular intervals after the burn. b) Coordinate fire management and weed management activities in the park.	Annual bush regeneration program coordinated with hazard reduction and ecological burn program	Pre and post fire weed control carried out in any weed infested fie management units burnt under this plan. Minimal coppicing or regrowth of weeds from treated rootstock All declared noxious weeds removed.
Ensure an adequate and accessible water supply for fire fighting	Ensure fire hydrants are installed in the new development to the west of the REP to applicable Australian Standard.	As required as development occurs	Fire hydrants in and surrounding the park are clearly marked and meet current standards of flow rate and pressure.
Monitor the impact of fire management activities in the park. Adjust practices to achieve relevant objectives, and periodically review the fire management plan.	a) Monitor impacts of fires carried out b) Review this fire management plan every 5 years c) Regularly revise burning prescriptions to ensure they incorporate the most recent information on the fire ecology of flora, fauna and plant communities of conservation value in the park.	a). Annually b). 2017 C). Annually	Monitoring and review carried out as scheduled in the plan New information on the fire management requirements of threatened flora and fauna incorporated into the fire management plan.
Ensure there is up-to-date information on fire management activities in the park.	Record fire management activities and wildfires.	Annual report	Records maintained of all fire management activities.
Ensure new developments adjoining the park incorporate adequate bushfire protection measures	All habitable buildings surrounding the park must be constructed in accordance with *Planning for Bushfire Protection* and AS 3959 - 2009 *Construction in Bushfire Prone Areas*	As part of DA assessment	All new developments in and adjacent to the park incorporate fire protection measures to Rural Fire Service standards.
Ensure adequate access for fire brigade vehicles and personnel through and around the park	a) Provide a fire brigade vehicle access route through the park b) Ensure the fire brigade vehicle access route is inspected regularly and maintained in a trafficable condition at all times. c) Provide gates in any person-proof fencing around bushland to NSW Fire Brigade requirements. Supply keys to Maroubra and Randwick fire brigades.	As required and inspect annually	Access routes inspected and maintained in a trafficable condition for fire service vehicles. Access gates provided to NSW Fire Brigade requirements, and keys provided to Maroubra and Randwick brigades.

Fire Management Objective	Recommended Action	Timing	Performance Indicators
Minimise damage to the emergency vehicle access route by preventing unauthorised vehicle access.	a). Provide suitable lockable bollards at each end of the emergency vehicle access route. b) Implement a security lock system (keys that can't be copied without permission) to control access. Issue copies of the key to the Maroubra and Randwick fire brigades c) Inspect bollards regularly to ensure that locks are in place and functioning	As required and inspect annually	No unauthorised vehicle use in the park Security lock system implemented, keys to bollards and gates distributed to Randwick and Maroubra fire brigades. Minimal damage to the fire brigade access route in the park.
Coordinate fire management activities in the park amongst the various stakeholders.	Hold meetings of stakeholders carrying out management activities in the park at the beginning and end of the bushfire danger period (October and March) to make sure they are all aware of any proposed fire management activities.	Bi-annually	Coordination meetings held and minuted.
Ensure all personnel carrying out fire management activities in the park are suitably trained and equipped.	a) Ensure all personnel engaged in prescribed burning activities in the park have the appropriate level of training and equipment as outlined in Section 6.4. b) Ensure all personnel engaged in prescribed burning or fire suppression activities in the park are made aware of the risk of unexploded grenades in the park.	As required	All personnel are able to demonstrate the required level of training and minimum levels of equipment. All personnel carrying out prescribed burning or fire suppression near the old grenade range informed of the potential
Develop, assist development of, or utilise existing education programs and materials aimed at • reducing deliberately lit fires • informing residents adjacent to the park of fire safety issues, and measures to improve protection of themselves and their property.	a) Prepare an information sheet and distribute to adjoining residents, park users and other interest groups. b) Direct an education program at park users and residents around the park.	a) 2012 b) Annually	Information sheets distributed and problem solving sessions offered as required when complaints or unfavourable comments are received. No deliberately lit fires on and around the park.
Minimise the risk of fire to users of the park	a) Erect appropriate signs on tracks and roads to warn park users of management bums. b) Close any sections of the park affected by wildfire and do not re-open until the area is inspected and any hazards resulting from the fire are removed.	a) As required	Post-fire safety inspections carried out after wildfires. No users of the park injured by wildfires or the effects of wildfires

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Bushfire Management Plan
Randwick Environment Park

Glossary

Assets: anything valued by the community which includes houses, crops, heritage buildings and places, infrastructure, the environment, businesses, and forests, that may be at risk from bush fire.

Bush Fire: a general term used to describe fire in vegetation, includes grass fire.

Bush Fire Hazard: the potential severity of a bush fire, which is determined by fuel load, fuel arrangement and topography under a given climatic condition.

Bush Fire Risk: the chance of a bush fire igniting, spreading and causing damage to the community or the assets they value.

Bush Fire Risk Management: a systematic process that provides a range of treatments which contribute to the well being of communities and the environment, which suffer the adverse effects of wildfire/bush fire.

Bush Fire Threat: potential bush fire exposure of an asset due to the proximity and type of a hazard and the slope on which the hazard is situated.

Consequence: outcome or impact of a bush fire event.

Fire Fighting Authorities: the NSW Rural Fire Service, NSW Fire Brigades, the National Parks and Wildlife Service and Forests NSW.

Likelihood: the chance of a bush fire igniting and spreading.

Major Bush Fire: A bush fire which requires the attendance of multiple brigades, or causes damage to property or injury to one or more persons.

Recovery costs: the capacity of an asset to recover from the impacts of a bush fire.

Risk Acceptance: an informed decision to accept the consequences and the likelihood of a particular risk.

Risk Assessment: the overall process of risk identification, risk analysis and risk evaluation.

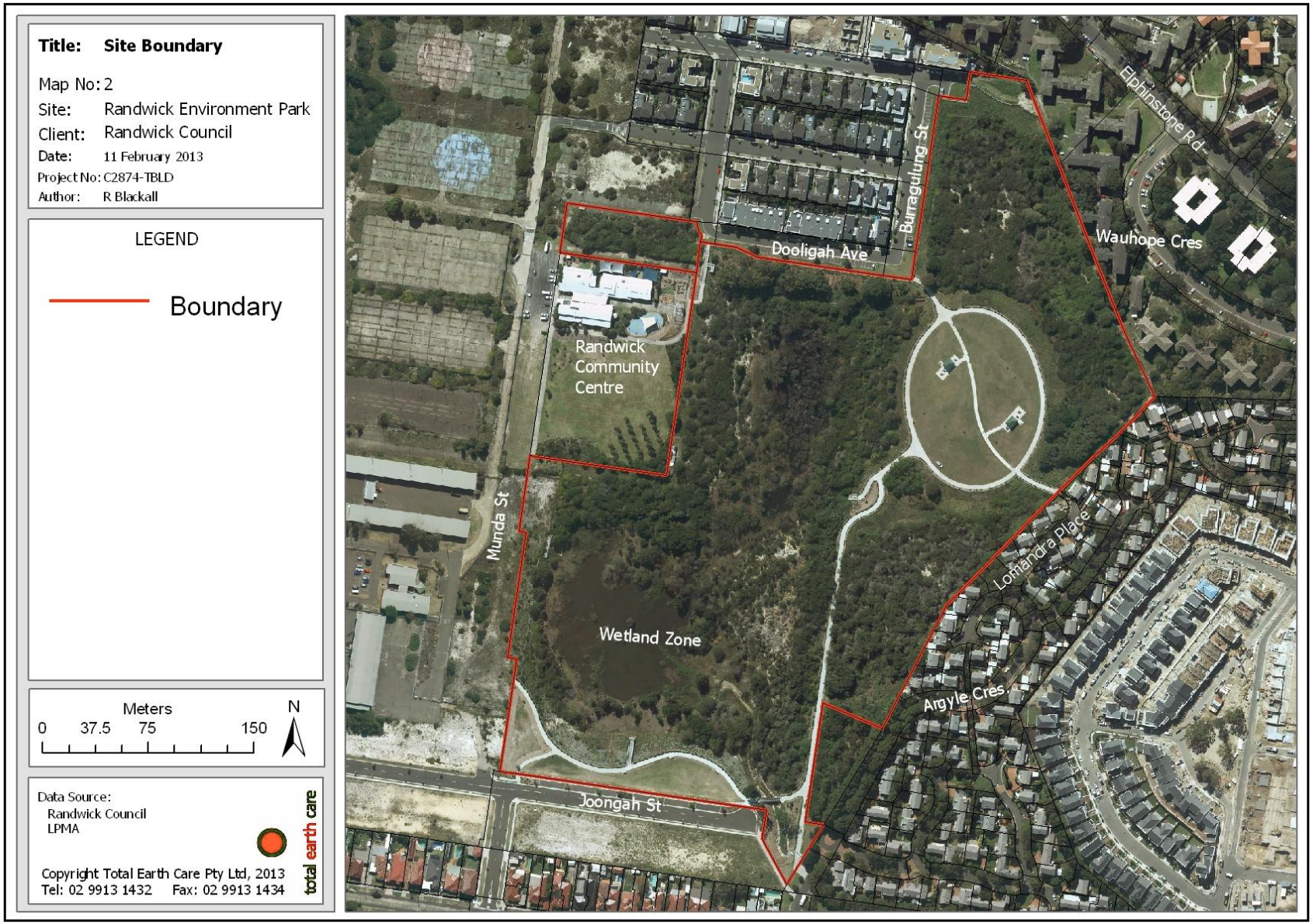
Risk Identification: the process of determining what, where, when, why, and how something could happen.

Risk Treatment: the process of selection and implementation of measures to modify risk.

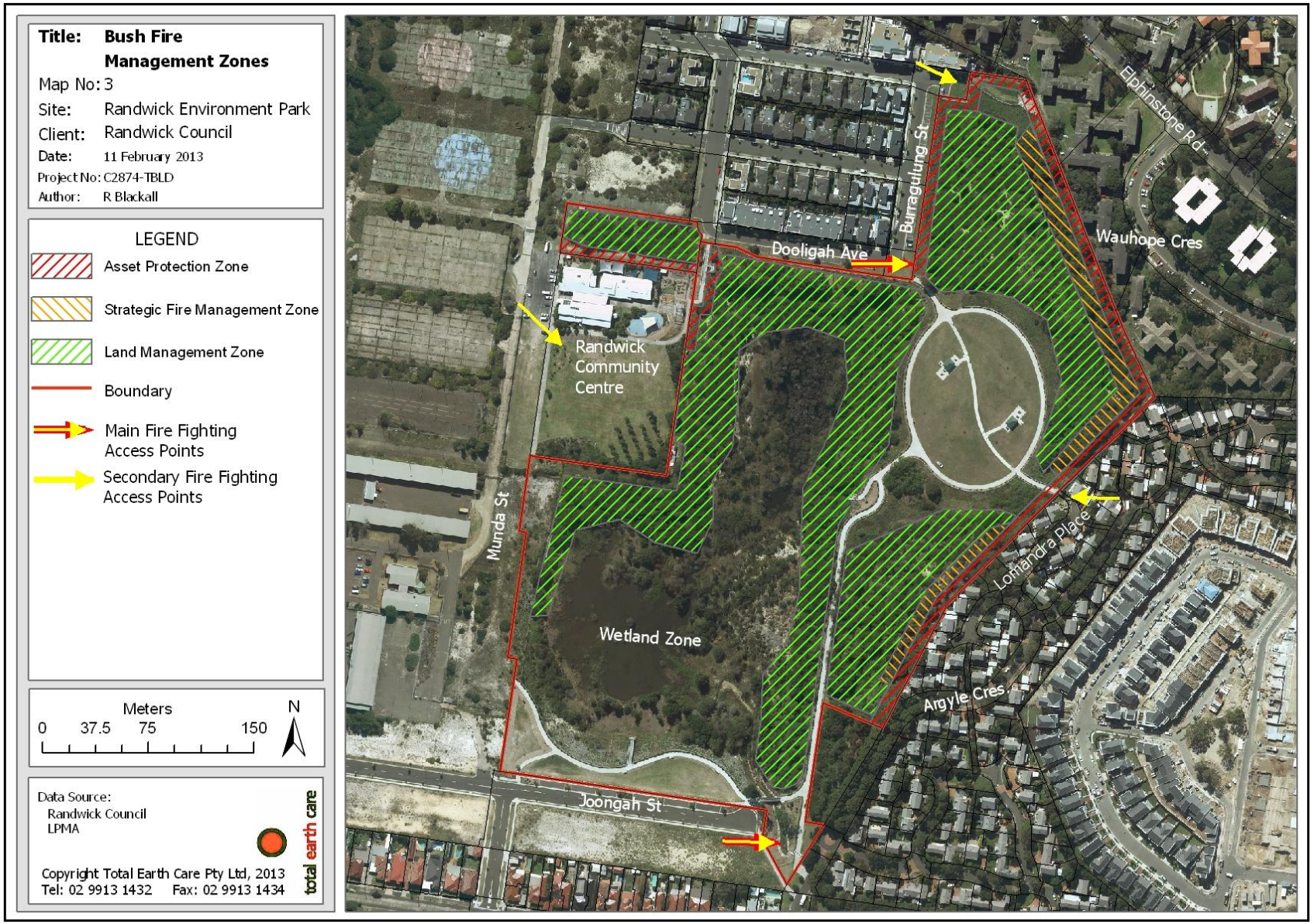
Vulnerability: the susceptibility of an asset to the impacts of bush fire.

Appendix 1 Maps

Map 1 Randwick Environment Park Locality



Map 2 Randwick Environment Park

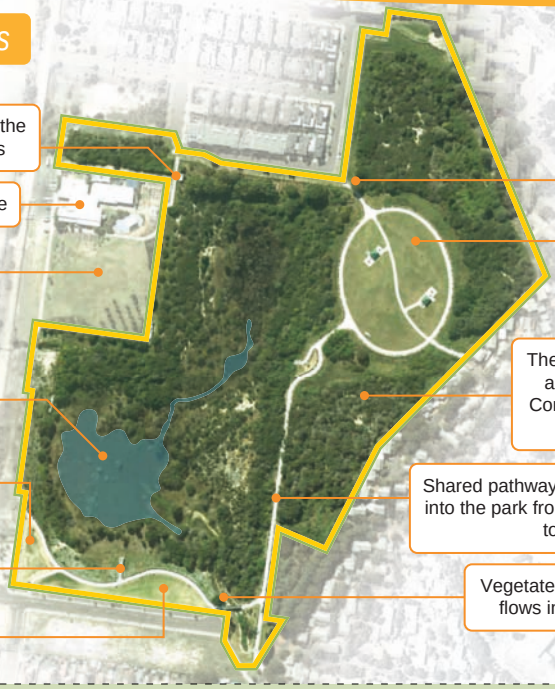


Map 3 Bush Fire Management Zones

APPENDIX D COMMUNITY CONSULTATION POST CARD

Randwick Environment Park

Park features



Please tick (✓)

1. How often do you visit Randwick Environment Park?

- ☐ Daily
- ☐ Once a month
- ☐ Rarely
- ☐ Once a week
- ☐ A few times a year
- ☐ Never

2. How long do you typically stay at the park?

- ☐ Less than an hour
- ☐ 2-5 hours
- ☐ 1-2 hours
- ☐ All day

3. What activities do you participate in while at the park?

- ☐ Walking
- ☐ Dog walking
- ☐ Cycling
- ☐ Nature appreciation
- ☐ Picnics
- ☐ Other _____
- ☐ Relaxation
- ☐ Other _____

4. How do you get to the park?

- ☐ Walk
- ☐ Cycle
- ☐ Drive
- ☐ Other _____

5. How far do you live from the park?

- ☐ Less than 500m
- ☐ 500m - 1km
- ☐ 1km - 5km
- ☐ More than 5km

6. What do you value most about the park?

- ☐ Walking/Cycling paths
- ☐ Wetland
- ☐ Bushland
- ☐ Lookouts
- ☐ Open space oval
- ☐ Picnic facilities
- ☐ Other _____
- ☐ Other _____

7. What else do you think Council could do to improve the park?

To keep up to date on the park, please fill in your details

Name:

Address:

Postcode

Email:

For more information on Randwick Environment Park and the children's photo competition, visit www.yoursayrandwick.com.au/randwickenvironmentpark

RANDWICK CITY COUNCIL1
REPLY PAID 80751
RANDWICK NSW 2031

Randwick City Council
a sense of community

Delivery Address:
Randwick City Council
30 Frances Street
RANDWICK NSW 2031

No stamp required if posted in Australia

Randwick Environment Park

Randwick Environment Park is a large 14ha park established to protect the unique Eastern Suburbs Banksia Scrub - a high value Endangered Ecological Community. In addition to this vegetation, the Park includes an open space recreation area with picnic facilities, pathways and a number of viewing decks.

Randwick City Council is currently reviewing how best to manage this valuable community asset. Council would appreciate your input into our planning for the Park.

This postcard is part of Council's community consultations for the Plan of Management review. Council welcomes your ideas and will consider all suggestions for the Park's future.

Council will be grateful if you could complete this Reply Paid survey or complete the survey on-line through www.yoursayrandwick.com.au/randwickenvironmentpark

Please return the survey by 5 October 2012.

APPENDIX E CONSULTATION SUMMARY

RANDWICK ENVIRONMNET PARK
PLAN OF MANAGEMENT REVIEW - USER SURVEY
RESULTS SUMMARY OCTOBER 2012

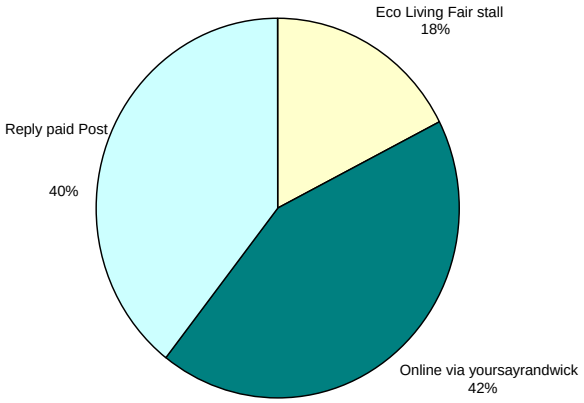
Summary

During the four week survey period 10 September to 5 October 290 responses to the Randwick Environment Park Plan of management review survey were received by Council.

Distribution

Hard copies of the survey were distributed via a stall at the Council's Eco Living fair held on 16 September, at Council's administration building, Randwick Community centre, through precinct committees, Bushcare groups, libraries, and were hand delivered to 1500 residents living in close proximity to the site. An equivalent online version of the survey was promoted via precinct comities, the Mayor's column in the southern courier and online via Council's website.

Figure 1: Breakdown of survey responses received



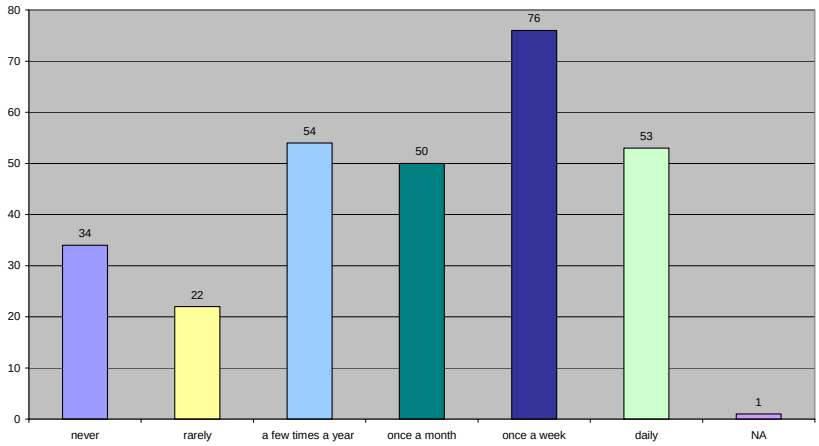
Survey Responses

Figure 1 shows the breakdown of surveys completed and provided to Council by source. Of responses received 51 hard copy surveys were received at the project stall held at Council's Eco Living fair; 115 via reply paid post and 124 via the website online survey.

Question 1: Frequency of visits to the Park

From the responses received, the majority of the survey respondents (25%) visited the park on a once a week ba sis as shown in Figure 2.. It should however be noted that 12% of the survey respondents had **not yet** visited the park at the time of completing the survey.

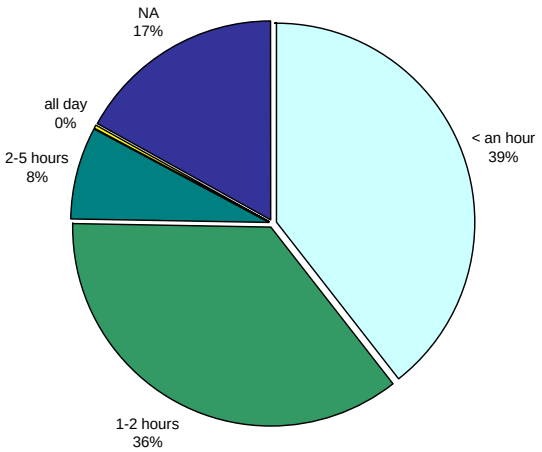
Figure 2: Frequency of visits to the Park



Question 2: Duration of Stay

Majority of survey respondents state that they typically visited the park for less than an hour with an overall majority or 75% of respondents spending less than two hours at the park as shown in Figure 3. Approximately 50 respondents however did provide an answer for this question and only one respondent specified that they spent all day at the park.

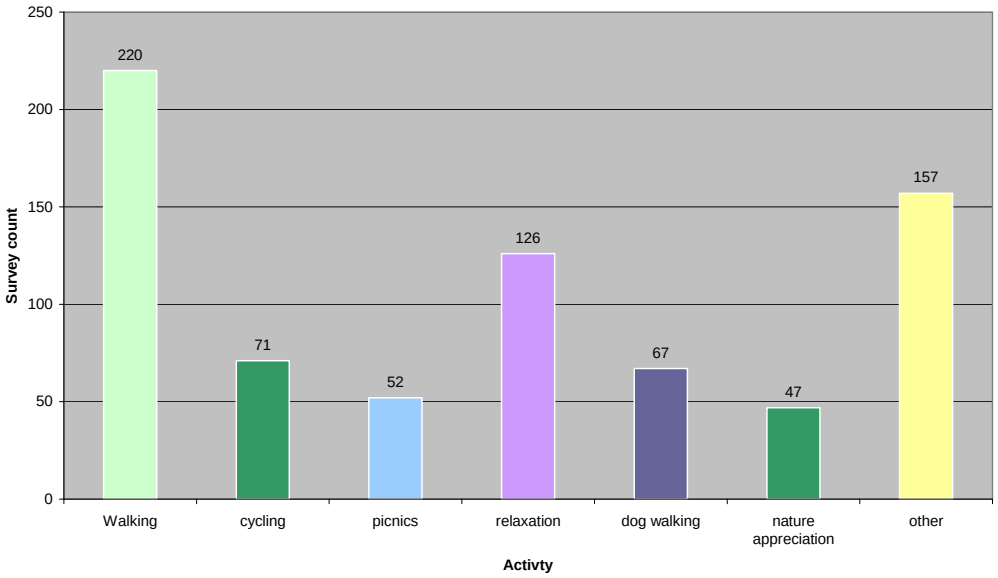
Figure 3: REP Visitor Stay Duration



Question 3: Activities undertaken at the Park

The survey respondents had a choice of 6 options and also the opportunity to list other activities under an "other" category. As shown in Figure 4 there was an over whelming support for walking as chosen activity for the park with 220 out of 291 (75%) selecting this option this was then followed by relaxation where 126 or 43% of respondents selected this as one of their chosen activities for the Park.

Figure 4: Activities undertaken at the Park



Question 4 & 5: Transport and distance from the Park

Of the survey participants the majority of participants (57%) stated that they walked to the Park and this corresponded with 56% of respondents who indicated that they lived less than 1km from the Park as shown in Figures 5/6.

Figure 5:Transport to REP

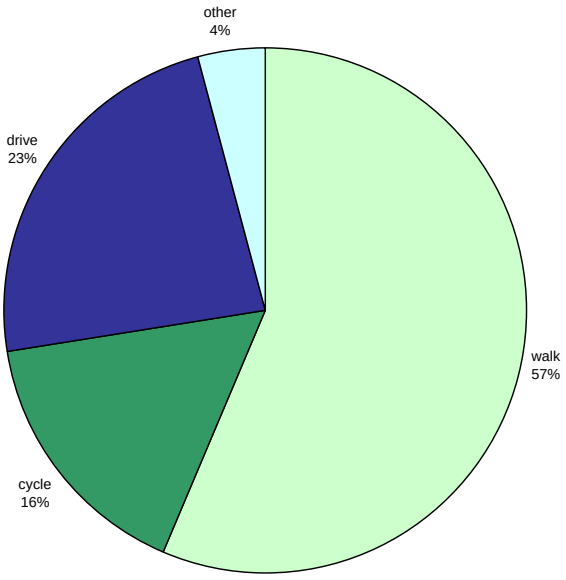
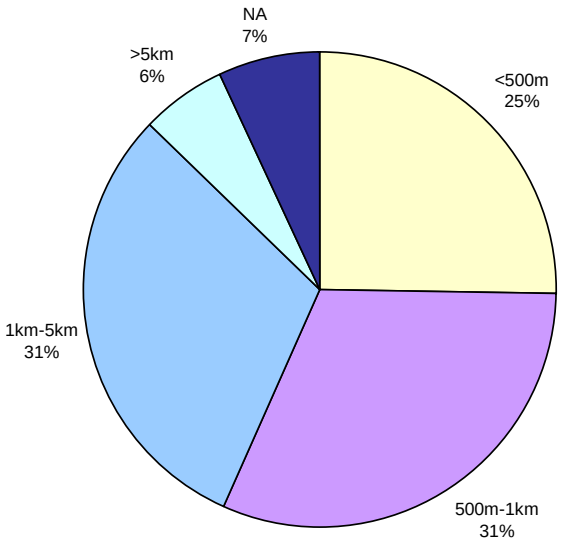


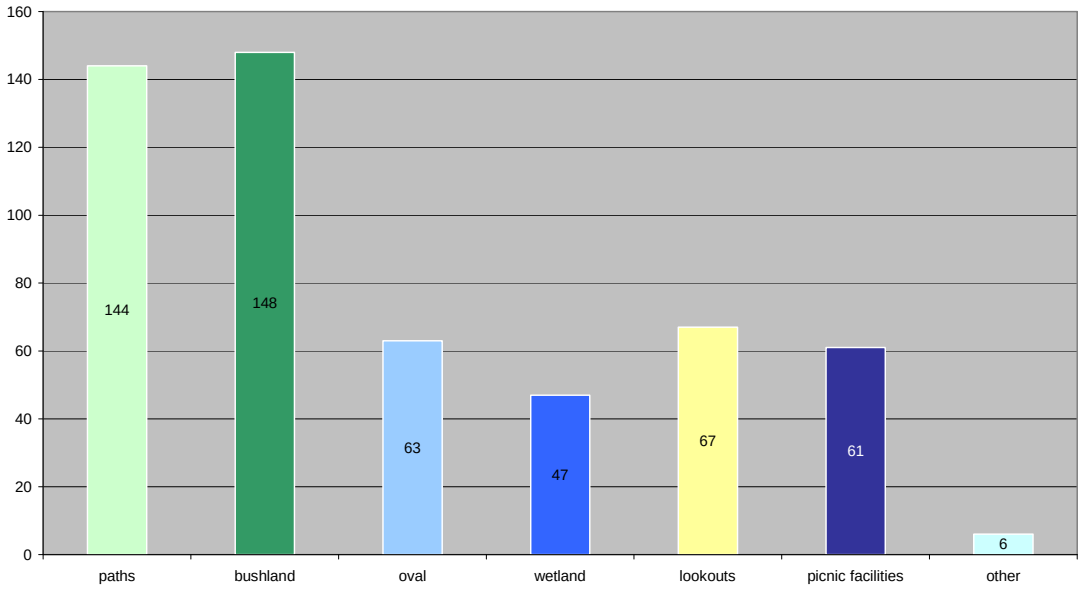
Figure 6: Distance visitors live from REP



Question 6: What survey respondents valued most about the Park

Survey participants were given an opportunity to indicate what they valued about the park, with more than one option possible. These value results are presented in Figure 7 below. Bushland was most highly valued by survey participants with more than 50% of respondents selecting this option. This compared to 49% for paths, 23% for look outs and ~20% for picnic facilities.

Figure 7: What REP Visitors value most about the Park



Question 7: Suggested improvements

As the last question in the survey participants were provided with an opportunity to provided suggestions on what Council could do to improve the park as an open question. Of respondents 21% suggested installation of toilets, 16% suggested the completion of the loop track around the wetland, 9% supported the preservation of the wetland and/or bushland and 8% supported the installation of signage on a diverse range of topics from not feeding the ducks, plant species identification signage and directional signage for access and exits (see figure 10 for more details on signage requested).

Figure 8: Suggested improvements for the Park

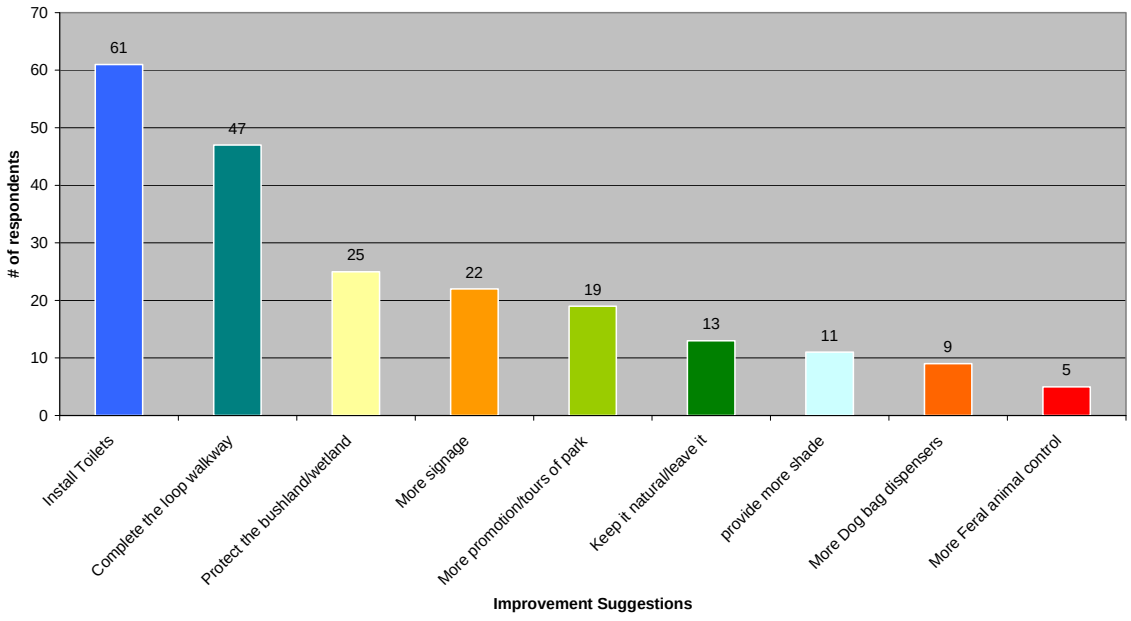
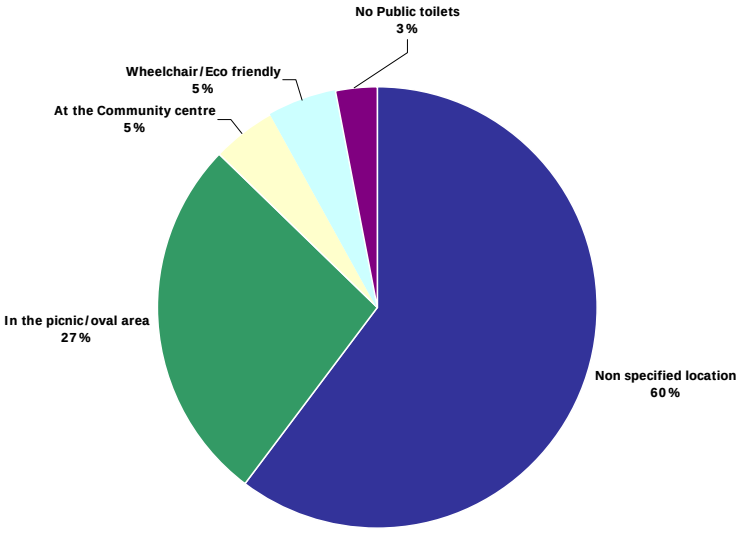


Figure 9: Public toilet request breakdown



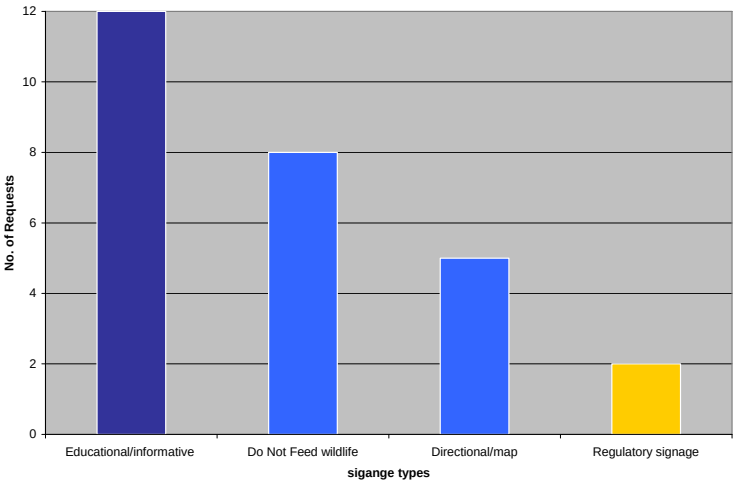
Request for Toilets at the Park:
From the survey results requests for toilets or comments relating to toilets were accumulated and summarised; these results are presented in Figure 9
Majority of requests received in the survey were for toilet facilities at the park. Of these 27% were for these to be located at the oval/picnic area and 5% were for these to be located at the community centre.

Breakdown of Issues from Question 7
To further understand suggested improvements for the park these were grouped based on comments received.

Dog related Issues: There were a number of comments made in relation to suggested improvements that related to dogs.
These included comments suggesting improved enforcement of dogs being on leash in the Park and actions to encourage owners to be responsible around picking up after their dogs and utilising the bins. There was also a sentiment around ensuring that dogs do not impact upon the bushland/ wildlife. With the request for additional dog bins there were comments regarding more appropriate location of these away from seating/picnic areas and being located at convenient locations like park entrances.

Signage as suggested improvement:
Suggestions for additional signage included interpretive signage at lookouts, information on flora and fauna and species identification/plant labels. Directional information and requests included site maps and signs showing entrances and exists to the site and paths and tracks within the site. Requests for regulatory signage were regard to dogs being on leash and littering. The overwhelming majority of the requests for signage were in relation to feeding of wildlife specifically the ducks and swans at the wetland area.

Figure 11:Requests for Signage



Question 7: Qualitative Information

Other answers provided in response to question 7 “what else do you think Council could do to improve the park provided valuable insight into participants’ thoughts on current and future condition of the park

What do you think Council could do to improve the Park

- Nothing it is just a magical spot in the middle of civilisation!!
- Make sure it remains natural and a place of peace and quiet
- Assure us that the quietness of this delightful area is not turned into the circus that all our other parks have become.
- Natural surroundings as well as birdlife flourishing I love it as it is!!!
- The bushland and wetlands are fantastic and I really enjoy having this open space.
- I regularly bring my grandchildren here for bike rides and they view it as a mini- Centennial Park.
- It is lovely just as it is, people can just walk /cycle around enjoy the wetlands/wildlife/bushland.
- The community need it just as it is to stay same, with our busy lives and everyone living so close to one another; you can meditate and just think when in that lovely park.
- It is an amazing park and the variety of wildlife should be protected and schools encouraged visiting to learn about our local ecology. Thank you to Council for maintaining the park.
- I remember going on picnics with my parents and adventuring in the surrounding bushland. A minimal level of development with this in mind would be refreshing. We have plenty of playground facilities in our city; make this our free-range play area.
- I like that it is a place I can take my kids that is close to home where they can run around freely see nature.
- Every time I visit I see more and more wildlife.
- I love the native plants and watching all the birds and lizards coming back to the area. It is such a great resource so close to home
- Thank you Council for the wetland. Please keep it safe.
- Please make sure the bush area and the wetlands are safeguarded for future generations. They sustain me and many others in the area.
- I was going to write to the Council to say how much I love the park, with its wild areas full of birds, the swans that nested there and had fluffy signets, the frogs - deafening at night, the bats I can see swooping at twilight, all the forest birds. It is a real TREASURE.
- Keep it natural with lots of native tree for birds and wild life.
- The bush regen work you are doing there is fantastic, really clearing out the weeds and giving the natives a chance. Thanks to RCC for having the vision to create this wonderful new park with the much needed wetland for this area
- It's perfect as it is. Thank you.

APPENDIX F FLORA AND FAUNA LISTS

Randwick Environmental Park, Kingsford - Indigenous plant species

Botanical name	Eastern Suburbs Banksia Scrub Zones: B1, B3, B4, B7, B10, B11	Moist scrub on sand-stone Zone: B2	Heath on sand-stone Zone: B6	Wetland Zone: W1	Recorded by	Conser-vation status: NSW and Australia	Conser-vation status: City of Randwick
Acacia longifolia [syn. A. sophorae]	Y	Y	Y	Y	RCC		
Acacia suaveolens	Y	Y	Y		RCC		
Acacia terminalis subsp. terminalis	Y		Y		RBG Sydney	Ee, Et	R (3)
Acacia ulicifolia	Y				RCC		
Agrostis avenacea				Y	RCC		
Allocasuarina distyla	Y				Ecotone 2000		
Allocasuarina littoralis	Y				Mills 2001		
Alternanthera denticulata				Y	RCC		R (1)
Astroloma pinifolium	Y				RCC		
Austrostipa mollis [syn. Stipa mollis]	Y				RBG Sydney		
Baeckea imbricata			Y		RCC		
Baloskion gracilie [syn. Restio gracilis]				Y	Adam & Stricker		R (1)
Banksia serrata	Y				RCC		
Baumea articulata				Y	Mills 2001		R (1)
Baumea teretifolia				Y	Adam & Stricker		
Blechnum sp.		Y			RCC		
Bossiaea heterophylla	Y				RCC		
Bossiaea scolopendria	Y				RCC		
Brachyloma daphnoides	Y				RCC		
Centella asiatica				Y	RCC		
Centrolepis fascicularis		Y		Y	RCC		
Cheilanthes sieberi	Y				RCC		
Commelina cyanea				Y	Ecotone 2000		
Conospermum ericifolium	Y				Ecotone 2000		
Conospermum taxifolium	Y				RCC		
Cryptandra amara	Y				Ecotone 2000		R (3)
Cyperus polystachyos				Y	Mills 2001		
Darwinia fascicularis	Y				RCC		
Dianella revoluta	Y				RCC		
Dichelachne crinita	Y				RCC		
Dillwynia floribunda			Y	Y	RCC		
Dillwynia glaberrima	Y				RCC		
Dillwynia retorta	Y		Y		RCC		
Drosera binata				Y	Adam & Stricker		
Drosera peltata					Ecotone 2000		
Einadia hastata					Ecotone 2000		
Eleocharis sphacelata				Y	Adam & Stricker		
Epacris microphylla	Y		Y		Ecotone 2000		
Epaltes australis				Y	Mills 2001		R (3)
Eragrostis brownii	Y				RCC		
Fimbristylis velata				Y	Mills 2001		R (2)
Gleichenia dicarpa	Y	Y	Y	Y	RCC		
Glycine clandestina	Y				Mills 2001		
Goodenia bellidifolia				Y	RCC		R (3)
Goodenia paniculata				Y	Adam & Stricker		

Randwick Environmental Park, Kingsford - Indigenous plant species

Haemodorum planifolium	Y				RCC		
Hakea teretifolia	Y		Y		RCC		
Hibbertia fasciculata	Y				RCC		
Hydrocotyle sp.				Y	Adam pers. comm.		
Hypericum gramineum				Y	RCC		
Hypolaena fastigiata	Y				RCC		
Imperata cylindrica	Y				RCC		
Isolepis nodosa	Y	Y		Y	RCC		
Juncus continuus				Y	Adam & Stricker		
Juncus planifolius				Y	Adam & Stricker		
Juncus usitatus				Y	Mills 2001		
Kunzea ambigua	Y		Y		RCC		
Lepidosperma laterale	Y			Y	RCC		
Lepidosperma limicola					Mills 2001 (B6 or B7)		
Leptospermum arachnoides			Y		RCC		
Leptospermum laevigatum	Y				RCC		
Leptospermum trinervium	Y				RCC		
Lepyrodia scariosa					Mills 2001 (B6 or B7)		
Leucopogon ericoides	Y		Y		RCC		
Lobelia alata		Y			RCC		
Ludwigia peploides				Y	RCC		R (2)
Monotoca elliptica	Y				RCC		
Myriophyllum sp.				Y	Adam (pers. comm.)		
Opercularia aspera					Ecotone 2000		
Orthocerus strictum					Mills 2001 (B6 or B7)		
Oxalis exilis					Mills 2001		
Persicaria decipiens				Y	Ecotone 2000		
Persicaria hydropiper				Y	Mills 2001		R (1)
Persicaria lapathifolia				Y	Mills 2001		R (2)
Persoonia lanceolata	Y	Y	Y		RCC		
Philydrum lanuginosum				Y	RCC		R (2)
Pimelea linifolia	Y				RCC		
Pittosporum undulatum		Y			RCC		
Pomax umbellata	Y				Mills 2001		
Pseudognaphalium luteoalbum				Y	Mills 2001		
Pteridium esculentum	Y				RCC		
Pterostylis concinna	Y				RCC		R (1)
Schizea bifida			Y		RCC		R (1)
Schoenus brevifolius				Y	Adam & Stricker		R (3)
Schoenus ericetorum					Ecotone 2000		
Selaginella uliginosa			Y		RCC		
Sporadanthus gracilis [syn. Lepyrodia gracilis]					Ecotone 2000		
Styphelia viridis	Y				RCC		
Thelymitra sp.	Y				Mills 2001		
Viminaria juncea					Mills 2001		
Wahlenbergia gracilis	Y				RCC		
Xanthosia pilosa	Y				RCC		
Xyris gracilis	Y				RCC		

Number of indigenous plant species recorded = 92

Randwick Environmental Park, Kingsford - Indigenous plant species

KEY:
Y = Recorded in at least one management zone corresponding to column heading. Where no management zone is specified, the location within REP is unsure.

Conservation status: NSW and Australia:
Et = Endangered under the *Threatened Species Conservation Act 1995* [NSW].
Ee = Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* [Clth].
Conservation status is believed to be correct as at 20 June 2002. Environment Australia and the National Parks and Wildlife Service NSW should be consulted for up-to-date information.

Conservation status: City of Randwick:
R = Rare in the City of Randwick - 1 to 3 very small populations (shown in parentheses) recorded since 1990.

NOTES:
1) Species names follow: Harden, G (ed.) 1992, 1993, 2000, 2002 *Flora of NSW,* vv1-4, NSW University Press, Kensington AND National Herbarium of NSW, Royal Botanic Gardens Sydney website: http://plantnet.rbgsyd.gov.au/PlantNet/NSWplants/nswplants.htm.

2) The list of species in this appendix was compiled from the following sources: Randwick City Council 2002, compilation of field records by Ondinea, D. & Hirschfeld, D. 1991-2002, (identification by Royal Botanic Gardens Sydney acknowledged as RBG); Adam, P. & Stricker, J. 1989, *Wetlands of the Sydney Region,* Project No.55 National Estate Grants Programme, surveys 1988-1989; Ecotone 2000, Appendix C *Flora and Fauna Study* in *Notice of Intention for* [works at] *Bundock Street Randwick,* 2000, based on surveys mostly by Bell, S. 1995-2000; Mills, K. 2001, *Statement of Evidence,* filed for applicant, Land & Environment Court No.10072 & 10073 of 2000, based on field surveys in April & December 2000.

3) Records from source documents have not been included if identification is not below genus level and if a species in that genus has been identified.

4) Where a species appears in more than one source document, only one source is acknowledged. RCC is acknowledged, if relevant, otherwise the earliest source is acknowledged.

5) The following indigenous species were recorded in ESBS near the southwest corner of Defence land at Kingsford, but not in REP: Lomandra glauca, Xanthorrhoea (resinifera ?).

6) The following indigenous species were recorded in dry & moist heath on sandstone near the present community centre on Bundock St on Defence land at Kingsford, but not in REP: Austrodanthonia tenuior [syn. Danthonia tenuior], Histiopteris incisa, Hypolepis muelleri, Microlaena stipoides, Oxylobium cordifolium.

7) The following native species recorded in REP have, or are likely to have, originated from plantings: Acacia decurrens, A. falcata, A. mearnsii, A. parramattensis, Allocasuarina verticillata, Banksia integrifolia, Carpobrotus glaucescens, Casuarina glauca, Eucalyptus (bicostata?), E. botryoides, E. ficifolia, E. (haemastoma?), E. robusta, E. sieberia, Grevillea sp., Melaleuca armillaris, M. hypericifolia, M. quinquenervia.

8) The following native species recorded in REP are not considered indigenous to REP: Cotula australis, Cyathea sp., Cynodon dactylon, Portulaca oleracea.

9) The following native species recorded in REP originated from an error during transfer of information: Acacia myrtifolia.

10) The following native species recorded in REP are likely to be incorrect identifications: Hibbertia riparia, Monotoca scoparia.

11) The following species recorded in REP may be indigenous or exotic: Crassula sp., Oxalis sp.

Randwick Environmental Park, Kingsford - Non-indigenous plant species

Botanical name	Recorded by	Comments
Acacia decurrens	RCC	Native to Sydney but present in REP via planting.
Acacia falcata	Ecotone 2000	Native to Sydney but present in REP via planting.
Acacia mearnsii	RCC	Native to Sydney but present in REP via planting.
Acacia parramattensis	Ecotone 2000	Native to Sydney but present in REP via planting.
Acacia pycnantha	Ecotone 2000	
Acacia saligna	RCC	
Acetosa sagittata	RCC	
Acetosella vulgaris	RCC	
Agave americana	Ecotone 2000	
Ageratina adenophora	Ecotone 2000	
Agonis flexuosa	Ecotone 2000	
Allocasuarina verticillata	RCC	Native to Sydney but present in REP via planting.
Ambrosia tenuifolia	Ecotone 2000	
Anagallis arvensis	Mills 2001	
Andropogon virginicus	RCC	
Anredera cordifolia	RCC	
Apium leptophyllum	Mills 2001	
Araujia hortorum	Ecotone 2000	
Aster subulatus	Mills 2001	
Axonopus affinis	Mills 2001	
Banksia integrifolia	RCC	Native to Sydney but probably present in REP via planting.
Bidens pilosa	RCC	
Bidens tripartita	Mills 2001	
Brassica fruticulosa	Ecotone 2000	
Brassica rapa ssp. sylvestris	Mills 2001	
Briza maxima	RCC	
Bromus catharticus	RCC	
Bromus unioloides	Mills 2001	
Bryophyllum delagoense	RCC	
Carpobrotus glaucescens	RCC	Native to Sydney but probably present in REP via planting.
Casuarina glauca	RCC	Native to Sydney but probably present in REP via planting.
Centaurium erythraea	Mills 2001	
Cestrum parqui	RCC	
Chenopodium album	Mills 2001	
Chenopodium ambrosioides	Mills 2001	
Chloris gayana	Mills 2001	
Chrysanthemoides monilifera	RCC	
Cinnamomum camphora	Mills 2001	
Cirsium vulgare	Mills 2001	
Cleome hassleriana	Mills 2001	
Conyza sp.	RCC	
Coprosma repens	Ecotone 2000	
Cordyline sp.	Mills 2001	
Coreopsis lanceolata	RCC	
Coronopus didymus	Mills 2001	
Cortaderia selloana	RCC	
Cotoneaster panosus	Ecotone 2000	
Cotula australis	Mills 2001	Native to Sydney but not considered indigenous to REP.
Cotula coronopifolia	Adam (in Ecotone 2000)	
Crocosmia x crocosmiiflora?	RCC	
Cyathea sp.	RCC	Native to Sydney but not considered indigenous to REP.
Cynodon dactylon	RCC	Native to Sydney but not considered indigenous to REP.

Randwick Environmental Park, Kingsford - Non-indigenous plant species

Cyperus brevifolius	Mills 2001	
Cyperus eragrostis	Mills 2001	
Datura stramonium	Mills 2001	
Digitaria sp.	Mills 2001	
Echinochloa crus-galli	Mills 2001	
Ehrharta erecta	RCC	
Eleusine indica	Ecotone 2000	
Eleusine tristachya	Mills 2001	
Eragrostis curvula	RCC	
Eucalyptus (bicostata?)	Ecotone 2000	
Eucalyptus botryoides	Mills 2001	Native to Sydney but present in REP via planting.
Eucalyptus ficifolia	Mills 2001	
Eucalyptus (haemastoma?)	Ecotone 2000	Native to Sydney but present in REP via planting.
Eucalyptus robusta	Ecotone 2000	Native to Sydney but present in REP via planting.
Eucalyptus sieberia	Ecotone 2000	Native to Sydney but present in REP via planting.
Foeniculum vulgare	Ecotone 2000	
Gamochaeta americana [syn. Gnaphalium americanum]	Mills 2001	
Gazania repens	Mills 2001	
Grevillea sp.	Mills 2001	Present in REP via planting.
Hydrocotyle bonariensis	Ecotone 2000	
Hypochaeris glabra	Mills 2001	
Hypochaeris radicata	RCC	
Impatiens walleriana	Mills 2001	
Ipomoea indica	RCC	
Isolepis prolifera	Ecotone 2000	
Jacaranda mimosaefolia	Mills 2001	
Juncus cognatus	Adam & Stricker 1989	
Juncus microcephalus	Adam & Stricker 1989	
Lagurus ovatus	Mills 2001	
Lantana camara	RCC	
Lepidium bonariense	Mills 2001	
Leucojum aestivum	Ecotone 2000	
Lolium perenne	RCC	
Lophostemon confertus	Mills 2001	
Lupinus sp.	Mills 2001	
Melaleuca armillaris	RCC	Native to Sydney but probably present in REP via planting.
Melaleuca hypericifolia	Mills 2001	Native to Sydney but present in REP via planting.
Melaleuca nesophylla	Ecotone 2000	
Melaleuca quinquenervia	RCC	Native to Sydney but probably present in REP via planting.
Melinis repens	RCC	
Morus nigra	Mills 2001	
Nerium oleander	Mills 2001	
Nothoscordum borbonicum	Mills 2001	
Ochna serrulata	Ecotone 2000	
Oenothera stricta	Ecotone 2000	
Olea europaea subsp. africana	RCC	
Opuntia sp.	RCC	
Oxalis sp. (pink-flowered)	Mills 2001	
Parietaria judaica	RCC	
Paspalum dilatatum	Ecotone 2000	
Paspalum urvillei	Ecotone 2000	
Pennisetum clandestinum	RCC	
Petrohagia nanteulii	Mills 2001	

Randwick Environmental Park, Kingsford - Non-indigenous plant species

Phalaris sp.	Mills 2001	
Phoenix (canariensis?)	Ecotone 2000	
Pinus pinaster	Mills 2001	
Pinus radiata	Mills 2001	
Plantago lanceolata	RCC	
Plumbago auriculata	Mills 2001	
Poa annua	Mills 2001	
Polycarpon tetraphyllum	Mills 2001	
Polygonum arenastrum	Mills 2001	
Portulaca oleracea	Mills 2001	Native to Sydney but not considered indigenous to REP.
Protasparagus aethiopicus [syn. Asparagus densiflorus]	Ecotone 2000	
Pyracantha angustifolia	Mills 2001	
Richardia stellaris	Ecotone 2000	
Ricinus communis	RCC	
Romulea rosea	RCC	
Rorippa palustris	Mills 2001	
Rumex crispus	Mills 2001	
Senecio madagascariensis	RCC	
Senecio pterophorus	Mills 2001	
Senna pendula var. glabrata	Ecotone 2000	
Setaria geniculata	Mills 2001	
Sida rhombifolia	RCC	
Silene anglica	Mills 2001	
Solanum nigrum	RCC	
Sonchus oleraceus	Mills 2001	
Sporobolus indicus var. capensis	Ecotone 2000	
Stenotaphrum secundatum	RCC	
Taraxacum officinale	Ecotone July 2000	
Tradescantia fluminensis	RCC	
Trifolium arvense	Mills 2001	
Trifolium repens	Mills 2001	
Vellereophyton dealbatum [syn. Gnaphalium candidissimum]	Mills 2001	
Verbena bonariensis	Ecotone 2000	
Verbena litoralis	Mills 2001	
Vicia sp.	RCC	
Vulpia sp.	RCC	
Watsonia sp.	Mills 2001	
Xanthium occidentale	Mills 2001	
Yucca aloifolia	Ecotone 2000	

Number of non-indigenous plant species recorded = 144

Randwick Environmental Park, Kingsford - Non-indigenous plant species

NOTES:
1) Species names follow: Harden, G (ed.) 1992, 1993, 2000, 2002 *Flora of NSW,* vv1-4, NSW University Press, Kensington AND National Herbarium of NSW, Royal Botanic Gardens Sydney website: http://plantnet.rbgsyd.gov.au/PlantNet/NSWplants/nswplants.htm.

2) The list of species in this appendix was compiled from the following sources: Randwick City Council 2002, compilation of field records by Digby, B. & Hirschfeld, D. 2001-2002; Adam, P. & Stricker, J. 1989, *Wetlands of the Sydney Region,* Project No.55 National Estate Grants Programme, surveys 1988-1989; Ecotone 2000, Appendix C *Flora and Fauna Study* in *Notice of Intention for* [works at] *Bundock Street Randwick,* 2000, based on surveys mostly by Bell, S. 1995-2000; Mills, K. 2001, *Statement of Evidence,* filed for applicant, Land & Environment Court No.10072 & 10073 of 2000, based on field surveys in April & December 2000.

3) A small number of the species in this list may have been recorded just to the north of REP, below Bundock St, and not in REP.

4) Records from source documents have not been included if identification is not below genus level and if a species in that genus has been identified.

5) Where a species appears in more than one source document, only one source is acknowledged. RCC is acknowledged, if relevant, otherwise the earliest source is acknowledged.

6) The following species recorded in REP may be indigenous or exotic: Crassula sp., Oxalis sp.

Randwick Environmental Park, Kingsford - Fauna species

A. Native Species

Common name	Scientific name	Conservation code	Recorded by
Native Frogs			
Common Eastern Froglet	Crinia signifera		Engel
Eastern Banjo Frog	Limnodynastes dumerilii		Wilson
Brown-striped Frog	Limnodynastes peronii		Mills
Smooth Toadlet	Uperoleia laevigata		White
Eastern Dwarf Tree Frog	Litoria fallax		Engel
Peron's Tree Frog	Litoria peronii		Wilson

Total number of native frog species recorded = 6

Native Reptiles			
Jacky Lizard	Amphibolurus muricatus		White
Red-throated Skink	Bassiana platynota [syn. Pseudemoia platynota]		Mills
Fence Skink	Cryptoblepharus virgatus		Wilson
Robust Ctenotus	Ctenotus robustus		Wilson
Copper-tailed Skink	Ctenotus taeniolatus		Mills
Oak Skink	Cyclodomorphus michaeli [syn. C. casuarinae]		Mills
Pale-flecked Garden Sunskink	Lampropholis delicata		Mills
Garden Sunskink	Lampropholis guichenoti		Mills
Eastern Blue-tongued Lizard	Tiliqua scinoides		Mills

Total number of native reptile species recorded = 9

Native Birds			
Musk Duck	Biziura lobata		Engel
Black Swan	Cygnus atratus		Mills
Pacific Black Duck	Anas superciliosa		Engel
Grey Teal	Anas gracilis		Engel
Chestnut Teal	Anas castanea		Engel
Hardhead	Aythya australis		Engel
Australasian Grebe	Tachybaptus novaehollandiae		Engel
White-faced Heron	Egretta novaehollandiae		Engel
Great Egret	Ardea alba [Egretta alba]	Me	Engel
Intermediate Egret	Ardea intermedia		Ambrose
Australian White Ibis	Threskiornis molucca		Engel
Black-shouldered Kite	Elanus axillaris		Mills
Swamp Harrier	Circus approximans		Ambrose
Brown Goshawk	Accipiter fasciatus		Mills
Grey Goshawk	Accipiter novaehollandiae		Hirschfeld
Brown Falcon	Falco berigora		Ambrose
Nankeen Kestrel	Falco cenchroides		Ambrose
Dusky Moorhen	Gallinula tenebrosa		Engel
Eurasian Coot	Fulica atra		Engel
Black-fronted Dotterel	Elseyornis melanops		Ambrose
Masked Lapwing	Vanellus miles		Ambrose
Silver Gull	Larus novaehollandiae		Engel
Crested Pigeon	Ocyphaps lophotes		Ambrose
Yellow-tailed Black-Cockatoo	Calyptorhynchus funereus		Ambrose

Randwick Environmental Park, Kingsford - Fauna species

Common name	Scientific name	Conservation code	Recorded by
Native Birds CONT'D			
Galah	Cacatua roseicapilla		Mills
Little Corella	Cacatua sanguinea		Mills
Sulphur-crested Cockatoo	Cacatua galerita		Luckman
Rainbow Lorikeet	Trichoglossus haematodus		Engel
Crimson Rosella	Platycercus elegans		Luckman
Eastern Rosella	Platycercus eximius		Ambrose
Common Koel	Eudynamys scolopacea		Mills
Southern Boobook	Ninox novaeseelandiae boobook		Dawes
Tawny Frogmouth	Podargus strigoides		Ambrose
Laughing Kookaburra	Dacelo novaeguineae		Ambrose
Sacred Kingfisher	Todiramphus sanctus		Luckman
Superb Fairy-wren	Malurus cyaneus		Engel
Spotted Pardalote	Pardalotus punctatus		Ambrose
White-browed Scrubwren	Sericornis frontalis		Ambrose
Brown Thornbill	Acanthiza pusilla		Ambrose
Yellow-rumped Thornbill	Acanthiza chrysorrhoa		Mills
Yellow Thornbill	Acanthiza nana		Wilson
Red Wattlebird	Anthochaera carnunculata		Engel
Little [or Brush] Wattlebird	Anthochaera chrysoptera		Luckman
Noisy Miner	Manorina melanocephala		Engel
Yellow-faced Honeyeater	Lichenostomus chrysops		Ambrose
White-plumed Honeyeater	Lichenostomus penicillatus		Ambrose
New Holland Honeyeater	Phylidonyris novaehollandiae		Ambrose
Eastern Spinebill	Acanthorhynchus tenuirostris		Luckman
Golden Whistler	Pachycephala pectoralis		Mills
Rufous Whistler	Pachycephala rufiventris		Ambrose
Grey Shrike-thrush	Colluricincla harmonica		Ambrose
Black-faced Monarch	Monarcha melanopsis	Me	Mills
Magpie-lark	Grallina cyanoleuca		Engel
Grey Fantail	Rhipidura fuliginosa		Ambrose
Willie Wagtail	Rhipidura leucophrys		Engel
Spangled Drongo	Dicrurus bracteatus		Ambrose
Black-faced Cuckoo-shrike	Coracina novaehollandiae		Engel
Figbird	Sphecotheres viridis		Luckman
Australian Magpie	Gymnorhina tibicen		Engel
Pied Currawong	Strepera graculina		Engel
Australian Raven	Corvus coronoides		Engel
Red-browed Finch	Neochmia temporalis		Ambrose
Welcome Swallow	Hirundo neoxena		Engel
Tree Martin	Hirundo nigricans		Ambrose
Little Grassbird	Megalurus gramineus		Mills
Silvereye	Zosterops lateralis		Ambrose

Total number of native bird species recorded = 66

Native Mammals			
Grey-headed Flying Fox	Pteropus poliocephalus	Ve, Vt	Hoye
an insectivorous bat			Wilson

Total number of native mammal species recorded = 2

Randwick Environmental Park, Kingsford - Fauna species

B. Exotic Species

Common name	Scientific name	Recorded by
Exotic Birds		
Rock Dove	Columba livia	Engel
Spotted Turtle-dove	Streptopelia chinensis	Engel
House Sparrow	Passer domesticus	Engel
European Goldfinch	Carduelis carduelis	Mills
Red-whiskered Bulbul	Pycnonotus jocosus	Ambrose
Common Blackbird	Turdus merula	Ambrose
Common Starling	Sturnus vulgaris	Engel
Common Myna	Acridotheres tristis	Engel

Total number of exotic bird species recorded = 8

Exotic Mammals		
Cat	Felis catus	Engel
Dog	Canis familiaris	Engel
Rabbit	Oryctolagus cuniculus	Engel

Total number of exotic mammal species recorded = 3

KEY:
Conservation code:
Vt = Vulnerable under the *Threatened Species Conservation Act 1995* [NSW].
Ve = Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* [Clth].
Me = Migratory species under the *Environment Protection and Biodiversity Conservation Act 1999* [Clth].
Conservation codes are believed to be correct as at 30 June 2002. Environment Australia and the National Parks and Wildlife Service NSW should be consulted for up-to-date information.

NOTES:
1) The list of species in this appendix was compiled from the following sources: Engel, D. 2002, (as appears in Appendix 4 *Randwick Environmental Park Draft Plan of Management,* May 2002, based on field surveys in 2002; Dawes, J. 2001, pers. comm., based on sighting in 2001; Ambrose, S. 2000, *Statement of Evidence,* filed for defendant, Land & Environment Court No.s 10072 & 10073 of 2000, based on surveys in 2000; Mahoney, M. 2000, *Statement of Evidence,* filed for defendant, Land & Environment Court No.s 10072 & 10073 of 2000, based on field surveys in 2000; Mills, K. 2001, *Statement of Evidence,* filed for applicant, Land & Environment Court No.s 10072 & 10073 of 2000, based on field surveys in April & December 2000; Hoye, G. 2001, *Statement of Evidence,* filed for respondent, Land & Environment Court No.s 10072 & 10073 of 2000, based on field surveys in Nov. 2000; Ecotone 2000, Appendix C *Flora and Fauna Study* in *Notice of Intention for* [works at] *Bundock Street Randwick,* 2000, based on surveys mostly by Wilson, B. 1995-2000; Luckman, J. 1998, *List of Birds Sighted "Bundock Street Site,* based on surveys c.1995-1998; Hirschfeld, D. 1997, field observation; White, A. c.1963-1967 pers. comm. & as appears in Ecotone 2000.

2) Where a species has been recorded by more than one source, only the most recent source is acknowledged.

3) The following bird species recorded in REP is believed to be an aviary escapee and, therefore, not listed above: Chestnut-breasted Mannikin.

4) The following native species recorded in REP is believed to have originated from an error during transfer of information: White-necked Heron.

APPENDIX G BACKGROUND DOCUMENT REVIEW

THOMPSON BERRILL
LANDSCAPE DESIGN

BACKGOUND DOCUMENT REVIEW
Randwick Environment Park

Environmental Management Plan, GHD 2008
Prepared for Department of Defense

- **EMP purpose** – To provide guidance and procedures for the management of potential bonded asbestos material related health risks during restoration works, minimizing potential exposure to workers.
- Bush restoration or landscaping works by volunteers council or contractors that disturb the soil must have an induction prior to commencing works.
- Safety methods during works include access restrictions, water hose/cart and PPE.
- Methods for identification and removal of bonded asbestos
- Methods for intrusive works and process if asbestos is found
- Air monitoring during bulk earthwork activities

Notes:

- PoM should make reference to this document when recommending works to be undertaken that could disturb soils, or requires bulk earthworks.

Site Audit Report, CH2MHILL 2008
Prepared for Department of Defense
(Executive Summary Only)

- **Site Audit Report purpose** – To review the investigation and remedial works undertaken and determine whether the site is suitable for recreation and open space land use consistent with uses proposed as the REP.
- The Environmental Management Plan (EMP), if implemented, is considered appropriate for the management of potential risks associated with the presence of asbestos containing materials in the form of fragments and cement sheets.
- A “Site Audit Statement’ has been issued (attached to the SAR) to certify the site as suitable for recreation and open space, as proposed.
- Some remedial works have been undertaken between 2000 and 2008. These are the removal of asbestos fragments south of the wetland and the remediation of soils adjacent to and within the former 9FSB area (to the west of the wetland).

Notes:

- This document notes soil tests have been undertaken across the site and only the areas deemed a risk have had remedial works undertaken. Refer to Report by HLA for testing undertaken on the Australian Rules Osval.

Wetland Management Plan, Woodlots & Wetlands 2002

- REP wetland is valued for its stormwater management functions (flood management, water quality), aesthetics, recreational values and ecological values. Improvements in stormwater management will improve aesthetic, recreational and ecological values.
- Improving water quality entering the wetland is a major objective

PO BOX 665, MANLY, NSW 2095, AUSTRALIA
LEVEL 1, PARK HOUSE, 34 BELGRAVE STREET, MANLY, NSW 2095, AUSTRALIA
TEL 61 2 9977 6444 FAX 61 2 9977 7604 EMAIL info@tbld.com.au www.tbld.com.au
(THOMPSON BERRILL LANDSCAPE DESIGN PTY LTD) ACN 082 033 565 ABN 57 082 033 565

- Water is likely to be present 15% of the time (from photographic evidence)
- Surrounding soils are considered 'disturbed terrain', Aeolian sands over sandstone; they have low cohesion and are highly erodible.
- Past sand mining onsite would have removed the 'A Horizon', which is now reforming from leaf litter decay.
- **Hydrology** – Catchment of detention basin is 96ha and mostly urbanized. Water enters basin from:
    - SE from Latham Park and Urban Areas (main catchment)
    - NE drain
    - E via a vegetated channel draining the Moverly Green Area
    - W broken storm water system

  There is an overflow grate at the southern end of the site that becomes operational when the water level in the wetland exceeds 31m, where it is conveyed by pipe to Lurline Bay.
- **Wetland** - urban storm water runoff is the dominant water source, inflows are highly rainfall dependant. Stormwater inflow rate can scour channels resulting in erosion. Sediment deposition will reduce the capacity of the basin. When water percolates, contaminates accumulate within site.
- **Ecological -** Water quality may compromise ecological processes, due to its ephemeral nature the processes have to be reestablished each time there is an inundation. Change in water levels results is plant deaths. Mobalising sediment within the site will fill in the deeper portions, reducing site diversity.
- Management Actions :
    - Remove sediment
    - At source control of storm water quality and quantity
    - Pollutant traps
    - Best Management Practices
    - Stabalise banks and inflow lines
    - Removal of invasive weeds
    - Discourage domestic pets
    - Establish resilient aquatic species
    - Remove dead acacias
    - Sing post to discourage entry into waters

Notes:

- Not all of the recommendations in this report were undertaken, re removal of sediment and recommended modifications. It would be advantageous to know which were and were not undertaken.
- A new storm water inlet has been implemented to the N of the wetland???.
- A technical review of this report and the current state of the wetland could be advantageous.

Draft Fire Management Plan, AVK Environmental Management 2002

Prepared for Department of Defense in consultation with an officer from NSW Fire Brigades

- **FMP purpose** – Designed to form part of the PoM this report aims to provide recommendations for maintenance and operational procedures to mimimise the bushfire threat to life, property and ecological diversity, and examine the potential to use fire as a tool in the management of the park.
- FMP covers;
    - Bushfire risks
    - Control of bushfires
    - Asset protection zones
    - Fire protection of built assets
    - Use of fire for weed removal and regeneration
- RCC has an obligation to reduce a fire hazard in REP, that is a threat to neighbouring properties.
- Fire fuel load is 25 tonnes per hectare OR 10-15 tonnes per hectare.
- The main assets likely to be threatened are the developments along the eastern boundary.
- Establishment and maintenance of an 'asset protection zone' along the eastern boundary, at 10m wide, should be a grassed strip that is regularly mown. Vehicle access along this boundary is not feasible.

- Recommendations to use prescribed burning for long term habitat management and rely on asset protection zones for protection of property.
- Adopt a mosaic burning pattern
- Bush regeneration in previously cleared areas may increase the fire hazard, and should therefore be considered in the FMP.
- Fire management units should be burnt every 15-30years. Adjoining units should not be burnt within 5yrs of each other.

Notes:

- Fuel load discrepancies within report, has the fuel load changed in the past 10years?
- Plan should be reviewed every 5 years
- Has a Bushfire Risk Management Plan been prepared for the Eastern Suburbs Fire District? This report noted a draft was being prepared.

THOMPSON BERRILL
LANDSCAPE DESIGN

BACKGOUND DOCUMENT REVIEW
Randwick Environment Park

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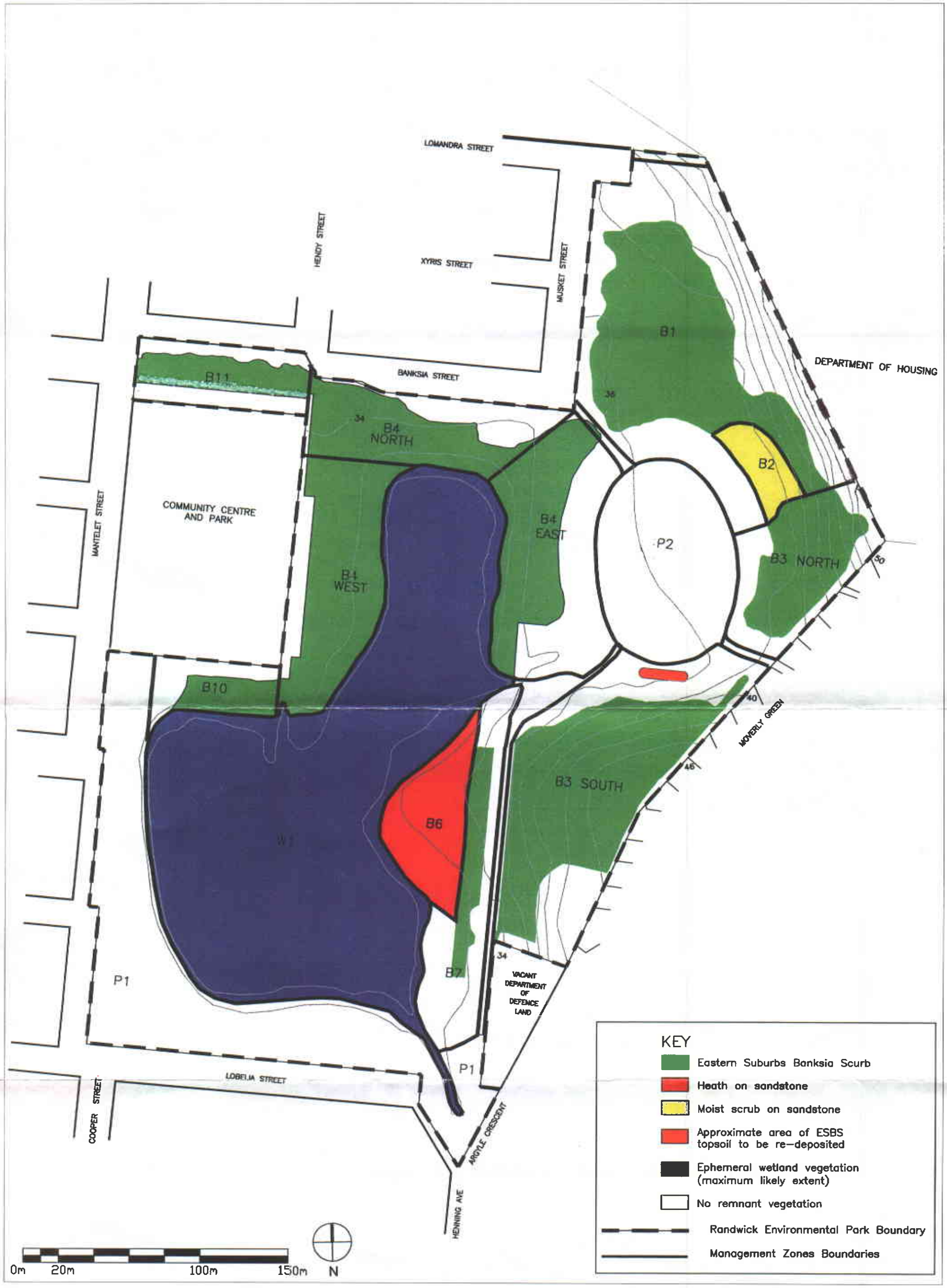
APPENDIX H NATIVE VEGETATION COMMUNITIES



RANDWICK ENVIRONMENTAL PARK, KINGSFORD

Scale:	1:2000
Date:	December 2002
Author:	RCC
Figure No:	5

NATIVE VEGETATION COMMUNITIES

APPENDIX I DEFENCE LAND BUNDOCK STREET, RANDWICK – NOTICE OF INTENTION

3.6 GEOLOGY AND SOILS

The surface geology of the Botany Basin comprises primarily a sequence of alluvial and coastal dune sands. The thickness of the sandy sediment varies from shallow around the perimeter of the system at the northern and eastern end of the site to up to 60 metres at the deepest parts of the basin.

The geology of the site comprises medium to fine grained aeolian sand with some scattered sandstone outcropping along Bundock Street frontage and to the east of the wetland, indicative of the location of the Site at the transition from the surrounding Hawkesbury Sandstone to the sandy plain of the Botany Basin. The depth to bedrock ranges from 0m where outcrop to greater than 12 m, with bedrock lying at depths of greater than about10m over the majority of the Site.

Further detail of this aspect is provided within the Summary Report of Contamination Studies included in **Appendix B**.

3.7 HYDROGEOLOGY

The unconsolidated sediments of the Botany Basin form the Botany Aquifer. The sediments of the aquifer are mostly fine grained, uniform, quartzose sands with interspersed layers of peat and clay, which are divided into a series of units.

The Botany Aquifer comprises a series of aquifers which are mostly unconfined, although locally peat, clay or Waterloo Rock layers may act to partially or completely confine the aquifer. Typically, Units 1 and 2 contain only minor quantities of groundwater, while the aeolian sands of Units 3 and 4 comprise the main aquifer.

There are two sources of recharge to the Botany Aquifer[8]. Direct rainfall recharge in open areas (eg. parks, golf courses etc.) within the catchment, and indirect recharge by rain falling on the relatively impermeable sandstone rim of the catchment which is then channelled to the lake/wetland systems in the catchment area. The main sources of discharge from the groundwater system are the Lachlan Swamps and Botany Bay.

Studies of the Botany Aquifer have identified three groundwater zones[8]. The Defence Land falls within the "Northern Zone" where groundwater recharge from rain falling within the catchment and storm water discharges to the various lakes which are in direct hydraulic connection with the groundwater. Groundwater levels in the Botany Aquifer tend to be controlled by rainfall which in some cases cause an almost immediate response in groundwater levels. Groundwater levels may also be affected by local groundwater pumping activities due to extremely permeable nature of the aquifer.

Information from the Department of Land and Water Conservation "boremaster records" indicates that a significant number of spear points and a small number of groundwater bores are registered in the immediate vicinity of the Defence Land. Most are situated to the west of the Site with some to the south and north.

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[8] Acworth, I.C., Jankowski, J. Hydrochemical Zonation of Groundwater in the Botany Sands Aquifer, Sydney. BMR Journal of Aust. Geology and Geophysical 14/2.

Results from groundwater studies at the Site have indicated that groundwater level ranges from about 20 to 32 m AHD (typically ranging from about 5m to 9m depth below the surface). Recent studies (mid 1999) have indicated that there can be a 3m fluctuation in groundwater levels beneath the Site for an approximate 1 in 20 year ARI rainfall event. The groundwater levels at the Site are also influenced by the presence of the wetland and existing stormwater management systems. The groundwater flow direction is towards the south west, with an average hydraulic gradient of 0.014.

Further detail of this aspect is provided within the Summary Report of Contamination Studies included in **Appendix B**.

3.8 HYDROLOGY (SITE DRAINAGE)

The Site falls within two stormwater drainage catchments - eastern and western catchments. The extent of the eastern catchment is able to be shown on **Figure 3.2.** Both catchments ultimately connect to the Lurline Bay Trunk Outfall Tunnel, which discharges to the ocean at Lurline Bay east of the site.

The eastern part of the Site (eastern catchment) represents a small portion of the eastern catchment which comprises a urbanised catchment covering a total area of some 80 hectares to the north and east of the site. Stormwater within this catchment drains to a wetland (which effectively acts as a detention basin), shown as the Detention Basin at the eastern part of the Site (see **Figures 1.1, 1.2 and 2.2**). As can be seen on **Figure 3.2** the majority of the catchment comprises the Council managed stormwater system surrounding the site. The Defence Land comprises a very small percentage of the total of the eastern catchment. Additionally, a large portion of the Defence Land falling within the eastern catchment is unsealed open space (ie. Naval Ovals sector), without any piped stormwater system.

Stormwater from the eastern catchment is discharged to the wetland via two Council controlled stormwater drains (which cross portions of the Site) and a Defence controlled stormwater drain. The Council stormwater drains discharge in the north eastern and south eastern corners of the wetland while the Defence stormwater drain discharges in the north western corner of the wetland.

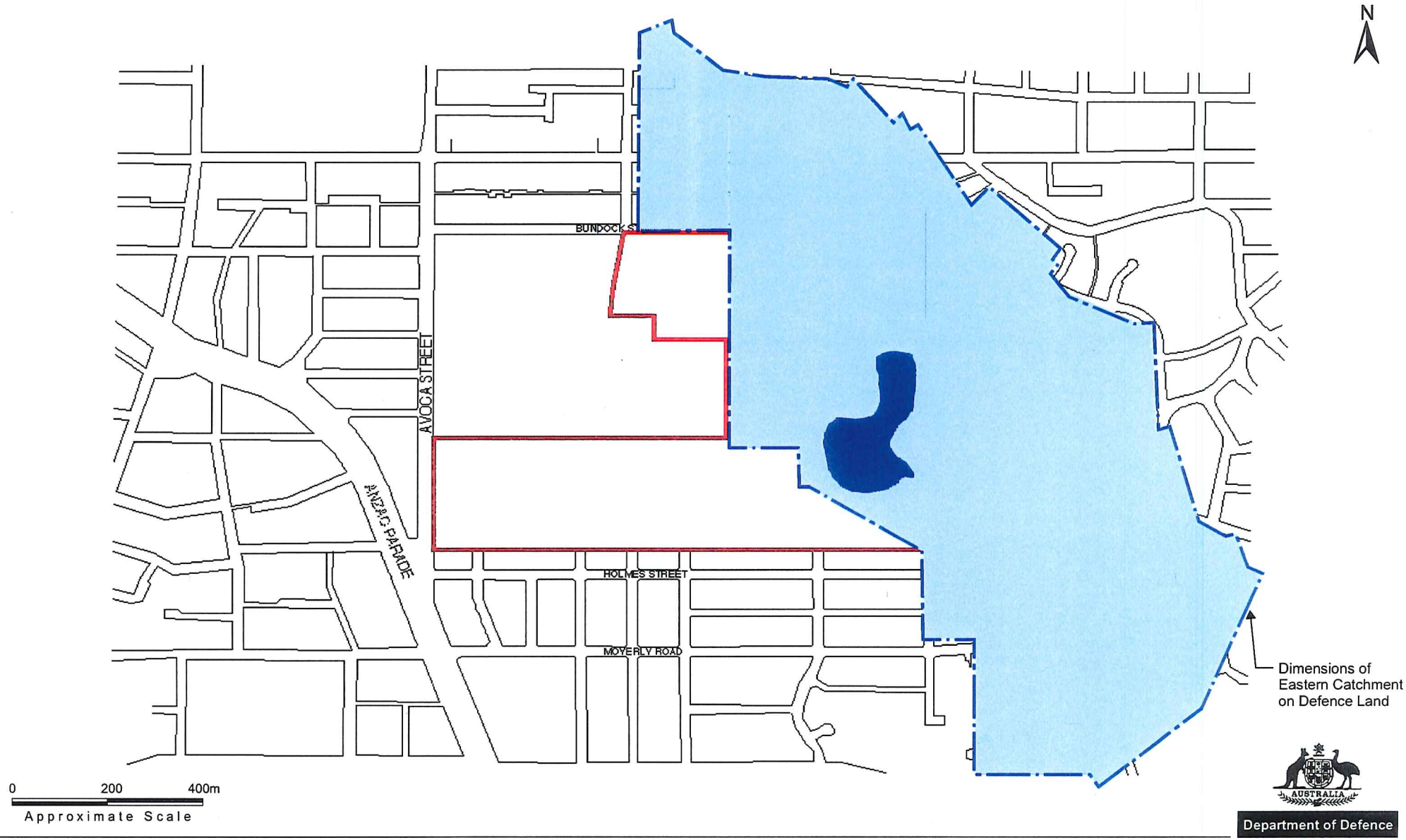
The western part of the Site (western catchment) drains south through the site stormwater system to a Sydney Water controlled drain located along the southern boundary which drains to the Lurline Bay Trunk Outfall Tunnel.

Additionally due to the high permeability of the sands at the Site, the relatively flat nature of the Site and the presence of large unseaied areas on the Site it is expected that direct infiltration to the groundwater system also occurs.

As part of the Moverly Green development immediately east of the Site, a formal outlet and overflow structure was constructed for the wetland. This comprised a concrete culvert connected by a pipeline to the Lurline Bay Trunk Outfall Tunnel to the south of the Defence Land. The concrete culvert has a weir that only permits overflow when the water level in the wetland rises above the top of the weir. The weir level for the overflow structure is set (at 31m AHD) near to the total capacity of the wetland, so that the weir only operates (with flows discharging to the Lurline Bay Trunk Outfall Drain) when the wetland is nearly full. All other runoff entering the wetland is held in the basin until it infiltrates through the sandy soil to the groundwater table.

CATCHMENT PLAN

NOTICE OF INTENTION, DEFENCE LAND, BUNDOCK STREET, RANDWICK



Date : 11 July 2000

File Name : VA0110_NOI_09.cdr

Figure 3.2

It is likely that the wetland was originally one of several swamps which dotted the Botany Basin, but which has been extended (and possibly deepened) as a result of sand extraction. Between 1970 and 1998 the elevation of the base of the wetland has risen by an average of nearly 0.5m, with some areas rising as much as about 2.5m, probably due to the influx of sediment transported in from the surrounding catchment.

Detailed analysis of both the groundwater levels and the wetland levels has indicated that the groundwater and water within the wetland are in hydraulic connection, and that stormwater held within the wetland basin is a source of recharge into the underlying groundwater system. The analysis has indicated that for the wetland to contain water for significant periods, a combination of high groundwater levels and a higher than average frequency of storm events is required. In these situations the high groundwater levels result in a lower rate of discharge (compared to those when groundwater levels are low) from the wetland to the groundwater, thus the groundwater effectively keeps the wetland "topped up". In periods of low groundwater levels, surface water accumulating in the wetland is continually discharging to the underlying groundwater system, and in combination with lower than average frequency of storm events will result in the wetland being dry or containing only small quantities of surface water.

3.9 FLORA AND FAUNA

A comprehensive assessment of the flora and fauna on the Surplus Defence Land and the impacts of the proposed actions on the ecological significance of the flora and fauna has been undertaken by Ecotone Ecological Consultants Pty Ltd. Their report is contained in **Appendix C**.

The Site has a long history of Defence use and is mostly developed land. The vegetation present comprises mostly cultivated trees, turfed areas and mowed grass with a few small, contained and isolated areas some natural vegetation regrowth. These are described in detail in Section 6.2 of **Appendix C**.

The eastern portions of the Randwick Surplus Defence Land, referred to as the Eastern Parcel[9] in the Ecotone report, contains vegetation that does not fall clearly into any recognised vegetation community type. Vegetation in this area has had structural and floristic features that have similarities with Eastern Suburbs Banksia Scrub and with other scrub communities normally growing on sandstone.

The area contains:

- a small number of species of Acacia Terminalis (spp Terminalis) listed in the schedule of the Commonwealth Endangered Species Protection Act 1992 (Commonwealth ESP Act) and the NSW Threatened Species Conservation Act, 1995 (NSW TSC Act); and
- vegetation including species included in the Final Determination for the listing of ESBS under the NSW TSC Act and the advice of the Scientific subcommittee under the Commonwealth ESP Act.

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9 With the exception of Area 1 as defined in Section 6.2.1 of **Appendix C**, this vegetation is not affected by the proposed actions.