



EASTERN CREEK WASTE PROJECT

REVISED 16 March 2017

ENVIRONMENTAL MANAGEMENT STRATEGY (EMS)

PESTS, VERMIN FERAL ANIMALS and DECLARED NOXIOUS WEEDS MANAGEMENT PLAN

Former QUARRY SITE AT OLD WALLGROVE ROAD EASTERN CREEK
MATERIALS PROCESSING CENTRE (MPC)
WASTE TRANSFER FACILITY associated with an adjacent
SOLID WASTE LANDFILL
Document Control

For controlled copies of this EMS the copy number is shown below and initialled in Red by Dial A Dump Industries and the ThaQuarry Unit Trust Project Manager.

Reference Documents:

Keystone Ecological - Consultant Elizabeth Ashby (**Keystone**) annexed in Appendix A.

Abel Ecology Vegetation Management Plan (**Abel**) annexed in Appendix B.

Prepared by: DADI June 2011	Authorised by: Christopher Biggs
Issue 7: Revised 16 March 2017	Position: Group General Counsel



REVISION HISTORY

Version	Date	Reasons for Change	Prepared By	Authorised by
1	June 2011	Initial commission	Legal	Group General Counsel
2	August 2012	Review	Legal	Group General Counsel
3	December 2013	Review	Legal	Group General Counsel
4	June 2014	Review	Legal	Group General Counsel
5	March 2015	Review	Legal	Group General Counsel
6	April 2016	Review	Legal	Group General Counsel
7	March 2017	Review	Legal	Group General Counsel



1 PESTS, VERMIN FERAL ANIMALS AND DECLARED NOXIOUS WEEDS

1.1 PROJECT APPROVAL CONDITIONS

Condition 14 of Schedule 3 requires the proponent to identify management measures for these aspects within the Environmental Management Strategy. Condition 14 is as follows.

The Proponent shall:

- a) Implement suitable measures to manage pests, vermin, feral animals and declared noxious weeds on site and identify those measures in the Environmental Management Strategy for the Project;*
- b) Inspect the site on a regular basis to ensure that these measures are working effectively, and that pests, vermin, feral animals or noxious weeds are not present on site in sufficient numbers to pose an environmental hazard, or cause the loss of amenity in the surrounding area; and*
- c) Perform ongoing monitoring of weed infestation on and adjoining the site.*

1.2 ACHIEVEMENT OF REQUIREMENTS

Table 1.1 lists the consent conditions for the preparation of measures to manage pests, vermin, feral animals and declared noxious weeds, provides a summary of the current compliance status



Table 1.1. Measures to Manage Pests, Vermin, Feral Animals and Declared Noxious Weeds Compliance Review (Condition 14 of Schedule 3).

CONSENT REQUIREMENTS	COMPLIANCE STATUS
a) <i>Implement suitable measures to manage pests, vermin, feral animals and declared noxious weeds on site and identify those measures in the Environmental Management Strategy for the Project;</i>	Complies Refer: Section 1 of this Management Plan; Abel (generally); and Sections 2.8 & 4.4 of Keystone
b) <i>Inspect the site on a regular basis to ensure that these measures are working effectively, and that pests, vermin, feral animals or noxious weeds are not present on site in sufficient numbers to pose an environmental hazard, or cause the loss of amenity in the surrounding area; and</i>	Complies Refer: Section 1.7 of this Management Plan; and Section 7 of Abel
c) <i>Perform ongoing monitoring of weed infestation on and adjoining the site.</i>	Complies Refer Section 7 of Abel

FLORA PROTECTION

Occupiers of land and owners of land have the responsibility of controlling noxious weeds on the land they occupy.

Under the Noxious Weeds Act 1993 No 11, noxious weeds are classified into weed control classes, with Classes 1, 2 and 5 noxious weeds also being *notifiable weeds* under the 1993 legislation. For each class of weed, the Proponent will:

- **Class 1, State Prohibited Weed:** notify the Blacktown City Council within 3 days if this class of weed is found present on Site, and the weed will be fully and continuously suppressed and destroyed;
- **Class 2, Regionally Prohibited Weed:** notify the Blacktown City Council within 3 days if this class of weed is found present on Site, and the weed will be fully and continuously suppressed and destroyed;
- **Class 3, Regionally Controlled Weed:** prevent this weed from spreading, and control its numbers and reduce its distribution;
- **Class 4, Locally Controlled Weed:** prevent this weed from spreading, and control its numbers and reduce its distribution;
- **Class 5, Restricted Plants:** notify the Blacktown City Council within 3 days if this class of weed is found present on Site, and the weed will be fully and continuously suppressed and destroyed.



1.3 AIM

The aim of this Management Plan is to:

- Ensure a uniform and coordinated approach to the control of pests, feral vermin and noxious weeds on site
- To monitor, identify and respond to the occurrence of plant species which pose a potential threat to natural areas
- To determine the success of weed control measures
- Define the roles and responsibilities of key personnel on site
- Ensure compliance with environmental legislative requirements

1.4 PROTECTED SPECIES

The Conservation Zone, is the remnant of the Cumberland Plain Woodland in the North West corner of the site. The Zone remains undisturbed as it is a supported habitat for a number of threatened species. The Riparian Corridor is the area beside the unnamed tributary of Ropes Creek.

Public access to the Conservation Zone and the Riparian Corridor is restricted to maintain the integrity of the environment. In controlling access to this area DADI continues to demonstrate its commitment to its environment and maintain public confidence in the operation of the Eastern Creek Facility.

1.5 BIRDS, PESTS, VERMIN (Benchmark Technique Table BM 35)

The Proponent will ensure that vermin, birds and insects are controlled through maintaining the Landfill in a generally clean and tidy manner, including applying Virgin Excavated Natural Material cover (VENM). Wastes are covered at the end of each daily shift, or in the case of potentially odorous or offensive wastes immediately following disposal at the tipping face.

Wastes will be compacted continually during the day's tipping operations to prevent access by vermin. If birds are observed to be a problem, then bird scares will be constructed and operated. If rats are observed, rat bait will be laid as appropriate.

Bird scares will be operated if the number of birds (particularly seagulls) on the tip exceeds 100 (number) at any one time during the operating hours.

Spraying with a biodegradable pesticide to reduce insects may also be required under certain circumstances. The type of spray to be used (when necessary) should be nominated and agreed with the operator and DECCW prior to use. Stocks of the agreed pesticide will be kept on the site in a suitable storage location at all times.



Areas of standing water, where mosquitoes may breed, must be eliminated, unless the open areas of water constitutes an operational facility, such as a leachate collection facility, sediment basin, or clean water runoff holding facility.

Proper fencing and closure of gates, will ensure that there is no unauthorised or out of hours dumping of wastes on the site which may attract vermin.

1.6 MANAGEMENT AND MITIGATION MEASURES

- Access to the Conservation Area is restricted through fencing around the perimeter and locked gates.
- A specific work direction be issued by the Site Project Manager to all relevant Sub-Contractors (including relevant plans) prescribing that NO ACCESS be permitted at any time to the Conservation Area, except for those activities specifically permitted and supervised by the Site Project Manager.

1.7 MONITORING AND COMPLIANCE REPORTING

DADI personnel complete Monthly Photo Audits in the Conservation Zone and Riparian Zone to ensure management and mitigation measures are operating effectively.

Monitoring locations are defined (Figure 1 and Figure 2)

- The boundaries of the Conservation Area
- Two diagonal transects across the width of the Conservation Area, one from the north west to south east corner, and one from the south west to north east corner
- The perimeter of the dam in the Conservation Area
- A 20 x 20m quadrat in the boxthorn thicket in south east corner of Conservation Area
- Transects following the approximate line of the watercourses in the Riparian Habitat

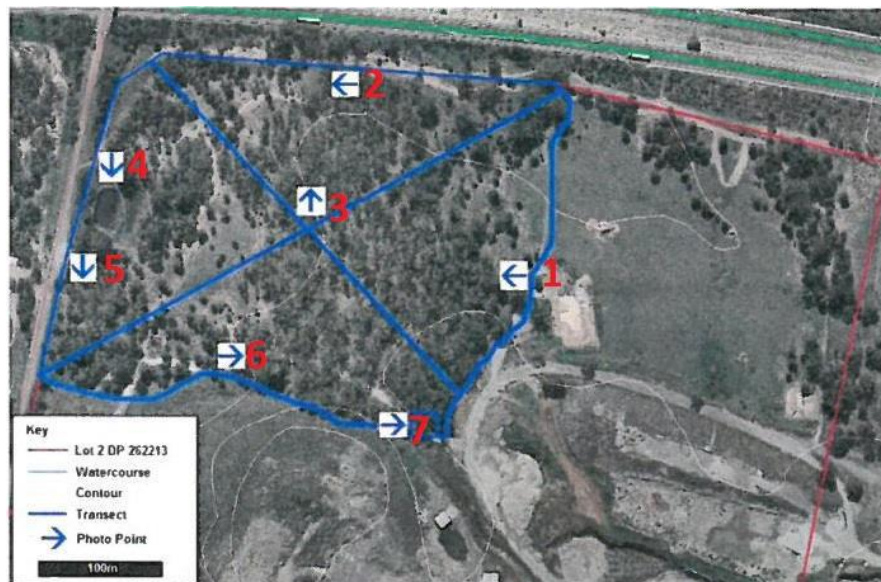


Figure 1. Conservation Area – Monitoring Points



Figure 2. Riparian Habitat – Monitoring Points

DADI personnel complete a Weed Monitoring Register following each contracted weed removal service. The data from all weed monitoring on site is then collated, managed and interpreted.

This data provides important information to be used within the project itself, and for applications outside the project, including exchange with local government and as an educational resource for the greater community.

1.8 SCHEDULE OF WORKS

The Proponent adopted the scheduled of works as outlined in section 7 of Abel (Appendix B).

The Proponent has completed the scheduled once-off activities, to:

- Fence Riparian Habitat
- Fence and gate Conservation Area
- Close single file tracks in Conservation Area
- Secure boundaries of conservation area from trail bikes. Provide structural habitat for fauna.



The Proponent has completed the works scheduled for the first year of opening, including the:

- Set up of monitoring points and transects
- Primary weeding of boxthorn thicket in Conservation Area
- Primary weeding of rest of Conservation Area
- Primary weeding of dam in Conservation Area
- Secondary weeding of boxthorn thicket in Conservation Area
- Piling of dead boxthorn in Conservation Area
- Secondary weeding of Conservation Area
- Follow up weeding of Riparian Habitat

With assistance from certified contractors the Proponent continues its scheduled regular periodic activities, including:

- Monitoring transects
- Following up weeding of Riparian Habitat
- Checking perimeter of Conservation Area for dumping
- Managing weed incursion on perimeter of Conservation Area
- Checking property boundary fencing

The Site Operations Manager has the responsibility of ensuring the continuation of regularly scheduled activities.



APPENDIX A – KEYSTONE

Guiding Ecological Principles and Constraints Lot

2 DP 262213

Lot 1 DP 400697

Lot 9 DP 241859 Lot

W DP 419612

**Archbold Road, Eastern Creek Blacktown
LGA**

For: Dial A Dump Industries



**REF: BCC 05-062/1
May 2007**

Guiding Ecological Principles and Constraints

Lot 2 DP 262213

Lot 1 DP 400697

Lot 9 DP 241859 Lot

W DP 419612

**Archbold Road, Eastern Creek Blacktown
LGA**

REF: BCC 05-062/1

May 2007

Author:

Elizabeth Margaret Ashby

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EXECUTIVE SUMMARY

Keystone Ecological has assessed the ecological constraints associated with the proposed development of the DADI Business Park within Stage 3 of the State Environmental Planning Policy No 59 Employment Zone at Eastern Creek.

The constraints considered are those as required by legislation and dictated by the biodiversity values of the site. This included the provisions of the following:

State Environmental Planning Policy No 59 Eastern Creek
Precinct Plan
Environment Protection and Biodiversity Conservation Act (1999)
National Strategy for Ecologically Sustainable Development
Environmental Planning and Assessment Act (1979)
Threatened Species Conservation Act (1995) and amendments Fisheries
Management Act (1994)
Rivers and Foreshores Improvement Act (1948)
Planning for Bushfire Protection (2001)
Noxious Weeds Act (1993)
Noxious Weeds Amendment Act (2005)

The biodiversity values of the site were investigated by desktop analysis and field survey. Realised and potential habitat of a number of threatened species and endangered ecological communities were found to occur on the subject site. These areas of ecological value are restricted to patches of remnant vegetation in the northern and southern parts of the site.

The value of the large remnant of Cumberland Plain Woodland in the north western corner of the site has been confirmed by this assessment in that it contained the Cumberland Plain Large Land Snail and supported potential habitat (such as tree hollows) for a number of other threatened species (such as microchiropteran bats). It is also in comparatively good condition with relatively few weeds in the understorey and none dominant.

The roading as proposed in the Precinct Plan introduces incompatible outcomes for this area with the placement of a community facility within its boundaries. While this fulfils the requirement for access and recreational opportunities it requires prohibited activity such as asset protection works.

Therefore, it is recommended that the roading plan be revisited with no community facilities placed inside of the remnant and only passive, low impact recreational activities encouraged.

The subject site has also experienced a great deal of disturbance with a long history of quarrying, deposition of spoil and overburden and other soil movements, seeding by introduced species, and significant hydrological changes to a small drainage channel. Water from the quarrying activities

has been dammed and overflowed into this drainage channel, with an increased sediment load and changes in its chemical nature.

The ecological values of these disturbed areas are greatly diminished as a result, especially in the area associated with the riparian zone in the south of the site. Although this area supported two endangered ecological communities (Alluvial Woodland and Cumberland Plain Woodland), they are in a disturbed state and their condition is poor. The riparian zone in particular is dominated by weed species, many of which are declared noxious.

The Precinct Plan requires that the riparian area be managed so that it functions as a wildlife corridor. In its current state it cannot fulfil this purpose and it will continue to deteriorate without radical intervention. The works required – particularly for noxious weed control – are so great as to constitute a virtual reconstruction of the riparian zone. With this in mind, it is recommended that consideration be given to its realignment and re-engineering so that both the developable area and the chance for successful rehabilitation are maximised.

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1 INTRODUCTION

1.1 Description of the site

The subject site is at Lot 2 DP 262213, Lot 1 DP 400697, Lot 9 DP 241859 and Lot W DP 419612 Archbold Road, Eastern Creek in the Blacktown City Council LGA. The subject site and surrounding lands are subject to State Environmental Planning Policy No 59 - Central Western Sydney Economic and Employment Area. Keystone Ecological has been contracted by Dial A Dump Industries to assess the ecological constraints on the subject site in light of the planning and legislative requirements in this area.

It occupies approximately 121 hectares and is bounded by the M4 Motorway to the north and Archbold Road to the west. Surrounding lands are largely cleared and grazed. Lands to the east are variously developed for quarrying and as a business park. The suburb of Minchinbury is to the north and other industrial land is to the north west of the subject site.

The site and its immediate surrounds are shown in Figure 1.

The site occupies the low and gently undulating rises and flats of the Cumberland Lowlands (Bannerman and Hazelton 1990). The subject site occupies the Blacktown soil landscape (Hazelton et al. 1989) that occurs on the Wianammata Group shales.

The site is dominated by a large quarry that has exploited the Minchinbury diatreme for gravel extraction. The majority of the remainder of the site is made up of overburden from the quarrying activities. This spoil has been seeded with exotic species of grasses and now supports grassland, chiefly of exotic species.

A large remnant of woodland vegetation occurs in the site's north western corner where no mining activities have occurred. This area has probably been logged or cleared in the past and grazed.

The southern part of the site contains a small unnamed drainage line that drains to Ropes Creek in the west. This area receives overflow from the dams associated with the neighbouring Hanson Asphalt plant and has a significant silt load. Vegetation in this area is young and sparse and highly disturbed.

1.2 Description of the proposal

The Eastern Creek Precinct Plan (Blacktown City Council 2002) has determined that the subject site is to support a landfill and industrial development with associated infrastructure.

There are two major components to the proposed development in response to SEPP 59 and the Precinct Plan.

The proposed development comprises bulk earthworks and facility construction for the use of the site as a materials processing centre (MPC), waste transfer station (WTS) and non-putrescible class 2 inert and solid waste landfill within the existing quarry void.

The facility is proposed for resource recovery accepting solid, inert building and demolition wastes. Liquid wastes, medical wastes, toxic and hazardous wastes will not be received at the facility. Green wastes, excluding putrescible material containing foodstuffs will be received and handled at the facility. Wastes will be treated by sorting, crushing and screening in order to recover resources for recycling. Recycled materials may be blended to form saleable products which will be stored on the site until sold. Unrecoverable materials, estimated at 20% of the volume received, will be transferred to the landfill area for disposal.

The land when fully operational will include a recycled materials sales facility, an inwards weighbridge, outwards weighbridge, wheel washing station, administration office, employee facilities, workshop, bunded above ground fuel storage, hard stand processing and stockpile areas, paved sales areas, parking areas, roadways, lighting, drainage, leachate wells, water treatment and storage facilities, radio controlled water spray system, security fencing and gates.

The proposal also incorporates the preparation of the remainder of the site for future industrial use by using the quarry overburden to grade the site to a 5% fall.

Development will largely be restricted to the already cleared and disturbed parts of the site, much of which is occupied by overburden from the quarry. Activities will require recontouring of the spoil and construction of ancillary support facilities, roads and parking areas.

Relevant to this assessment, there is a road proposed along the southern and eastern boundaries of the vegetation remnant in the north western corner of the subject site. This feeds from a proposed roundabout on Archbold Road and will in time connect the proposed MPC, WTS and SWL.

A detention basin for stormwater control is proposed for location at the east of the woodland remnant in the north western part of the site. This will take the form of a vegetated swale, with a sump to the drainage system that feeds under the M4 Motorway.

Similarly, another detention basin is proposed to be located in the south western corner of the site. This will feed into the drainage system of the unnamed tributary to Ropes Creek.

In the long term, it is proposed to fill the quarry as a landfill. It is proposed to then rehabilitate that area for future development. This activity will occur over decades.

2 LEGISLATIVE FRAMEWORK

At each level of government there is a relevant piece of legislation or planning provision against which a proposal must be assessed. Of particular relevance in an ecological sense are those policies and laws designed to protect threatened species, populations and ecological communities and other sensitive environmental features.

2.1 State Environmental Planning Policy No. 59 Central Western Sydney Economic and Employment Area (SEPP 59)

This planning policy has zoned the lands of the subject site and adjacent lands principally for employment, residential and regional open space purposes. To this end, it supersedes the Blacktown Local Environment Plan and development proposals are to be assessed against the appropriate Precinct Plan (see below) and other guiding principles articulated in SEPP 59.

One of the aims of the policy is to *"... provide for the optimal environmental and planning outcomes ... by ...conserving those areas that have a high biodiversity or heritage, scenic or cultural value and, in particular, areas of remnant vegetation..."*

To this end, a consent authority must take the following matters into consideration in relation to ecological issues:

- development should be consistent with the principles of ecologically sustainable development which requires an active approach to anticipating and preventing damage to the environment, and where possible, ensuring that developments are planned in a way that enhances the environment; and
- development should be consistent with the principles of total water cycle management, including minimising total water usage, minimising waste water requiring treatment and disposal, minimising stormwater impacts on the environment, and maximising water retention and reuse.

The SEPP requires that significant bushland and other natural features be conserved and that development should be planned to minimise impacts on areas of high biodiversity and should seek to enhance the values of these areas. This may be partly satisfied by consideration of the suitability of the site or part thereof for open space that will enhance and link the regional open space and special uses corridor and provide for the needs of the local community.

The lands within SEPP 59 are variously zoned as Employment Zone, Residential Zone or Regional Open Space Zone; the subject site is zoned as Employment Zone.

The relevant ecological objectives of the **Employment Zone** are to:

- enhances the biodiversity of the region by the retention of significant bushland communities or through the regeneration of bushland communities as part of landscaping;
- enhances or does not degrade the water quality of natural waterways and their riparian zones; and
- allow for local open space that is accessible and well located, that promotes the use and enjoyment of local open space for both residents and the workforce, that may include elements of the natural environment, and that provides for active and passive recreation.

Within this area, the subject site is classified into different types of use, as shown in the Concept Masterplan in the Precinct Plan. Within the subject site, there are areas defined as a Conservation Area and a Riparian Corridor, with the locations determined for an Electricity Zone Substation and two Drainage Detention Basins. The locations of these are depicted in Figure 2. The Conservation Area is the remnant in the north west corner of the site. The Riparian Corridor is that area beside the unnamed tributary of Ropes Creek. The Substation is to be located near the southern end of Archbold Road and the two Detention Basins are located at opposite ends of the site – one in the north and the other in the south.

In addition to these zoning provisions, the subject site is specifically nominated as being permitted (with consent) to be used for the purpose of a waste facility for non-putrescible material.

Tree preservation provisions also apply within the Precinct. Therefore, trees may not be damaged or removed without consent unless the tree is dead, declared noxious or is assessed by a qualified arborist as dying, in poor condition or potentially dangerous.

2.2 Eastern Creek Precinct Plan

SEPP 59 requires that the Precinct Plan address important ecological issues. In particular, it must consider ecological communities and issues of biological diversity within or adjacent to the Precinct, including any remnant vegetation. The Plan may also make provision for preparation of guidelines for any communities of flora and fauna so that ecosystem diversity is maintained.

In particular, the relevant objectives of the plan are to:

- promote economic growth and employment opportunities within Central Western Sydney;
- ensure the orderly provision of infrastructure and services;
- provide a safe and efficient stormwater management system that minimises stormwater impacts on the environment;
- ensure ecologically sustainable development that takes an active approach to anticipating and preventing damage to the environment;

- minimise the impact of development on areas of high biodiversity, archaeological significance, and heritage;
- ensure the traffic and public transport needs for the Precinct are achieved;
- ensure the best possible urban design outcomes are achieved;
- ensure the community service needs of the working population are met;
- allow for the provision of adequate open space for the use and enjoyment of the working population; and
- ensure the provision of high quality landscaping throughout the Precinct.

The Precinct Plan proposes to achieve this outcome by prescription of activities in each zone with particular regard to remnant vegetation and riparian corridors.

It is recognized in the Precinct Plan that opportunities exist for the establishment of regional vegetation corridors along a number of local drainage lines, including Ropes Creek and its tributaries. Development must be designed so that the riparian vegetation is suitable as habitat and as a movement corridor for native species.

In order to facilitate such a corridor, the Precinct Plan identifies the following strategies:

- retain quality stands of trees along significant existing drainage corridors and within setbacks to roads;
- retain individual trees and stands of existing trees throughout the site;
- use native seedbanks for replanting;
- locate open space around significant (good quality) stands of existing trees outside the regional corridors;
- maximise the conservation of existing drainage lines for drainage and vegetation retention purposes;
- effectively design any upgrading of drainage paths to conserve existing trees as practicable, and, where necessary, plant native trees to maximize canopy connectivity along these corridors;
- take into account significant trees in the urban design of road alignments;
- target retention of appropriate quality trees in non-open space areas through a tree retention policy for the workforce;
- retain appropriate and healthy trees where possible in road reserves and open space areas;
- retain pockets of understorey vegetation within the open space network and drainage corridors of the Precinct. These pockets should be regenerated as required to remove exotic species and enhance native shrub and ground covers;
- the native tree canopy must be retained and, where necessary, enhanced with the aim of developing a continuous canopy linking the corridors lands to the western of the Precinct with the Western Sydney Regional Parklands to the east;
- a continuous understorey link must be maintained and enhanced;

- weed control measures must be implemented to remove noxious and environmental weeds from the creek corridor and only native species shall be used in any landscaping; and
- landscaping of passive recreation areas must complement the native landscapes.

Further controls have been identified in the Precinct Plan to enable protection of the riparian areas in particular. When measured from the top of the bank on either side of the creek, development consent shall not be granted, except for development associated with the protection, enhancement and management of the riparian corridor, on land within the Precinct that is within 40 metres of Ropes Creek tributary.

Also, Development Applications relating to an area directly adjacent to an identified conservation area or riparian corridor are to have regard to the following:

- retention of quality stands of trees along significant existing drainage corridors;
- the nature and function of the riparian environmental corridors affected by the proposed development;
- the impact of the proposed development on the riparian environment;
- whether the area has high biological diversity; and
- whether the land has connective importance as part of the corridor of bushland that allows for the potential passage of species of flora or fauna between two or more areas of bushland.

The following actions are required to facilitate this outcome:

- seeds of locally indigenous species, including threatened and regionally significant species, should be collected and propagated prior to development, and used in vegetating the corridor network;
- plantings should allow for a continuous canopy along the length of corridors to facilitate movement of non ground-dwelling fauna;
- applications for the development of sites that contain existing vegetation shall be accompanied by a tree survey to identify all significant trees to be retained;
- habitat trees should be retained where possible. If a habitat tree is to be removed, it should be inspected by a fauna ecologist for fauna occupation prior to its removal. If the habitat tree is occupied by breeding native fauna, the removal of the tree should be postponed until the young have matured. Existing tree hollows should also be dismantled and placed in appropriate locations as specified by a fauna ecologist.

In regards to bushfire management, the Precinct Plan requires that all asset protection zones be located wholly within the development site, but outside of any conservation area or riparian corridor.

2.3 Environment Protection and Biodiversity Conservation Act (1999)

The Environment Protection and Biodiversity Conservation Act (1999) (EPBC Act) is a nationally applicable Act that is administered by the Department of the Environment and Heritage (DEH). This Act requires approval for actions that are likely to have a significant impact on matters of National Environmental Significance (NES).

There are seven matters of NES that are triggers for Commonwealth assessment and approval. These are:

1. World Heritage properties;
2. National Heritage places;
3. Ramsar wetlands of international importance;
4. Nationally threatened species and communities;
5. Migratory species;
6. Nuclear actions; and
7. Commonwealth marine environment.

Threatened species and ecological communities are listed under Part 13, Division 1, Subdivision A of the EPBC Act (1999). Migratory species are listed under Part 13, Division 2, Subdivision A of the Act.

The Department of the Environment and Heritage identifies the following:

"Under the EPBC Act a person must not take an action that has, will have or is likely to have a significant impact on any of these matters of NES without approval from the Commonwealth Environment Minister. There are penalties for taking such an action without approval.

In general, an action that may need approval under the Act will involve some physical interaction with the environment, such as clearing native vegetation, building a new road, discharging pollutants into the environment, or offshore seismic survey.

If, following a referral, it is determined that an action is likely to have a significant impact, and approval is therefore required, the action is called a 'controlled action'. The proposal will then undergo a formal assessment and approval process, and cannot proceed unless approval is granted.

If it is determined that an action is not likely to have a significant impact, then the action is not a controlled action. Approval under the EPBC Act is not required and the action may proceed, subject to obtaining any other necessary permits or approvals."

2.4 National Strategy for Ecologically Sustainable Development

SEPP 59 requires that development within the designated lands be consistent with the principles of Ecologically Sustainable Development (ESD). The National Strategy for ESD (Council of Australian Governments 1992) has defined ESD as 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased'.

The core objectives of this strategy are to:

- enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations
- provide for equity within and between generations
- protect biological diversity and maintain essential ecological processes and life-support systems

In terms of native vegetation, the strategy aims to conserve and, where appropriate, restore native vegetation to maintain and enhance biodiversity, protect river water quality and conserve soil resources. The strategy states that, *inter alia*, this can best be done by facilitating community and land manager involvement in the development of catchment and regional vegetation management plans and by encouraging off-reserve conservation.

2.5 Environmental Planning and Assessment Act (1979), the Threatened Species Conservation Act (1995) and amendments and Fisheries Management Act (1994)

The Environmental Planning and Assessment Act (1979) (EPA Act) is intimately related to the Threatened Species Conservation Act (1995) (TSC Act) and Fisheries Management Act (1994) (FM Act) in terms of assessment of developments proposals for impact upon threatened species.

Section 5A of EPA Act (1979) now sets out seven factors that require consideration in terms of the likely significance of the impact of an action. Prior to recent amendments, this assessment was informally known as the 'eight part test', and is now referred to as a 'seven part test'.

For the purposes of this Act and, in particular, in the administration of sections 78A, 79C (1) and 112, these seven factors must be taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats as listed under the TSC Act (1995) and the FM Act (1994).

If the application is for development on land that is, or is a part of, critical habitat, or is likely to significantly affect threatened species, populations or

ecological communities, or their habitats, a Species Impact Statement must be prepared.

The seven factors for consideration are:

- (a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction;
- (b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction;
- (c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
 - (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
 - (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction;
- (d) in relation to the habitat of a threatened species, population or ecological community:
 - (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
 - (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
 - (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality;
- (e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly);
- (f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan;
- (g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

2.6 Rivers and Foreshores Improvement Act (1948)

This act requires that no development occur within 20 metres of the top of bank of any gazetted stream. The Precinct Plan satisfies and exceeds this requirement for the Ropes Creek tributary, in that no development whatsoever is allowed on land within the Precinct that is within 40 metres of Ropes Creek tributary.

2.7 Planning for Bushfire Protection (2001)

This legislation is designed to protect life and property from bushfire attack by imposing protection measures such as construction standards, setbacks from bushland and fuel management of the interface.

The requirement for fuel management can have an ecological impact and must be assessed as part of the development proposal as potential impact on threatened species, populations and communities within the subject site.

The compliance of the proposed development with these requirements is assessed elsewhere (Holmes Fire and Safety 2006).

2.8 Noxious Weeds Act (1993) and Noxious Weeds Amendment Act (2005)

The Noxious Weeds Act (1993) and the Noxious Weeds Amendment Act (2005) define noxious weeds per control area and specify the required control measures for each. There is a fundamental shift between the acts in how these weeds are to be classified and the control actions to be implemented. However, as the Noxious Weeds Amendment Act (2005) does not come into force until 1st March 2006 and the guidelines pursuant to that legislation are unavailable, the requirements under both pieces of legislation are outlined herein. Occupiers of land and owners of land have the responsibility for controlling noxious weeds on the land they occupy under both pieces of legislation.

The control categories for noxious weeds under the 1993 legislation are W1, W2, W3 and W4. A W1 weed is referred to in this Act as a *notifiable weed*, which means that the relevant authorities must be notified within 3 days of the presence of such a weed being known to the owner/occupier.

For each category, the following actions are required:

W1: The presence of the weed on land must be notified to the local control authority and the weed must be fully and continuously suppressed and destroyed.

W2: The weed must be fully and continuously suppressed and destroyed.

W3: The weed must be prevented from spreading and its numbers and distribution reduced.

W4a: The weed must not be sold, propagated or knowingly distributed and any part of the weed must be prevented from growing within 3 metres of the boundary of a property.

W4b: The weed must not be sold, propagated or knowingly distributed and any existing weed must be prevented from flowering and fruiting.

W4c: The weed must not be sold, propagated or knowingly distributed and the weed must be prevented from spreading to an adjoining property.

W4d: The weed must not be sold, propagated or knowingly distributed and must be fully and continuously suppressed and destroyed unless it is listed for preservation or protection by some other instrument.

W4e: The weed must be fully and continuously suppressed and destroyed. All reasonable precautions must be taken to ensure produce, soil, livestock, equipment and vehicles are free of the weed before sale or movement from an infested area of the property.

W4f: The weed must not be sold, propagated or knowingly distributed. Any biological control or other control program directed by the local control authority must be implemented.

W4g: The weed must not be sold, propagated or knowingly distributed.

Under the Noxious Weeds Amendment Act 2005, noxious weeds are classified into *weed control classes*:

Class 1, State Prohibited Weeds: noxious weeds that pose a potentially serious threat to primary production or the environment and are not present in the State or are present only to a limited extent

Class 2, Regionally Prohibited Weeds: noxious weeds that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent.

Class 3, Regionally Controlled Weeds: noxious weeds that pose a serious threat to primary production or the environment of an area to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.

Class 4, Locally Controlled Weeds: noxious weeds are plants that pose a threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.

Class 5, Restricted Plants: noxious weeds that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.

Class 1, 2 or 5 noxious weeds are *notifiable weeds* and the same provisions of the 1993 legislation apply.

3 BIODIVERSITY OF THE SITE

Field survey, literature review, searches of all available databases and interpretation of aerial photography was undertaken to ascertain the biodiversity of the subject site.

3.1 Previous relevant studies

A study of the flora and fauna present in the Eastern Creek Precinct was undertaken by Australian Museum Business Services (AMBS 2002) on behalf of Blacktown City Council. This information has informed the Precinct Plan.

The subject site was part of that study and was then known as the "Fitzpatrick property".

The study area was large (700 hectares) and survey on the Fitzpatrick property was not intensive. However, a fauna survey study site was placed in the woodland in the north western corner of the subject site and opportunistic observations were made in the south eastern area. Vegetation survey was conducted across all of the subject site.

The vegetation remnant in the north was described as representing Cumberland Plain Woodland. The vegetation along the unnamed tributary in the southern part of the subject site was dominated by regenerating *Casuarina glauca* and did not have the floristic features to support its description as River-flat Forest.

The vegetation remnant of Cumberland Plain Woodland in the north west was defined as being of high ecological importance. This was due to its size, connectivity with other remnants, structural diversity and the potential or realised habitat for threatened species. In particular, the endangered Cumberland Plain Large Land Snail and the endangered population of *Marsdenia viridiflora* subsp. *viridiflora* were recorded from this area.

The vegetated areas of the drainage channel in the south were defined as being of moderate ecological importance because of its connectivity to other remnants to the east and potential connectivity to Ropes Creek in the west.

Lands to the east of the subject site (known as the "Wonderland site") were the subject of another study by Conacher Travers (2003). This flora and fauna assessment report identified a number of important ecological features, including occurrences of Cumberland Plain Woodland, *Grevillea juniperina* subsp. *juniperina*, Cumberland Plain Large Land Snail and the Eastern Bentwing-bat.

3.2 Databases

Several publicly available databases were interrogated for records of species of interest in and near the subject site.

Fauna and flora records held by the Department of Environment and Conservation and the Department of Environment and Heritage were searched. The online component of the Atlas of NSW Wildlife (NSW NPWS 2006, <http://wildlifeatlas.nationalparks.nsw.gov.au>) was searched, as was the similar database of the Department of Environment and Heritage (Protected Matters Search Tool, www.deh.gov.au/erin).

Fauna and flora records held by State Forests of NSW were searched via BioNet (<http://www.bionet.nsw.gov.au>).

The floristic records held by the National Herbarium of NSW at the Royal Botanic Gardens were interrogated via their online flora search tool (<http://plantnet.rbgsyd.nsw.gov.au/floraonline.htm>) as well as via data available in BioNet.

Fauna records held by the Australian Museum were interrogated via BioNet.

3.3 Vegetation mapping

The vegetation that occurs in western Sydney has been the subject of a number of mapping programmes over many years.

The first of these was the vegetation definition and mapping conducted by Doug Benson of the Royal Botanic Gardens of the Penrith 1:100 000 map sheet (Benson 1992).

Although this mapping is now relatively dated, it still provides a historical account of broad scale vegetation types present in 1992 throughout the Cumberland Plain area. It identified a small area of Grey Box Woodland in the north western corner of the subject site. This vegetation type is equivalent to what is now known as Cumberland Plain Woodland.

The NSW National Parks and Wildlife built on and updated past mapping and classified not only the vegetation type, but its condition and conservation importance, using a combination of canopy and understorey features (NPWS 2002).

This mapping reveals that the subject site supports Cumberland Plain Woodland in the north western corner and a combination of Cumberland Plain Woodland and River-flat Forest in the south east.

The larger remnant in the north west is classified as being of high priority "core habitat" because of its relatively good condition. All other vegetation on the subject site is classified as of the lowest conservation priority - "other remnant vegetation". This is due to its small size and highly disturbed condition.

The mapping of NPWS (2002) was further refined and fully described by Tozer (2003). This mapping confirmed the NPW (2002) mapping, with no alteration to the vegetation types or condition classes on the subject site.

3.4 Field survey and aerial photography interpretation

Colour aerial photography at a scale of 1:25,000 was interpreted for vegetation patterns. This photography dated from March 2002 and the vegetation apparent at that time coincides with that seen on the ground during survey for this report. It also coincided with the boundaries as mapped by NPWS (200) and Tozer (2003).

The vegetation mapped by NPWS (2002), Tozer (2003), recognised by AMBS (2002) and observed in survey for this report differed to that recognised by Benson (1992) in that Benson (1992) did not report any vegetation in the southern part of the site. While this could be due to an oversight, it is more likely that the vegetation observed currently has regrown since that time or was present only as very small trees in the early 90's.

This explanation fits with the current interpretation that the vegetation in that area is principally made up of pioneer species that are colonising the constantly disturbed habitats of the riparian zone.

The subject site was surveyed for this Constraints Assessment on 7th and 12th December 2005, 24th and 27th January 2006 and 25th March 2007. The woody regenerating remnants were surveyed for the occurrence of threatened species of flora and fauna and their habitats. Particular attention was given to species and communities known to occur in the local area such as the Cumberland Plain Large Land Snail, Cumberland Plain Woodland and River-flat Eucalypt Forest. Hollow-bearing trees were also identified and tagged.

Flora and Fauna survey details are shown in Figure 1.

4 SIGNIFICANT ECOLOGICAL ATTRIBUTES

Survey of the site, habitat assessment and interrogation of scientific databases has revealed a number of significant ecological features of the subject site. Threatened species of fauna have been located on site, endangered ecological communities have been recognised and mapped and habitat for other listed threatened species have also been identified. In addition to positive ecological attributes, a number of noxious weeds were also detected on the site, some in large numbers.

4.1 Flora of Conservation Significance

Of those plant species listed under the Commonwealth EPBC Act (1999) and the State TSC Act (1995) that occur within 10 kilometres of the subject site, it is judged that the potential exists for *Marsdenia viridiflora* subsp. *viridiflora*, *Hypsela sessiliflora*, *Pimelea spicata*, *Acacia pubescens*, and *Grevillea juniperina* subsp. *juniperina* to occur on the subject site. However, despite this potential, none of these species were observed on the subject site during survey.

4.1.1 Endangered Populations of Flora

Marsdenia viridiflora* subsp. *viridiflora

Marsdenia viridiflora subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith LGAs is listed as Endangered under Schedule 1 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

This species is a climber with twining stems, and long, narrow leaves. The bell-shaped flowers are greenish or yellow and the fruit are pear-shaped and large, up to 8 centimetres long. As with all members of this group, it exudes a milky latex when cut or broken (Harden and Williams 1992).

Marsdenia viridiflora subsp. *viridiflora* has a wide distribution in southern Queensland but has been recorded rarely in NSW, from the botanical subdivisions of the north western and central western slopes (Harden and Williams 1992) and from a disjunct occurrence near Sydney (NSW Scientific Committee 2003).

Examples of this endangered population have recently been recorded from Prospect Reservoir, Bankstown, Smithfield, Cabramatta Creek and the former Australian Defence Industries site at St Marys (NSW Scientific Committee 2003, DEC 2006).

The species is known to occur in woodland and scrub (Harden and Williams 1992) and, on the Cumberland Plain, particularly occurs as sparsely scattered plants in open shale woodland (NSW Scientific Committee 2003, DEC 2006).

No examples of this endangered population are known from conservation reserves, but this species has been recorded from Scheyville National Park, in the Hawkesbury LGA (NPWS 2006).

Threats to this endangered population include habitat loss for urban expansion, and infrastructure development. It is also vulnerable to fire and other stochastic events due to its rarity and small size.

Potential habitat is present on the subject site for this species in the Cumberland Plain Woodland. Although it was not observed during survey, it has been reported in previous studies as occurring on the site (AMBS 2002, Conacher Travers 2003).

4.1.2 Endangered Species of Flora

Hypsela sessiliflora

Hypsela sessiliflora is listed as Endangered under Schedule 1 of the Threatened Species Conservation Act (1995). This species is listed as Extinct under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

This species was thought to be extinct until its rediscovery in 1999 in the Erskine Park Employment Area, Penrith LGA (Penrith City Council 2002).

Hypsela sessiliflora is a prostrate herb with small and narrow (2-4 mm long, 1-2.5 mm wide) ovate to oblong leaves. It produces a few solitary white or pale purple flowers in spring (Wiecek 1992).

Its single known location occupies an area of less than 10x15 metres NSW Scientific Committee 2003), in a damp habitat in the South Creek catchment (Penrith City Council 2002). The vegetation mapped as occurring in this area is Cumberland Plain Woodland and River-Flat Eucalypt Forest; presumably this species is within the moister habitats of the River-Flat Eucalypt Forest.

The species is not known to occur in any formal conservation reserve and is threatened by loss of habitat and hydrological disturbances and grazing (NSW Scientific Committee 2003).

Potential habitat occurs on the subject site for this species in the damper parts of the Cumberland Plain Woodland around the dams and in the riparian zone in the southern part of the site. It was not observed during survey.

Pimelea spicata

Pimelea spicata is listed as Endangered under Schedule 1 of the Threatened Species Conservation Act (1995). This species is listed as Endangered under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

Pimelea spicata is a small spreading or erect shrub (Harden 1990) that has a relatively scattered but restricted distribution, occurring in two disjunct areas, the Cumberland Plain and coastal Illawarra (NPWS 2004). The majority of the known populations of this species (21 of 26) occur on the Cumberland Plain from Mount Annan and Narellan Vale in the south to Freemans Reach in the north and from Penrith in the west to Georges Hall in the east.

In western Sydney, *P. spicata* occurs on an undulating topography of substrates derived from Wianamatta Shale in areas supporting, or that previously supported, Cumberland Plain Woodland (NPWS 2004). This species is able to resprout after disturbance (e.g. fire, drought, mechanical damage) and it flowers sporadically throughout the year, probably in response to rainfall (NPWS 2004). Fruit production is very variable and seed is probably stored in the soil.

Although only one population occurs within a formal conservation reserve (Western Sydney Regional Park), other populations have some form of protection: one is within an area that is the subject of a formal Commonwealth Conservation Agreement, another is within Mount Annan Botanic Garden and a large population is within the lands surrounding Prospect Reservoir (DEC 2004).

Habitat loss and habitat degradation are the main threats to the survival of this species. The local extinction of at least two populations has occurred due to industrial and residential development in western Sydney (DEC 2004). Habitat degradation includes that brought about by weed invasion as well as physical disturbances such as mowing, grazing and dumping of rubbish (NPWS 2004).

Potential habitat occurs for this species on the subject site in the remnant of Cumberland Plain Woodland, although it was not observed during survey.

4.1.3 Vulnerable Species of Flora

Acacia pubescens

Acacia pubescens (Downy Wattle) is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is listed as Vulnerable under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

Acacia pubescens is a small, spreading bipinnate Acacia and is notable for its obvious hairs on its leaves and branches (Morrison and Davies 1991). This species has a highly fragmented distribution (NSW Scientific Committee No Date) as it is restricted to the Sydney area, with strongholds in the Bankstown-Fairfield-Rookwood area and Pitt Town, and outlying locations at Barden Ridge (NPWS 2003). Its eastern distributional limit is at Bardwell Valley, north western limit is at Mountain Lagoon while its south western limit is at Oakdale (NPWS 2003).

It is known from over 150 populations, but only five of these are within conservation reserves (NPWS 2003).

Its recorded habitat is open forest and woodland (Morrison and Davies 1991) on alluviums, shales, and the intergrade between shales and sandstones (NPWS 2003). Soils are characteristically gravelly, often with ironstones (NPWS 2003). This species flowers from August to October (Morrison and Davies 1991) but it is a clonal species, with recruitment more often from vegetative reproduction than from seedlings (NPWS 2003).

Potential habitat occurs for this species on the subject site in the Cumberland Plain Woodland remnant in the north western part of the site. It was not observed during survey.

Grevillea juniperina* subsp. *juniperina

Grevillea juniperina subsp. *juniperina* is listed as a vulnerable species on Schedule 2 of the Threatened Species Conservation Act 1995 (NSW). It is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

This species is a broadly spreading to erect shrub, up to 3 metres high and 3 metres wide. The leaves are prickly, narrow, often bright green, up to 22mm long and clustered along short lateral branches. Flowers may be red to pinkish, yellow, pale orange or greenish and occur between July and October (Makinson 2000).

Grevillea juniperina subsp. *juniperina* is endemic to Western Sydney with its distribution centred on an area bounded by Blacktown, Erskine Park, Londonderry and Windsor, with outlier populations at Kemps Creek and Pitt Town (NPWS 2002).

There are more than 30 known populations of this species and, although relatively common within its core area, most populations are vulnerable to land use changes or disturbance as they occur on private land or in marginal habitat along roadsides (NPWS 2002).

There is only one confirmed population within a conservation reserve - one small population of 11 plants occurs within Castlereagh Nature Reserve (NPWS 2002).

G. juniperina subsp. *juniperina* has been recorded from soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence) of the Blacktown and Berkshire Park soil landscapes and typically contain lateritic ironstone gravels. It is generally found in flat or gently sloping, low-lying sites (NPWS 2002).

G. juniperina subsp. *juniperina* is known to occur within a number of endangered ecological communities - both forms of Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest (NPWS 2002).

Associated canopy species of the Cumberland Plain Woodland include *Eucalyptus tereticornis*, *E. moluccana*, *E. crebra*, *E. fibrosa* and *E. eugenioides*; understorey species include *Bursaria spinosa*, *Dillwynia sieberi*, *Ozothamnus diosmifolius*, *Daviesia ulicifolia*, *Acacia falcata*, *Acacia parramattensis*, *Themeda australis*, *Aristida ramosa*, *Cymbopogon refractus*, *Eragrostis brownii*, *Cheilanthes sieberi*, *Dianella revoluta* and *Goodenia hederacea*.

This species seems to be a pioneer species, as most populations are found in disturbed sites, particularly along roadsides. Makinson (2000) has noted that *G. juniperina* subsp. *juniperina* has a tendency to colonise mechanically disturbed areas. Plants appear to prefer relatively open conditions where understorey species such as *Bursaria spinosa* (Native Blackthorn) are sparse (NPWS 2002).

Populations are usually between 40 and 300 plants, but larger populations of thousands of plants are known to occur near Erskine Park, Mount Druitt and Marsden Park (NPWS 2002, Sinclair Knight Mertz 2000).

As the distribution of this species coincides with major growth areas in Sydney, loss, degradation and fragmentation of habitat due to clearing of native vegetation is a major threat to *G. juniperina* subsp. *juniperina*. Other disturbances also occur such as rubbish dumping, trampling, road works, dumping of fill, changes in drainage, recreational activities, weed invasion and inappropriate fire regimes.

This species was not observed on the subject site, however, it has been reported from the properties to the east of the subject site in a similar vegetation community (AMBS 2002).

4.2 Vegetation Communities of Conservation Significance

Two endangered ecological communities as listed under the TSC Act (1995) were confirmed as occurring on site: Cumberland Plain Woodland and River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (formerly known as Sydney Coastal River-flat Forest). Cumberland Plain Woodland is also listed under the Commonwealth legislation, the EPBC Act (1999).

The Cumberland Plain Woodland occurs on the flats in the north western part of the site and the River-Flat Eucalypt Forest is restricted to the riparian area in the southern part. The quarry obviously does not support vegetation and the overburden from the quarry supports grassland, mainly of introduced species.

The distribution of these communities on the subject site is shown in Figure 1.

4.2.1 Cumberland Plain Woodland

Cumberland Plain Woodland is listed as an endangered ecological community under the NSW Threatened Species Conservation Act (1995) and the Commonwealth Environmental Protection and Biodiversity Conservation Act (1999).

Two forms of Cumberland Plain Woodland have been recognised — Shale Hills Woodland and Shale Plains Woodland. As its name suggests, Shale Hills Woodland occurs mainly on the elevated and sloping parts of the Cumberland Plain, chiefly in the southern half. The canopy is dominated by *Eucalyptus moluccana* (Grey Box), *E. tereticornis* (Forest Red Gum) and *E. crebra* (Narrow-leaved Ironbark). Its shrubby understorey is dominated by *Bursaria spinosa* (Blackthorn) and other shrubs, such as *Acacia implexa*, *Indigofera australis* and *Dodonaea viscosa* subsp *cuneata*.

The habitat for Shale Plains Woodland is more abundant and so this is the most widely distributed sub-form of Cumberland Plain Woodland. The canopy is again dominated by *Eucalyptus moluccana* (Grey Box), *E. tereticornis* (Forest Red Gum), but may be joined by other species such as *Corymbia maculata* (Spotted Gum) and *E. eugenioides* (Thin-leaved Stringybark). *Bursaria spinosa* is again the dominant shrub species.

The ground layer may be rich in species and similar for both forms. Grasses, such as *Themeda australis* (Kangaroo Grass), *Microlaena stipoides* var *stipoides* (Weeping Meadow Grass) commonly occur with herbs such as *Dichondra repens* (Kidney Weed), *Brunoniella australis* (Blue Trumpet) and *Desmodium varians*.

Cumberland Plain Woodland is confined to the well structured clay soils of western Sydney, derived from Wianamatta shale (NSW Scientific Committee 1997). It has been estimated that this community once occupied 125,000 hectares across the Cumberland Plain, but that it now occurs in fragmented pockets across only 9% of that area (NPWS 2002a, 2002b). It is further represented across another 14% of the landscape as scattered trees (NPWS 2004).

It occurs in the local government areas of Auburn, Bankstown, Baulkham Hills, Blacktown, Camden, Campbelltown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Penrith and Wollondilly. Cumberland Plain Woodland occurs in a number of conservation reserves including Scheyville National Park, Windsor Downs Nature Reserve, Leacock Regional Park and Mulgoa Nature Reserve.

Habitat for other threatened species – such as the *Pimelea spicata* and the Cumberland Plain Large Land Snail (*Meridolum corneovirens*) – is contained within Cumberland Plain Woodland. However, due to the fragmented nature and disturbance history of most of the remnants, many serious weed species also occur.

The Shale Plains Woodland form of this vegetation community occurs as a large remnant in the north western corner of the subject site as well as a

small and disturbed fragment in the south adjacent to the riparian vegetation.

4.2.2 River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney basin and South East Corner bioregions

River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is listed as an Endangered Ecological Community under Schedule 1 of the Threatened Species Conservation Act (1995). It is not listed as under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The NSW Scientific Committee describes this community exhaustively in its final determination (NSW Scientific Committee 2005a). In summary, this ecological community occurs on silts and loams on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. The structure of the community may vary from tall open forests to woodlands but clearing may have resulted in it occurring only as scattered trees.

This community is threatened by continuing fragmentation and degradation, flood mitigation and drainage works, landfilling and earthworks, pollution, weed invasion, overgrazing, trampling, acid sulfate soils, removal of dead wood and rubbish dumping (NSW Scientific Committee 2005a).

This vegetation community occurs in the riparian area in the southern part of the subject site.

4.3 Fauna of Conservation Significance

Of those fauna species listed under the Commonwealth EPBC Act (1999) and the State TSC Act (1995) that occur within 10 kilometres of the subject site, it is judged that the potential exists for *Litoria aurea* Green and Golden Bell Frog, *Lophoictinia isura* Square-tailed Kite, *Pteropus poliocephalus* Grey-headed Flying-fox, *Saccolaimus flaviventris* Yellow-bellied Sheath-tail-bat, *Mormopterus norfolkensis* Eastern Freetail-bat, *Chalinolobus dwyeri* Large-eared Pied Bat, *Falsistrellus tasmaniensis* Eastern False Pipistrelle, *Miniopterus schreibersii oceanensis* Eastern Bentwing-bat, *Myotis macropus* Large-footed Myotis, *Scoteanax rueppellii* Greater Broad-nosed Bat and *Meridolum corneovirens* Cumberland Plain Large Land Snail to occur on the subject site.

Of these, only *Meridolum corneovirens* Cumberland Plain Large Land Snail was observed on site, confined to the north western corner of the north western remnant.

4.3.1 Endangered Species of Fauna

***Litoria aurea* Green and Golden Bell Frog**

The Green and Golden Bell Frog is listed as Endangered under Schedule 1 of the Threatened Species Conservation Act (1995). This species is listed as Vulnerable under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Green and Golden Bell Frog is a relatively large frog (up to 100mm), with irregular large spots and stripes of gold generally on a green background (Barker et al. 1995). The groin is a distinctive turquoise blue (Barker et al. 1995). This species has a broad distribution across eastern and south eastern New South Wales and far eastern Victoria (Cogger 2000), but generally occurs in isolated coastal pockets of its former distribution (NSW NPWS 1999). There are fears that previously known highland populations are now extinct (NSW NPWS 1999). The Green and Golden Bell Frog is found in large permanent swamps and ponds with emergent vegetation, particularly *Typha* sp and *Eleocharis* sp (Robinson 1993). It is occasionally found in unshaded ornamental ponds and farm dams (Robinson 1993), or under debris on low wet river flats (Cogger 2000). Optimum habitat includes such water bodies free of the predatory fish *Gambusia* sp, with a nearby grassy area and shelter sites such as vegetation or rocks (NSW NPWS 1999). They have also been recorded in highly disturbed sites, including building sites, brick pits, cleared land and landfill areas (NSW NPWS 1999). This species is active both day and night (Robinson 1993) and breeds in summer in warm and wet periods (NSW NPWS 1999).

Potential breeding and foraging habitat for this species occurs in the small dams in the western and north western parts of the site. This species was not observed during survey.

***Meridolum corneovirens* Cumberland Plain Large Land Snail**

The Cumberland Plain Large Land Snail is listed as Endangered under Schedule 1 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Cumberland Plain Large Land Snail is found on the Cumberland Plain in remnant pockets of urban bushland, in areas associated with Wianamatta Shale and old Nepean River gravels. Current knowledge suggests that it is restricted to Cumberland Plain Woodland and Castlereagh Woodlands of Western Sydney and also along the fringes of River-Flat Eucalypt Forest, especially where it meets Cumberland Plain Woodland (NPWS 2000).

It typically occurs under logs and debris and around bases of trees or clumps of grass, burrowing into loose soil, especially in times of drought (NSW Scientific Committee 1997). Today, with much of its original habitat disturbed, the snails are also found living under piles of old building

rubble, under bricks, in piles of old timber, under car bodies and sheets of corrugated iron.

The observation of only dead shells does not mean that the population is destroyed as they could be buried in the soil or hiding in inaccessible places (NSW Scientific Committee 1997).

This snail lives in a very restricted area of western Sydney between Prospect and Liverpool to the east and the Hawkesbury-Nepean River to the west, north to the Windsor-Richmond area and south to Picton.

Meridolum corneovirens, like many Australian land snails, feeds on fungi (Australian Museum no date).

A number of empty shells of this species were observed in the remnant of the north western corner of the subject site. The Wildlife Atlas database (DEC 2006) also indicates that this species has been recorded from the subject site previously in 2001.

4.3.2 Vulnerable Species of Fauna

***Lophoictinia isura* Square-tailed Kite**

The Square-tailed Kite is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Square-tailed Kite is a medium sized raptor with long wings and tail which is often seen soaring along treetops in open woodland areas throughout most of Australia (NSW NPWS 1999). Habitats include coastal forests and wooded lands of tropical and temperate Australia (NSW NPWS 1999). Records also exist from along vegetated watercourses further inland. Sightings of Square-tailed Kites are almost always solitary and usually over forest or woodlands, rarely over completely open country (Hollands 2003). This species is a specialist canopy hunter, regularly taking passerines and large insects (NSW NPWS 1999).

This species forms monogamous lifelong pairs and occupy huge territories of well over 100 square kilometres (Slater et al. 1995). During winter, this species often moves to coastal plains, where they feed on waterbirds on and around permanent wetlands (Garnett and Crowley 2000).

The subject site provides potential foraging habitat for this species in the wooded areas, principally in the Cumberland Plain Woodland. This species was not observed during survey.

***Pteropus poliocephalus* Grey-headed Flying-fox**

The Grey-headed Flying-fox is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is listed as

Vulnerable under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Grey-headed Flying-fox is a large flying-fox with a white or greyish head, reddish mantle around the neck and thick, shaggy fur extending to the ankles (Strahan 1995). This species has a distribution along eastern coastal Australia from Rockhampton in Queensland to western Victoria (Churchill 1998). The Grey-headed Flying-fox is a common species in rainforest and wet sclerophyll forest (Strahan 1995), also frequenting mangroves, paperbark swamps and cultivated areas (Churchill 1998). It is usually seen in large, noisy colonies, or in day 'camps' usually placed close to water in gullies with dense forest canopies (Tidemann 1995). This is a highly mobile species, and camps are regularly moved in response to local food availability (Churchill 1998). Most births occur around October (Strahan 1995). They forage widely at night for rainforest fruits and native blossoms (Strahan 1995), and is likely to be an important pollinator for many native species (Tidemann 1995).

Potential foraging habitat occurs on the subject site in the flowering eucalypts of the Cumberland Plain Woodland. This species was not observed during survey.

***Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat**

The Yellow-bellied Sheathtail-bat is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Yellow-bellied Sheathtail-bat is distinguished by glossy black fur on the upper body and white or cream fur on the lower body (Strahan 1995). Males have a prominent throat pouch (Churchill 1998). This species is found roosting in tree hollows in a very wide variety of habitats ranging from wet forests to deserts (Menkhorst and Knight 2001). They have also been recorded roosting in abandoned nests of Sugar Gliders, in buildings or in animal burrows (Churchill 1998). It is a common species in northern Australia, however is a rare visitor to southern areas in late summer-autumn (Menkhorst and Knight 2001). Females produce two young between the months of September and March (Strahan 1995).

The subject site provides potential foraging and roosting habitat for this species, principally in the wooded areas. This species was not observed during survey.

***Mormopterus norfolkensis* Eastern Freetail-bat**

The Eastern Freetail-bat is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Eastern Freetail-bat one of the smallest of the freetail-bats, with long fur and heavily wrinkled membranes (Strahan 1995). Males have a throat pouch (Strahan 1995). The Eastern Freetail-bat has a distribution from south of Sydney extending north into southern Queensland, near Brisbane (Churchill 1998). This species is generally found in warm temperate to subtropical rainforest and sclerophyll forests and woodlands (Strahan 1995). Most records are from dry eucalypt forest and woodland east of the Great Dividing Range (Allison and Hoyer 1995). This fast flying insectivore forages over water and below the vegetation canopy (Strahan 1995). It roosts by itself or in small colonies generally in tree hollows and crevices (Strahan 1995), however has been found roosting under roofs (Churchill 1998). Nothing is known of the reproduction of this species (Churchill 1998).

The subject site provides potential foraging and breeding habitat for this species in the forested and open areas and over the dams. This species was not observed during survey.

***Chalinolobus dwyeri* Large-eared Pied Bat**

The Large-eared Pied Bat is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is listed as Vulnerable under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Large-eared Pied Bat is a wattled bat with glossy black fur and a fringe of white around the body, beneath the wings and tail membrane (Strahan 1995). Distribution records range from south eastern Queensland to New South Wales from the coast to the western slopes of the Great Dividing Range (Churchill 1998).

This species has been recorded from habitats ranging from coastal wet sclerophyll forest to dry sclerophyll and open woodland (Strahan 1995). Small groups have been observed roosting in caves and mines (Strahan 1995) and, unlike many other species, Large-eared Pied Bats roost close to the entrance (Hoyer and Dwyer 1995). Twins are born in November or December (Strahan 1995).

Potential foraging habitat occurs on the subject site in Cumberland Plain Woodland. This species was not observed during survey.

***Falsistrellus tasmaniensis* Eastern False Pipistrelle**

The Eastern False Pipistrelle is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Eastern False Pipistrelle is a large, robust bat with dark to reddish brown fur on the back, and paler grey fur on the belly (Churchill 1998). There is a characteristic notch on the outer margin of the ear, near the tip (Churchill 1998).

This species is found from south east Queensland, through New South Wales and into Victoria and Tasmania (Churchill 1998). Eastern False Pipistrelles inhabit sclerophyll forests east of the Great Dividing Range and they appear to prefer wet habitats where trees are over 20 metres high (Churchill 1998).

Eastern False Pipistrelles generally roost in small colonies in the trunks of hollow eucalypts, however, they have also been found roosting in caves and old wooden buildings (Churchill 1998). They apparently hibernate over winter in the southern parts of its range (Phillips 1995). A single young is born in December (Menkhorst and Knight 2001).

Flight is swift and direct, often just below or within the tree canopy (Churchill 1998).

Potential foraging habitat occurs on the subject site in Cumberland Plain Woodland. This species was not observed during survey.

***Miniopterus schreibersii oceanensis* Eastern Bentwing-bat**

The Eastern Bentwing-bat is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Eastern Bentwing-bat has recently been identified as a result of revision to the taxonomy of the Common Bentwing-bat (*Miniopterus schreibersii*). The Eastern Bentwing-bat closely resembles the Little Bentwing-bat, however is larger (Strahan 1995). This species is distributed across the well-watered parts of eastern and northern Australia, however it hibernates in the southern parts of the range (Strahan 1995). Its range extends along the entire east coast of Australia, with a gap forming along the Gulf of Carpentaria, where records begin again in the Kimberley (Churchill 1998). Roost sites include caves, mines and tunnels with colonies reaching thousands in number (Strahan 1995). A single young is born in separate maternity caves November or December (Strahan 1995). This species hibernates in selected caves that are cold enough to reduce their metabolic temperatures and prolong fat reserves over winter (Churchill 1998).

The subject site provides potential foraging habitat for this species in the forested and adjacent open areas. This species was not observed during survey.

***Myotis macropus* Large-footed Myotis**

The Large-footed Myotis is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Large-footed Myotis is a small bat, distinguished by its large feet (Strahan 1995). This is a predominately coastal species, and rarely extends further than 100 kilometres inland (Churchill 1998). It has a distribution from the Kimberley to Victoria and South Australia and occurs inland along some major river systems such as the Murray River (Churchill 1998).

This species has been recorded from most habitat types, with proximity to water being the main habitat determinant (Churchill 1998). It roosts communally in caves, similar spaces, or among dense rainforest foliage (Strahan 1995). Roosts are usually close to water and colonies are usually made up of between 10 to 15 individuals (Churchill 1998).

They are generally torpid over winter (Richards 1995). In the southern parts of its range, a single young is born from November to December (Menkhorst and Knight 2001).

It uses its large feet to catch small fish or aquatic insects when flying over rivers and lakes, but it also forages for aerial insects (Strahan 1995).

The subject site provides potential foraging habitat in the small dams in the west and north western parts of the site. This species was not observed during survey.

***Scoteanax rueppellii* Greater Broad-nosed Bat**

The Greater Broad-nosed Bat is listed as Vulnerable under Schedule 2 of the Threatened Species Conservation Act (1995). This species is not listed under the Schedules of the Environment Protection and Biodiversity Conservation Act (1999).

The Greater Broad-nosed Bat is the largest of the broad-nosed bats, with a dark reddish-brown back and slightly paler below (Hoye and Richards 1995). It has a broad, almost bare muzzle, large eyes and well spaced ears (Strahan 1995). The Greater Broad-nosed Bat has a distribution ranging from the Atherton Tablelands in northern Queensland, down along the coastal regions into southern New South Wales (Churchill 1998).

In the southern parts of its range, this species is only found at low altitudes (below 500m) (Churchill 1998). This species inhabits wetter forests (Strahan 1995), particularly along gullies (Churchill 1998). It roosts in trunk or branch hollows and the roofs of old buildings (Churchill 1998).

This species is usually recorded along forest edges or watercourses (Strahan 1995), flying relatively slowly with little manoeuvrability (Menkhorst and Knight 2001). They feed on slow-flying prey such as large moths hawked quite low to the ground along the edges of vegetation (Churchill 1998). They are also known to eat other bats and probably do so in the wild (Churchill 1998).

Maternity sites are formed in suitable trees and young are born in January (Strahan 1995). This species generally emerges soon after sunset, flying 3 to 6 metres above the ground (Hoye and Richards 1995).

The subject site provides potential – albeit marginal - foraging and breeding habitat for this species in the forested areas. This species was not observed during survey.

4.4 Noxious Weeds

A number of noxious weed species as listed under the Noxious Weeds Act (1993) and the Noxious Weeds Amendment Act (2005) were located on the subject site: *Ageratina adenophora* (Crofton Weed), *Cortaderia selloana* (Pampas Grass), *Hypericum perforatum* (St John's Wort), *Ligustrum lucidum* (Broad-leaved Privet), *Ludwigia peruviana* (Ludwigia), *Lycium ferocissimum* (African Boxthorn) and *Parietaria judaica* (Pellitory).

***Ageratina adenophora* (Crofton Weed)**

This species is currently listed as W2, which means that it must be fully and continuously suppressed and destroyed. Under the Noxious Weeds Amendment Act (2005), it is declared as a Noxious Weed Class 4 in the Blacktown LGA. This means that the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.

This species was introduced from the Americas and is a perennial shrub growing to 1-1.5 metres in height. Its stems are covered in purplish hairs; leaves are rhomboidal, with blades almost as broad as long. Flower heads are clustered at the end of stems and are white in color. The plant flowers in late summer and autumn.

It is commonly found along the shaded banks of rivers and creeks, and around drains. The plant produces numerous seeds that are dispersed by wind and water and infestations can become quite large and dense.

Crofton Weed has been linked to the death of horses and can cause an acute pulmonary consolidation of the lungs of the animals.

Physical control by hand removal is possible if infestations are small and isolated. Herbicide control depends on the locality, and other species that may be present. Products such as Grazon DS, Tordon 75 D, and various Glyphosate based herbicides are effective.

This species was observed only in the riparian area in the southern part of the site.

***Cortaderia selloana* (Pampas Grass)**

This species is currently listed as W2, which means that it must be fully and continuously suppressed and destroyed. Under the Noxious Weeds Amendment Act (2005), it is declared as a Noxious Weed Class 4 in the

Blacktown LGA. This means that the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.

This species was introduced as a garden plant and, at that time, was thought to be sterile. However this is not the case as Pampas Grass has become a weed in many areas.

Physical control can be very successful, if the infestations are small. There are also registered herbicides that are appropriate for use.

This species was observed only in the riparian area in the southern part of the site.

***Hypericum perforatum* (St John's Wort)**

This species is currently listed as W2, which means that it must be fully and continuously suppressed and destroyed. Under the Noxious Weeds Amendment Act (2005), it is declared as a Noxious Weed Class 4 in the Blacktown LGA. This means that the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.

It was introduced from Europe, possibly for its medicinal properties. While it is used in herbal medicine, it causes photosensitisation in cattle, horses and goats, resulting in loss of condition, low productivity and sometimes death.

An integrated approach to St John's Wort control is recommended. Isolated single stalk annual plants can be removed by pulling or chipping, however all roots must be removed or the plant will regenerate. Mature seed heads should be physically removed and burnt. Several herbicides are registered for use on this plant, and they can be used at any time of the year when active growth occurs. A mite (*Aculus hyperici*) has been released at many locations since 1991, but has rarely established, most likely due to poor seasonal conditions. Biological control will not eradicate St John's Wort but it may bring heavily infested areas under control.

This species was observed only in the Cumberland Plain Woodland remnant in the north west of the site. It was not common.

***Ligustrum lucidum* (Broad-leaved Privet)**

This species is currently listed as W4b, which means that it must not be sold, propagated or knowingly distributed and any existing weed must be prevented from flowering and fruiting. Under the Noxious Weeds Amendment Act (2005), it is declared as a Noxious Weed Class 4 in the Blacktown LGA. This means that the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant must not be sold, propagated or knowingly distributed.

Introduced as a garden plant, Privet has become a major pest of urban bushland and riparian zones. It produces numerous berries that are a food source for some bird species, and they spread seeds across a wide area. Seed viability appears to be quite high.

Physical control is effective on small plants only. There are a number of herbicides registered for use on this species, recommended methods of application being the cut stump treatment or as an overall foliar treatment.

This species was observed only in the riparian area in the southern part of the site.

***Ludwigia peruviana* (Ludwigia)**

This species is currently listed as W2, which means that it must be fully and continuously suppressed and destroyed. Under the Noxious Weeds Amendment Act (2005), it is declared as a Noxious Weed Class 5 across all of NSW, which means that this is a notifiable weed.

It has the potential to become a serious weed in wetlands and creeks and drainage channels. This species produces millions of very small and light seeds that are distributed by wind and water.

If plants have not seeded, physical removal can be an effective control method. Limited herbicides are available and no *biological control* agents are available.

This species was observed only in the Cumberland Plain Woodland remnant in the north west of the site. It was not common.

***Lycium ferocissimum* (African Boxthorn)**

This species is currently listed as W2, which means that it must be fully and continuously suppressed and destroyed. Under the Noxious Weeds Amendment Act (2005), it is declared as a Noxious Weed Class 4 in the Blacktown LGA. This means that the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.

African Boxthorn was introduced for use as a hedgerow plant. Native birds and other animals soon found the ripe fruit a useful food source and has spread the seed over large distances. African Boxthorn has proven to be a hardy plant, able to withstand droughts, fire, and frosts. In times of stress, the plant will often drop all leaves and seem almost dead until conditions are favourable, when it can quickly produce new leaves and flowers. The long sharp spines can puncture vehicle tyres and restrict cattle grazing; well established plants provide a harbour for vermin.

Small seedlings can be physically removed successfully. However, larger plants with well-developed root systems are more difficult, as they can regenerate from root fragments. There are a number of herbicides

registered for control; the condition of the plants has a big impact on the results. There are no biological control agents available.

This species was widespread across the site, being found in all vegetation types and remnants. It was most common in the riparian area in the southern part of the site.

***Parietaria judaica* (Pellitory)**

This species is currently listed as W3, which means that it must be prevented from spreading and its numbers and distribution reduced. Under the Noxious Weeds Amendment Act (2005), it is declared as a Noxious Weed Class 4 in the Blacktown LGA. This means that the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.

This species is a native to the Mediterranean region and naturalised populations exist in South Australia, Queensland and New South Wales. It prefers moist situations, growing in pavement cracks in urban settings. In bushland situations it can compete successfully with other species, sometimes forming dense monotypic stands.

It is predicted to have some environmental impact on open, rocky positions such as rock ledges of cliffs and gullies where it can exploit moisture in the fissures and compete with native plant species.

Dispersal is by seed which can be carried by flowing water or adhere to the fur of animals and human clothing. Seeds will germinate throughout the year. Eradication is not considered possible since the plant is very widespread.

This species was not common on the subject site, only being found in the riparian area in the southern part of the site.

5 CONSTRAINTS

The major ecological constraints associated with the subject site are those associated with minimising impact on threatened species and their habitats. To that end, the specific constraints articulated in the Precinct Plan are also targeted at vegetation retention, particularly in regards to that in the riparian zone and in a configuration likely to function as a wildlife corridor. Noxious weed control is also required across the site.

Marsdenia viridiflora subsp. viridiflora

Incompatible activities: grazing, trail bike riding, rubbish dumping, clearing, underscrubbing, further disturbing or reducing the area of Cumberland Plain Woodland habitat, inappropriate fire regime

Compatible activities: rehabilitation of habitat by control of weeds, rehabilitation of habitat by control of rabbits, passive recreation, appropriate fire regime

Hypsela sessiliflora

Incompatible activities: grazing, trail bike riding, rubbish dumping, clearing, underscrubbing, further disturbing or reducing the area of Cumberland Plain Woodland habitat, inappropriate fire regime, hydrological changes to habitat

Compatible activities: rehabilitation of habitat by control of weeds, rehabilitation of habitat by control of rabbits, passive recreation, appropriate fire regime

Pimelea spicata

Incompatible activities: grazing, trail bike riding, rubbish dumping, clearing, underscrubbing, further disturbing or reducing the area of Cumberland Plain Woodland habitat, inappropriate fire regime,

Compatible activities: rehabilitation of habitat by control of weeds, rehabilitation of habitat by control of rabbits, passive recreation, appropriate fire regime

Acacia pubescens

Incompatible activities: grazing, trail bike riding, rubbish dumping, clearing, underscrubbing, further disturbing or reducing the area of Cumberland Plain Woodland habitat, inappropriate fire regime,

Compatible activities: rehabilitation of habitat by control of weeds, rehabilitation of habitat by control of rabbits, passive recreation, appropriate fire regime

Grevillea juniperina* subsp. *juniperina

Incompatible activities: grazing, trail bike riding, rubbish dumping, clearing, underscrubbing, further disturbing or reducing the area of Cumberland Plain Woodland habitat, inappropriate fire regime

Compatible activities: rehabilitation of habitat by control of weeds, rehabilitation of habitat by control of rabbits, passive recreation, appropriate fire regime

Cumberland Plain Woodland

Incompatible activities: grazing, trail bike riding, rubbish dumping, clearing, underscrubbing, filling and bulk earth works, inappropriate fire regime

Compatible activities: rehabilitation of habitat by control of weeds, rehabilitation of habitat by control of rabbits, passive recreation, appropriate fire regime

River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions

Incompatible activities: grazing, trail bike riding, rubbish dumping, clearing, underscrubbing, hydrological changes, filling and bulk earth works, inappropriate fire regime

Compatible activities: rehabilitation of habitat by control of weeds, rehabilitation of habitat by control of rabbits, passive recreation, appropriate fire regime

***Litoria aurea* Green and Golden Bell Frog**

Incompatible activities: removal of aquatic habitat, disturbance of aquatic habitat, presence of predators such as *Gambusia*, rubbish dumping, hydrological changes, filling and bulk earth works

Compatible activities: rehabilitation of habitat by control of weeds, rehabilitation of habitat by control of predators

***Lophoictinia isura* Square-tailed Kite**

Incompatible activities: grazing, trail bike riding, rubbish dumping, clearing, underscrubbing, further disturbing or reducing the area of Cumberland Plain Woodland habitat, removal of roost sites, disturbing or reducing the populations of prey species, removal of dams used for drinking, inappropriate fire regime

Compatible activities: rehabilitation of habitat by control of weeds, passive recreation, appropriate fire regime

***Saccolaimus flaviventris* Yellow-bellied Sheath-tail-bat**

Incompatible activities: clearing, further disturbing or reducing the area of Cumberland Plain Woodland habitat, loss of roost trees, removal of dams used for drinking, inappropriate fire regime

Compatible activities: rehabilitation of habitat by control of weeds, retention of habitat trees, provision of artificial roost boxes, passive recreation, appropriate fire regime

***Mormopterus norfolkensis* Eastern Freetail-bat**

Incompatible activities: clearing, further disturbing or reducing the area of Cumberland Plain Woodland habitat, loss of roost trees, loss of aquatic habitat for foraging, removal of dams used for drinking, inappropriate fire regime

Compatible activities: rehabilitation of habitat by control of weeds, retention of habitat trees, provision of artificial roost boxes, provision of aquatic habitat for foraging, passive recreation, appropriate fire regime

***Pteropus poliocephalus* Grey-headed Flying-fox**

Incompatible activities: clearing, further disturbing or reducing the area of Cumberland Plain Woodland habitat, removal of dams used for drinking, inappropriate fire regime

Compatible activities: rehabilitation of habitat by control of weeds, provision of food trees in landscaping, passive recreation, appropriate fire regime

***Chalinolobus dwyeri* Large-eared Pied Bat**

Incompatible activities: clearing, further disturbing or reducing the area of Cumberland Plain Woodland habitat, removal of dams used for drinking, inappropriate fire regime

Compatible activities: rehabilitation of habitat by control of weeds, passive recreation, appropriate fire regime

***Falsistrellus tasmaniensis* Eastern False Pipistrelle**

Incompatible activities: clearing, further disturbing or reducing the area of Cumberland Plain Woodland habitat, loss of roost trees, removal of dams used for drinking, inappropriate fire regime

Compatible activities: rehabilitation of habitat by control of weeds, retention of habitat trees, provision of artificial roost boxes, passive recreation, appropriate fire regime

***Miniopterus schreibersii oceanensis* Eastern Bentwing-bat**

Incompatible activities: clearing, further disturbing or reducing the area of Cumberland Plain Woodland habitat, inappropriate fire regime

Compatible activities: rehabilitation of habitat by control of weeds, passive recreation, appropriate fire regime

***Myotis macropus* Large-footed Myotis**

Incompatible activities: clearing, further disturbing or reducing the area of Cumberland Plain Woodland habitat, loss of roost trees, loss of aquatic habitat for foraging, removal of dams used for drinking, inappropriate fire regime

Compatible activities: rehabilitation of habitat by control of weeds, retention of habitat trees, provision of artificial roost boxes, provision of aquatic habitat for foraging, passive recreation, appropriate fire regime

***Scoteanax rueppellii* Greater Broad-nosed Bat**

Incompatible activities: clearing, further disturbing or reducing the area of Cumberland Plain Woodland habitat, loss of roost trees, removal of dams used for drinking, inappropriate fire regime

Compatible activities: rehabilitation of habitat by control of weeds, retention of habitat trees, provision of artificial roost boxes, passive recreation, appropriate fire regime

***Meridolum corneovirens* Cumberland Plain Large Land Snail**

Incompatible activities: clearing, further disturbing or reducing the area of Cumberland Plain Woodland habitat, loss of understorey, inappropriate fire regime

Compatible activities: rehabilitation of habitat by control of weeds, passive recreation, appropriate fire regime

Riparian zone

Incompatible activities: works associated with asset protection zones, clearing or disturbing vegetation within the riparian zone of the Ropes Creek tributary, hydrological changes

Compatible activities: rehabilitation of habitat by control of weeds, appropriate fire regime, retention of quality stands of trees, retention of understorey vegetation within corridors

Conservation area

Incompatible activities: works associated with asset protection zones

Compatible activities: rehabilitation of habitat by control of weeds, appropriate fire regime, retention of quality stands of trees, retention of understorey vegetation, provision of passive recreational opportunities.

Noxious Weed Control

Incompatible activities: passive management, further earth works without follow up weed management

Compatible activities: implementation of weed control program, control of soil disturbance, appropriate fire regime

6 RESPONSES TO THE CONSERVATION CHALLENGE

The common themes to the conservation challenges detailed above are the retention and rehabilitation of the natural vegetation, minimising disturbance to the understorey, retention of aquatic habitat, institution of an appropriate fire regime and maintenance of current hydrological characteristics.

The development proposal facilitates these conservation requirements to a large extent, by concentrating the development of the business park and associated facilities outside of the Cumberland Plain Woodland remnant in the north west and outside of the riparian zone in the south east.

However, these responses may be enhanced and strengthened if alternative designs and layouts were considered.

6.1 Cumberland Plain Woodland

Of particular relevance is the layout of the proposed road off Archbold Road that is adjacent to the Cumberland Plain Woodland remnant in the north western corner of the site. The proposed road runs along the remnant's southern and eastern boundaries.

This road configuration is part of the Precinct Plan and the preferred layout of the proponent is to have no facilities on the northern side of this road, within the remnant.

Any construction within the remnant has the potential for ecological impact. This may come about due to clearing for the building footprint itself, clearing for bushfire protection within a prescribed asset protection zone, addition of nutrients to the system and alteration to hydrology by runoff of stormwater. This is recognised by the constraints detailed in the Precinct Plan, including the prohibition of asset protection zone works within conservation areas. Having no development within the Cumberland Plain Woodland remnant would avoid any potential impacts.

In ecological terms, this would avoid all of the potential impacts that may result from further disturbance and loss of Cumberland Plain Woodland. Pedestrian access to the open space may be via a number of walkways from the road. The Precinct Plan requires that the remnant is integrated with the Business Park and that it is not isolated or trapped behind a wall of industrial buildings. Specific design and landscaping requirements can be placed on this lot so that the aesthetic intent of the Precinct Plan is also maintained.

6.2 Riparian Zone

Development options for the riparian zone also present conservation challenges. Strictly, as required by the Precinct Plan, development should be excluded from the riparian zone for a distance of 40 metres either side from the top of bank from the unnamed (but mapped) tributary of Ropes Creek.

However, the Precinct Plan is explicit in regards to the types of riparian corridors that are to be conserved and the functionality that it intends to provide. It has identified that “good quality stands of trees” are a priority for retention. Also, it maintains that the intention of retention and management of riparian corridors is to ensure that it is suitable as habitat and as movement corridors for native species.

The vegetation along the Ropes Creek tributary is delineated in the Precinct Plan as being of “low ecological value”, a finding that is confirmed by this constraints study. Most of the noxious weeds on site were observed in this area and the vegetation was dominated by weed species. Some of the noxious weeds require major rehabilitation works and soil conditioning for control. Others may only be controlled by application of herbicide that may be harmful to other species.

As the intention of vegetation retention in this area is principally to provide for a wildlife corridor, it is instructive to note the history of disturbance and surrounding land uses.

The vegetation mapped by NPWS (2002), Tozer (2003), recognised by AMBS (2002) and observed in survey for this report, differs from that recognised by Benson (1992). Benson (1992) did not report any vegetation in the southern part of the site. While this could be due to an oversight, it is more likely that the vegetation observed in contemporary studies is young regrowth, dating from a time subsequent to Benson’s work, or was present at that time as very small trees and therefore easily overlooked.

This explanation fits with the current interpretation that the vegetation in that area is dominated by of pioneer species (such as *Casuarina glauca* and the aggressive weed *Juncus acutus*) that are colonising the disturbed habitats of the riparian zone in relatively recent times.

The riparian area has been modified significantly over time with disturbances such as clearing and grazing, probably soil works and land shaping, and has often received overflow from the tailings dam upslope for the Pioneer quarry. This overflow brings with it a significant sediment load and exotic chemicals, and must have significantly altered the water quality.

AMBS (2002) classified the conservation value of this riparian area as “moderate”, based only on its connectivity to other remnants to the east and potential connectivity to Ropes Creek in the west. However, this connectivity is now compromised. The lands to the east are either developed or to be developed; there is little if any vegetation with which to connect in that direction.

The drainage channel across the lands to the west, draining towards Ropes Creek, is entirely devoid of woody vegetation. These lands are also slated for industrial development and potential connectivity is further frustrated by the Precinct Plan’s roading plan.

The riparian zone requires a significant degree of active management in order to facilitate its rehabilitation. The noxious weeds themselves require major soil works and/or herbicide application for control. Access must be established and maintained to avoid erosion and bank destabilisation. A large number of other weed species must be controlled, probably through both mechanical and chemical means. The ground and shrub layer in the riparian area are virtually made up only of weed species – native species must be replanted and the habitat manipulated to favour their long term survival. The vegetation structure must be made more diverse and of native species. The eucalypts are sparse and there is a predominance of Swamp Oak – a species of lesser value as fauna habitat. Water quality must improve and the banks made secure and stable. There are also many opportunities to enhance the area as fauna habitat.

If all of these works are not implemented both within and without the subject site, then it is likely that it will further deteriorate in an ecological sense.

Given that the required level of works is so great, the riparian zone will virtually be a constructed one.

As such significant works are required to rehabilitate this area, there is merit in the proposal to realign the creek so that it maximises the developable area, while still retaining the required riparian corridor and allowing for weed control, bank stabilisation, replanting, revegetation and other management and engineering works.

There is also merit in revisiting the Precinct Plan's unsupported requirement of a riparian corridor 80 metres wide. This is twice the required width for any other riparian corridor in the Precinct and it is also twice the width as strictly required under the Rivers and Foreshores Improvement Act (1948).

The functionality of this part of the unnamed tributary as a wildlife corridor is arguable, whatever size, as cleared land adjoins it both upstream and downstream. It is judged that the stated conservation objectives of the riparian zone can be accommodated by a protected zone of 40 metres, being 20 metres either side from top of bank of the unnamed tributary of Ropes Creek.

To this end, a diversion channel was created along the southern boundary in readiness for riparian works that include rehabilitation. Significant trees have also been identified for protection within and without the 80 metre riparian zone.

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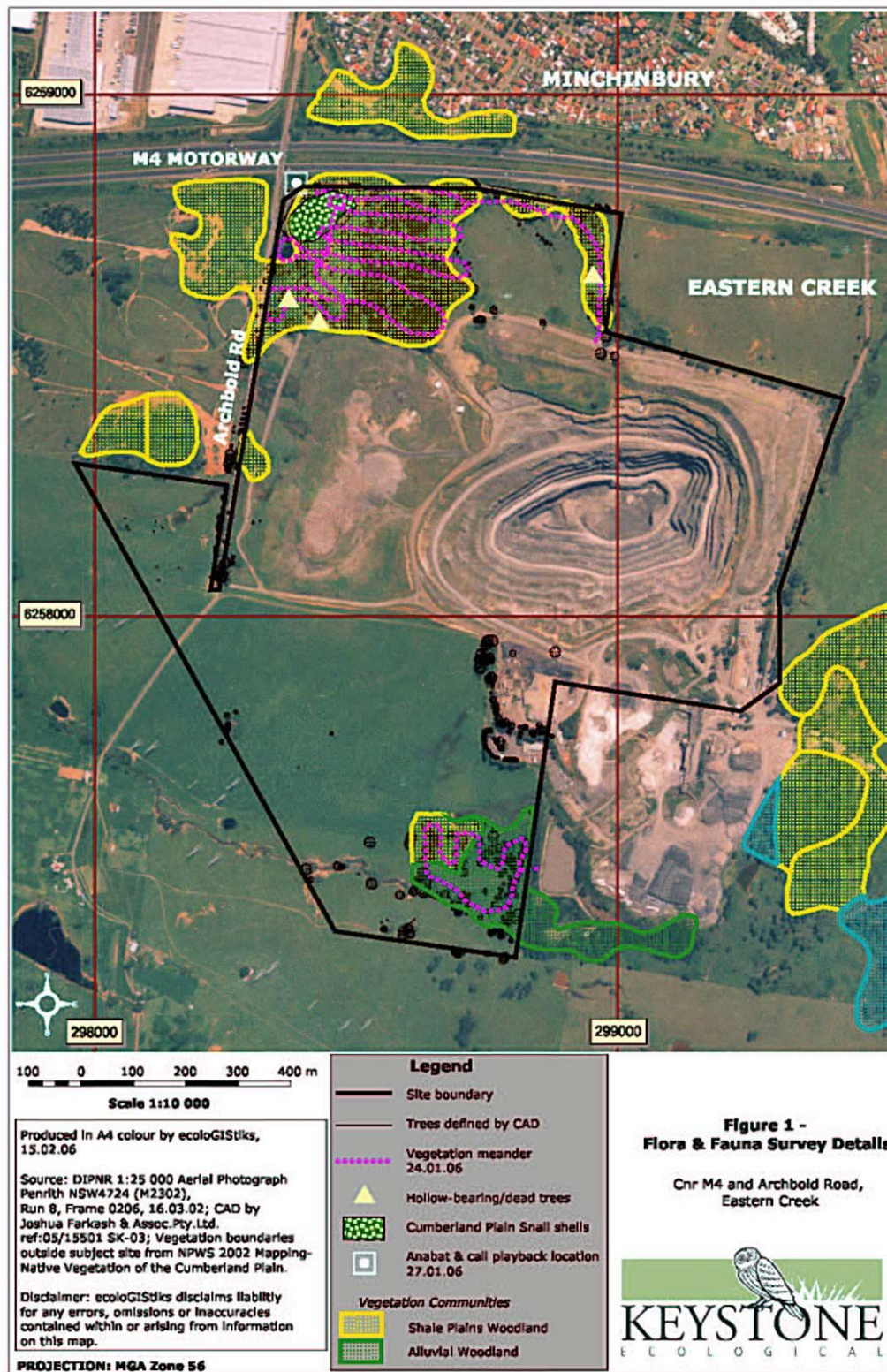
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8 FIGURE



9 TABLES

Table 1: Flora species of conservation significance recorded within 10 kilometres of the subject site. V = Vulnerable, E = Endangered, EPop = Endangered Population

Source: NPWS Atlas database, January 2006

Family	Scientific Name	TSC Act (1995) Status
Asclepiadaceae	<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>	EPop
Asclepidaceae	<i>Cynanchum elegans</i>	E
Ericaceae	<i>Epacris purpurascens</i> var. <i>purpurascens</i>	V
Fabaceae	<i>Dillwynia tenuifolia</i>	V, EPop
Fabaceae	<i>Pultenaea parviflora</i>	E
Lobeliaceae	<i>Hypsela sessiliflora</i>	E
Mimosaceae	<i>Acacia bynoeana</i>	V
Mimosaceae	<i>Acacia pubescens</i>	V
Myrtaceae	<i>Micromyrtus minutiflora</i>	V
Orchidaceae	<i>Pterostylis saxicola</i>	E
Proteaceae	<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	V
Proteaceae	<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	V
Proteaceae	<i>Persoonia nutans</i>	E
Thymelaeaceae	<i>Pimelea curviflora</i> var. <i>curviflora</i>	V
Thymelaeaceae	<i>Pimelea spicata</i>	E

Table 2: Fauna species of conservation significance recorded within 10 kilometres of the subject site. V = Vulnerable, E = Endangered
Source: NPWS Atlas database, January 2006

Fauna Group	Scientific Name	Common Name	TSC Act (1995) Status
Amphibians	<i>Litoria aurea</i>	Green and Golden Bell Frog	E
Birds	<i>Lophoictinia isura</i>	Square-tailed Kite	V
	<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	V
	<i>Xanthomyza phrygia</i>	Regent Honeyeater	E
	<i>Lathamus discolor</i>	Swift Parrot	E
	<i>Pyrrholaemus sagittatus</i>	Speckled Warbler	V
	<i>Burhinus grallarius</i>	Bush Stone-curlew	E
Mammals	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V
	<i>Petaurus australis</i>	Yellow-bellied Glider	V
	<i>Petaurus norfolcensis</i>	Squirrel Glider	V
	<i>Phascolarctos cinereus</i>	Koala	V
	<i>Pteropus poliocephalus</i>	Grey-Headed Flying-fox	V
	<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V
	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V
	<i>Miniopterus australis</i>	Little Bentwing-bat	V
	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V
	<i>Myotis macropus</i>	Large-footed Myotis	V
	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V
	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V
	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V
Snails	<i>Meridolum corniovirens</i>	Cumberland Plain Large Land Snail	E

Table 3: Flora species recorded on the subject site. Vegetation Community 1 = Alluvial Woodland, 2 = Shale Plains Woodland. X = recorded in this community, C = common in this community. * = introduced, w = Noxious Weed

Family		Scientific Name	Common Name	Vegetation Community	
				1	2
Acanthaceae		<i>Brunoniella pumilio</i>	Dwarf Blue Trumpet	X,C	X,C
Amaranthaceae		<i>Alternanthera denticulata</i>	Lesser Joyweed		X
Amaranthaceae	*	<i>Alternanthera pungens</i>	Khaki Weed		X
Anthericaceae		<i>Caesia parviflora</i>	Pale Grass Lily	X	X
Anthericaceae		<i>Tricoryne elatior</i>	Yellow Rush-lily		X,C
Apiaceae	*	<i>Hydrocotyle bonariensis</i>	Pennywort	X	
Asclepiadaceae	*	<i>Gomphocarpus fruticosus</i>	Narrow Leaf Cotton Bush		X
Asclepidaceae	*	<i>Araujia sericifera</i>	Moth Plant	X	X
Asparagaceae	*	<i>Asparagus officinalis</i>	Asparagus		X
Asparagaceae	*	<i>Myrsiphyllum asparagoides</i>	Bridal Creeper	X	
Asparagaceae	*	<i>Protasparagus aetheopicus</i>	Asparagus Fern	X	X
Asteraceae		<i>Brachyscome angustifolia</i>	-		X
Asteraceae		<i>Chrysocephalum semipapposum</i>	Clustered Everlasting		X
Asteraceae		<i>Lagenifera stipitata</i>	Common Lagenifera		X
Asteraceae		<i>Vittadinia pustulata</i>	-		X
Asteraceae		<i>Vittadinia sulcata</i>	-		X
Asteraceae	*w	<i>Ageratina adenophora</i>	Crofton Weed	X	
Asteraceae	*	<i>Ambrosia artemisiifolia</i>	Annual Ragweed	X	X
Asteraceae	*	<i>Bidens pilosa</i>	Cobblers Pegs	X	X
Asteraceae	*	<i>Bidens subalternans</i>	Cobblers Pegs		X
Asteraceae	*	<i>Cirsium vulgare</i>	Spear Thistle	X	X
Asteraceae	*	<i>Conyza albida</i>	Tall Fleabane	X	X
Asteraceae	*	<i>Hypochaeris radicata</i>	Flatweed	X	X
Asteraceae	*	<i>Senecio madagascariensis</i>	Fireweed	X	X
Asteraceae	*	<i>Senecio pterophorus</i>	African Daisy	X,C	X
Asteraceae	*	<i>Sonchus asper</i>	Prickly Sowthistle	X	
Asteraceae	*	<i>Sonchus oleraceus</i>	Common Sowthistle	X	
Brassicaceae	*	<i>Capsella bursa-pastoris</i>	Shepherd's Purse	X	X
Campanulaceae		<i>Wahlenbergia gracilis</i>	Native Bluebell		X
Casuarinaceae		<i>Casuarina glauca</i>	Swamp Oak	X	X,C
Chenopodiaceae		<i>Einadia hastata</i>	Berry Saltbush		X
Chenopodiaceae		<i>Einadia polygonoides</i>	-	X	X
Chenopodiaceae		<i>Einadia trigonos</i>	Fishweed	X	X
Chenopodiaceae	*	<i>Chenopodium murale</i>	Nettle-leaf Goosefoot		X
Clusiaceae		<i>Hypericum gramineum</i>	Little St Johns Wort		X
Clusiaceae	*w	<i>Hypericum perforatum</i>	St John's Wort		X
Commelinaceae		<i>Commelina cyanea</i>	Scurvy Weed	X,C	X
Convolvulaceae		<i>Dichondra repens</i>	Kidney Weed	X,C	X,C
Cyperaceae		<i>Cyperus gracilis</i>	-	X	X,C
Cyperaceae		<i>Fimbristylis dichotoma</i>	Common Fringe-rush	X	
Cyperaceae		<i>Gahnia clarkei</i>	Saw Sedge		X
Cyperaceae	*	<i>Cyperus eragrostis</i>	Umbrella Sedge	X	
Davalliaceae	*	<i>Nephrolepis cordifolia</i>	Fish-bone Fern	X	
Epacridaceae		<i>Astroloma humifusum</i>	Native Cranberry		X
Euphorbiaceae		<i>Phyllanthus virgatus</i>	-	X	X
Euphorbiaceae	*	<i>Chamaesyce sp.</i>	-	X	X
Fabaceae		<i>Dillwynia sieberi</i>	Prickly Parrot-pea		X,C
Fabaceae		<i>Indigofera australis</i>	Native Indigo		X
Fabaceae		<i>Glycine microphylla</i>	Twining Glycine	X	

Table 3 (cont'd): Flora species recorded on the subject site. Vegetation Community 1 = Alluvial Woodland, 2 = Shale Plains Woodland. X = recorded in this community, C = common in this community. * = introduced, w = Noxious Weed

Family		Scientific Name	Common Name	Vegetation Community	
				1	2
Fabaceae		<i>Glycine tabacina</i>	Variable Glycine	X	X
Fabaceae		<i>Hardenbergia violacea</i>	False Sarsparilla		X
Fabaceae		<i>Desmodium varians</i>	-	X	
Faboideae	*	<i>Erythrina X sykesii</i>	Coral Tree		X
Gentianaceae	*	<i>Centaurium tenuiflorum</i>	-		X
Juncaceae		<i>Juncus usitatus</i>	Common Rush		X
Juncaceae	*	<i>Juncus acutus</i>	-	X,C	X
Loranthaceae		<i>Amyema</i> sp.	-		X
Malaceae	*	<i>Cotoneaster glaucophyllus</i>	Cotoneaster	X	
Malvaceae	*	<i>Sida acuta</i>	-	X	X
Malvaceae	*	<i>Malva sylvestris</i>	Tall Mallow		X
Malvaceae	*	<i>Sida rhombifolia</i>	Paddy's Lucerne	X,C	X,C
Mimosaceae		<i>Acacia elongata</i>	Swamp Wattle		X
Mimosaceae		<i>Acacia falcata</i>	Sickle Wattle		X
Mimosaceae		<i>Acacia parramattensis</i>	Sydney Green Wattle		X
Mimosaceae		<i>Acacia stricta</i>	Straight Wattle		X
Myoporaceae		<i>Eremophila debilis</i>	Winter Apple	X	X
Myrtaceae		<i>Eucalyptus moluccana</i>	Grey Box	X	X,C
Myrtaceae		<i>Eucalyptus sideroxylon</i>	Mugga Ironbark		X
Myrtaceae		<i>Eucalyptus tereticornis</i>	Forest Red Gum	X	X
Oleaceae	*w	<i>Ligustrum lucidum</i>	Broad-leaved Privet	X	
Oleaceae	*	<i>Olea europea</i> subsp. <i>Africana</i>	African Olive	X	X
Onagraceae	*	<i>Ludwigia peploides</i>	Water Primrose		X
Onagraceae	*w	<i>Ludwigia peruviana</i>	Ludwigia		X
Oxalidaceae		<i>Oxalis perennans</i>	-	X,C	X
Phormiaceae		<i>Dianella longifolia</i>	Flax Lily		X
Phytolaccaceae	*	<i>Phytolacca octandra</i>	Inkweed		X
Pittosporaceae		<i>Bursaria spinosa</i>	Blackthorn	X	X,C
Plantaginaceae		<i>Plantago debilis</i>	Slender Plantain		X
Plantaginaceae	*	<i>Plantago lanceolata</i>	Ribwort	X	X
Poaceae		<i>Agrostis</i> sp.	-		X
Poaceae		<i>Aristida calycina</i>	Wire Grass		X
Poaceae		<i>Aristida ramosa</i>	Wire Grass		X,C
Poaceae		<i>Aristida vagans</i>	Threeawn Speargrass		X,C
Poaceae		<i>Austrodanthonia</i> sp.	Wallaby Grass		X
Poaceae		<i>Bothriochloa macra</i>	Redleg Grass		X
Poaceae		<i>Chloris ventricosa</i>	Tall Chloris	X	X
Poaceae		<i>Cymbopogon refractus</i>	Barbwire Grass		X
Poaceae		<i>Cynodon dactylon</i>	Common Couch	X,C	X,C
Poaceae		<i>Eragrostis leptostachya</i>	Paddock Lovegrass	X	X
Poaceae		<i>Eriochloa pseudoacrotricha</i>	Early Spring Grass	X,C	X
Poaceae		<i>Microlaena stipoides</i>	Weeping Grass	X,C	X,C
Poaceae		<i>Oplismenus aemulus</i>	Basket Grass	X	
Poaceae		<i>Paspalidium distans</i>	-		X
Poaceae		<i>Themeda australis</i>	Kangaroo Grass	X	X,C
Poaceae	*	<i>Aloe</i> sp.	Aloe	X	
Poaceae	*	<i>Briza subaristata</i>	-		X
Poaceae	*	<i>Bromus cartharticus</i>	Prairie Grass	X	X
Poaceae	*	<i>Chloris gayana</i>	Rhodes Grass	X,C	X,C
Poaceae	*w	<i>Cortaderia selloana</i>	Pampas Grass	X	

Table 3 (cont'd): Flora species recorded on the subject site. Vegetation Community 1 = Alluvial Woodland, 2 = Shale Plains Woodland. X = recorded in this community, C = common in this community. * = introduced, w = Noxious Weed

Family		Scientific Name	Common Name	Vegetation Community	
				1	2
Poaceae	*	<i>Ehrharta erecta</i>	Panic Veldtgrass	X	
Poaceae	*	<i>Eleusine tristachya</i>	Goosegrass		X
Poaceae	*	<i>Eragrostis curvula</i>	African Lovegrass	X,C	X
Poaceae	*	<i>Melinis repens</i>	Red Natal Grass		X
Poaceae	*	<i>Panicum maximum</i>	Guinea Grass		X,C
Poaceae	*	<i>Paspalum dilatatum</i>	Paspalum	X	X
Poaceae	*	<i>Phalaris</i> sp.	-	X	
Poaceae	*	<i>Setaria gracilis</i>	Slender Pigeon Grass	X,C	X,C
Poaceae	*	<i>Sporobolus africanus</i>	Parramatta Grass	X	X,C
Poaceae	*	<i>Vulpia myuros</i>	Rat's Tail Fescue		X
Polygonaceae		<i>Persicaria hydropiper</i>	Water Pepper		X
Polygonaceae		<i>Rumex brownii</i>	-	X	
Polygonaceae	*	<i>Rumex crispus</i>	Curled Dock		X
Portulacaceae		<i>Portulaca oleracea</i>	Purslane	X	X
Rosaceae	*	<i>Rosa rubiginosa</i>	Briar Rose		X
Rubiaceae		<i>Asperula conferta</i>	Common Woodruff	X	X
Sapindaceae		<i>Dodonaea viscosa</i>	Hop Bush		X
Sinopteridaceae		<i>Cheilanthes sieberi</i>	Mulga Fern		X,C
Solanaceae		<i>Solanum prinophyllum</i>	Forest Nightshade	X	X
Solanaceae	*	<i>Datura</i> sp.	Common Thornapple		X
Solanaceae	*w	<i>Lycium ferocissimum</i>	African Boxthorn	X,C	X
Solanaceae	*	<i>Solanum americanum</i>	Glossy Nightshade	X	X
Solanaceae	*	<i>Solanum pseudocapsicum</i>	Jerusalem Cherry	X	X
Stackhousiaceae		<i>Stackhousia viminea</i>	Slender Stackhousia		X
Thymeleaceae		<i>Pimelea latifolia</i> subsp. <i>hirsuta</i>	-		X
Typhaceae		<i>Typha domingensis</i>	Narrow-leaved Cumbungi	X	
Typhaceae		<i>Typha orientalis</i>	Broad-leaved Cumbungi	X	X
Urticaceae	*w	<i>Parietaria judaica</i>	Pellitory	X	
Verbenaceae	*	<i>Verbena bonariensis</i>	Purple Top	X	X

Table 4: Fauna species recorded on the subject site. Heard or observed = direct observation, this study; call recorded = Anabat call detector, this study; Anecdotal = reported siting by site manager, this study; X = reported for the subject site by AMBS in previous study.

Fauna Group	Scientific Name	Common Name	Nature and source of record
Gastropods	<i>Meridolum corniovirens</i>	Cumberland Plain Large Land Snail	Observed,X
Amphibians	<i>Crinia signifera</i>	Common Eastern Froglet	Heard,X
	<i>Uperoleia laevigata</i>	Smooth Toadlet	X
Reptiles	<i>Lampropholis</i> sp.	Skink	Observed,X
	<i>Tiliqua scincoides</i>	Eastern Blue Tongue	Observed
	<i>Pseudechis porphyriacus</i>	Red-Bellied Black Snake	Anecdotal,X
Birds	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe	X
	<i>Aythya australis</i>	Hardhead	X
	<i>Coturnix ypsilophora</i>	Brown Quail	X
	<i>Ocyphaps lophotes</i>	Crested Pigeon	X
	<i>Streptopelia chinensis</i>	Spotted Turtle-Dove	X
	<i>Cacatua roseicapilla</i>	Galah	X
	<i>Platycerus elegans</i>	Crimson Rosella	X
	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	X
	<i>Podargus strigoides</i>	Tawny Frogmouth	X
	<i>Malurus cyaneus</i>	Superb Fairy-wren	X
	<i>Manorina melanocephala</i>	Noisy Miner	Observed,X
	<i>Acanthiza pusilla</i>	Brown Thornbill	X
	<i>Pardalotus punctatus</i>	Spotted Pardalote	X
	<i>Rhipidura fuliginosa</i>	Grey Fantail	X
	<i>Rhipidura leucophrys</i>	Willie Wagtail	X
	<i>Grallina cyanoleuca</i>	Australian Magpie-Lark	X
	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	Observed,X
	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	Observed
	<i>Cracticus torquatus</i>	Grey Butcherbird	X
	<i>Gymnorhina tibicen</i>	Australian Magpie	Observed,X
	<i>Corvus coronoides</i>	Australian Raven	Heard,X
	<i>Hirundo neoxena</i>	Welcome Swallow	X
	<i>Acridotheres tristis</i>	Common Myna	X
	<i>Sturnus vulgaris</i>	Common Starling	X
Mammals	<i>Canis familiaris</i>	Dog	Scat,X
	<i>Vulpes vulpes</i>	European Red Fox	X
	<i>Felis catus</i>	Cat	X
	<i>Oryctolagus cuniculus</i>	Rabbit	Scat,X
	<i>Macropus giganteus</i>	Eastern Grey Kangaroo	Scat
	<i>Vespadelus vulturnus</i>	Little Forest Bat	Call recorded

Acknowledgements

Thanks go to Mr Joe Carlin and Mr Barry Collier for their assistance in the field. Thanks are also extended to Mr Glen Troy, Site Manager at Hansens Quarry, for his help and advice regarding access to the site.

Licensing

When conducting flora and fauna surveys, consultants are required to possess licences to ensure that works are completed in an appropriate manner.

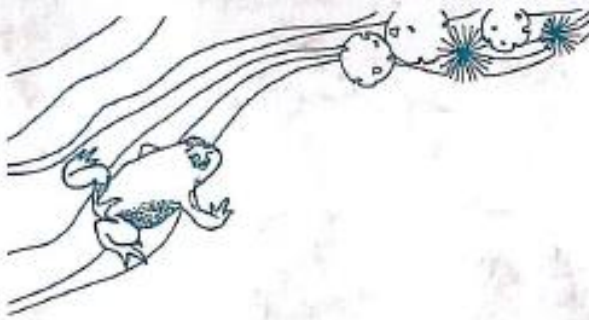
Staff and sub-consultants of Keystone Ecological are licensed under the NSW National Parks and Wildlife Act (1974) from the NSW NPWS. This allows Keystone Ecological to undertake scientific investigations, collect specimens of protected flora and fauna across NSW in service and non-service areas. This licence requires that all survey results are reported to the NSW NPWS for inclusion into the Atlas of NSW Wildlife.

Staff and sub-consultants of Keystone Ecological also hold an Animal Research Authority under the Animal Research Act (1995), as administered by NSW Agriculture. Surveys are approved and supervised by an Animal Care and Ethics Committee, applying the standards as detailed in the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes (NHMRC 1997).



Dial A Dump Industries, Eastern Creek
Environmental Management Strategy (EMS)
Pests, Vermin Feral Animals and Declared Noxious Weeds

APPENDIX B – ABEL



Vegetation Management Plan

for

**Light Horse Business Centre,
Archbold Road, Eastern Creek**

**Lot 2 DP 262213, Lot 1 DP 400697,
Lot 9 DP 241859 and Lot W DP 419612**

Proposed Resource Recovery and Landfill Facility



Date: 22 October 2009

Prepared for: Alexandria Landfill Pty Ltd

Prepared by: Abel Ecology

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LIST OF ABBREVIATIONS

EEC	Endangered Ecological Community
LGA	Local Government Area

Note regarding maps in this report

The maps used in this report having aerial photography, cadastral and topographic information have been obtained from the NSW Department of Lands Spatial Information eXchange and are Copyright © Department of Lands, 2009.

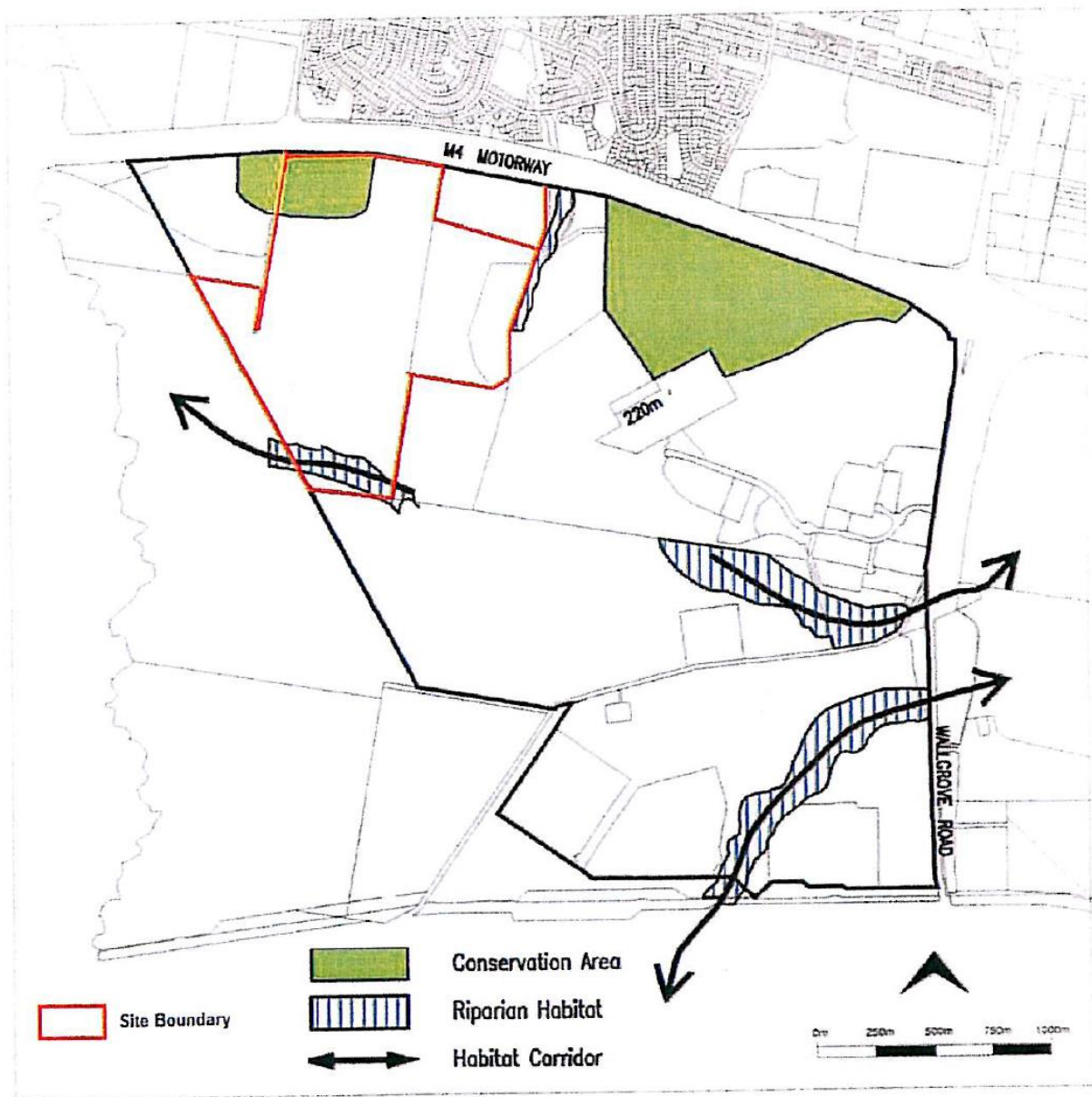


Figure 1. Locality Map

Base map from Figure 17, *Biodiversity Conservation Areas in State Environmental Planning Policy No. 59 – Central Western Sydney Economic and Employment Area, Eastern Creek Precinct Plan* (Blacktown City Council 2005)

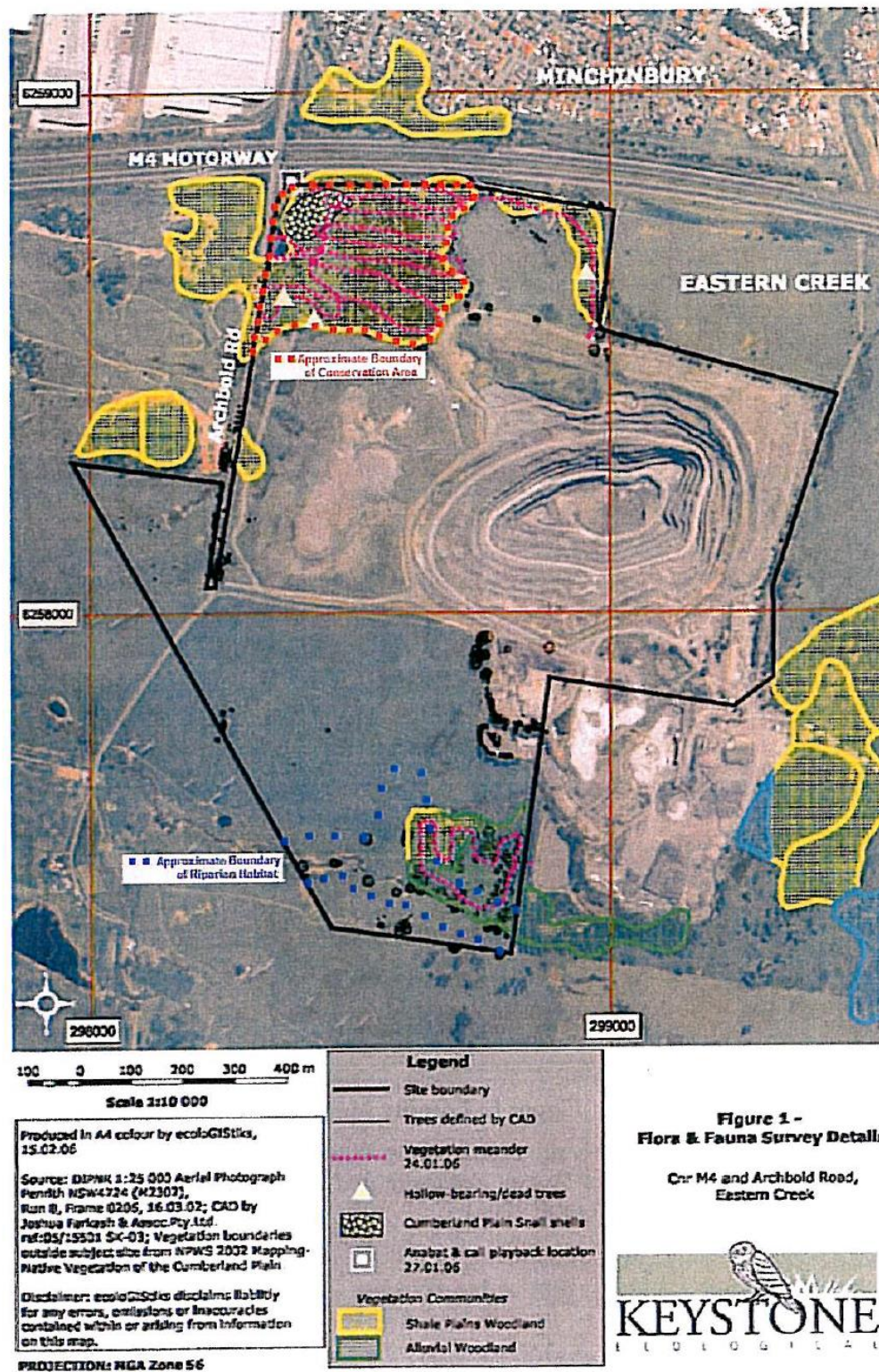


Figure 2. Site Map

Map from Figure 1, *Flora and Fauna Impact Assessment*, Lot 2 DP 262213, Lot 1 DP 400697, Lot 10 DP 241859 and Lot W DP 419612, Blacktown LGA. Unpublished report, Keystone Ecological (Ashby 2007)

1. General

1.1 Purpose of the Plan

This Management Plan specifies the manner in which the land to which it applies will be used and managed. It also specifies the objectives for that use and management. The Plan may also be used to determine priorities for the use of resources and funds and to guide the carrying out of works.

1.2 Land to which the Plan applies

This Plan applies only to the two areas of land identified in Figure 1 and Figure 2 as Conservation Area and Riparian Habitat within Lot 2 DP 262213. This Plan does not apply to all land within this Lot.

The boundaries of the two areas are defined as follows:

1 The Conservation Area

- a) The Conservation Area is bounded by the property boundary to the north and west and Shale Plains Woodland boundary to the south and east. The land is roughly a square of slightly less than 300m x 300m with an area of approximately 8.3ha (Ashby 2007).

2 The Riparian Habitat

- b) The Riparian Habitat according to Section 8.3.5b of SEPP 59 is defined as 40m either side of the bank of Ropes Creek tributary (Blacktown City Council 2005). The land is approximately 80m north-south x 400m east-west with an area of approximately 3.2ha. The locations of the watercourses on site is defined by the Prospect 9030-2N Third Edition Topographic & Orthophoto Map 1:25 000.

We note that there is differences between the areas as defined by the SEPP59 plan and the NPWS 2002 mapping. The maps in SEPP 59 are at coarse scale with no indication of spatial resolution or reference to survey points or other precise spatial data.

1.3 Management authority, tenure and ownership

For the purposes of this Plan, the management authority is the owner of the land, currently Alexandria Landfill Pty Ltd.

1.4 Strategic context

The strategic planning objectives (or vision) for the land to which the Plan applies are:

- a) to protect the remnant native vegetation within natural areas as self-sustaining ecological systems, retaining as far as possible locally indigenous plants and animals
- b) to maintain the scenic, scientific and heritage values of natural areas
- c) to prevent degradation of natural areas and minimise physical disturbance to land
- d) to maintain important habitat reserves

1.5 Planning framework

1.5.1 SEPP 59

The land to which this Plan applies is subject to *State Environmental Planning Policy No. 59 – Central Western Sydney Economic and Employment Area, Eastern Creek Precinct Plan* (Blacktown City Council 2005). This document is referred to as SEPP 59 in this document, and the *Precinct Plan* in the Consent Conditions.

The relevant parts of the SEPP applying to this development have been analysed in detail in the *Guiding Ecological Principles and Constraints* (Ashby 2006) and are included in this Plan.

1.5.2 Consent Conditions

Development consent has been granted in accordance with the conditions reproduced below from the *Eastern Creek Waste Project Final Draft Conditions for Application No 06_0239* (NSW Government Department of Planning 2009).

51. *The Propoepnent (sic) shall not disturb those areas identified as Conservation Areas in the Precinct Plan.*
52. *The Proponent must comply with Clean up notices issued by the Environment Protection Authority to the Proponent in relation to creek rehabilitation and restatement work within Lot 2 DP 262213.*

Landscape and Vegetation Management Plan

53. *The Proponent shall prepare and implement a Landscape and Vegetation Management Plan for the project to the satisfaction of the Director-General. This plan must:*
 - a) *be prepared in consultation with DWE and Council and be submitted to the Director-General for approval within prior to Construction;*
 - b) *be prepared in accordance with DWE's Guidelines for Controlled Activities – Vegetation Management Plans; and*
 - c) *include:*
 - a) *a Landscape Plan for the project, which identifies screen plantings to minimise visual impacts, particularly on the amenity berms;*
 - b) *detailed plans and procedures to:*
 - *restore and maintain the waterways and riparian zones of the Ropes Creek Tributary on the site;*
 - *manage weeds in the vicinity of the riparian zones;*
 - *integrate works into the proposed landscaping for the rest of the site;*
 - *manage impacts on fauna; and*
 - *monitor the performance of the proposed restoration works.*
 - d) *Provide details on how those areas identified as Conservation Areas in the Precinct Plan shall be actively managed for conservation purposes including:*
 - *improving the quality of the vegetation in these areas*
 - *measure to control pests vermin, and noxious weeds; and*
 - *measures to control access.*

This Plan complies with these conditions/exceptions as outlined below.

- 51 This Plan specifies that conservation areas shall be protected from all pedestrian, vehicular, and domestic animal access except for land and vegetation management activities and emergency services.
- 52 This notice has already been complied with and is outside the scope of this Plan.
- 53b The Guidelines for controlled activities (DWE 2008) are specifically for riparian areas and not other terrestrial landscapes. Nevertheless, this Plan complies with the general principles in the Guidelines including measures for controlling access, defining a schedule of works, and using photo monitoring points.
- 53ca The reference to berms and screen plantings apply to the waste facility area, not the conservation areas, which is outside the scope of this Plan.
- 53cb This item has been largely covered by the *Light Horse Business Centre Restoration of the Riparian Zone Management Plan* (Site Image Landscape Architects), the works of which have been completed (See *Section 2.2 Riparian Habitat*). This Plan also specifies protection of the area and exclusion of domestic animals to minimise impacts on fauna, ongoing weed management activities, and performance monitoring.

53cd This Plan specifies active management of vegetation to promote regeneration and improve its quality, measures to control pests and noxious weeds, and measures to control access to the conservation areas.

Requirements under any of the above policies or plans made under the Environmental Planning and Assessment Act 1979, the Native Vegetation Management Act 1997 or the Threatened Species Conservation Act 1995 are independent of, and apply in addition to, the requirements specified by this Management Plan.

1.6 Management objectives

Management objectives for the two areas are informed by SEPP 59 as analysed by the *Guiding Ecological Principles and Constraints* (Ashby 2006), the Consent Conditions, and the *Best Practice Guidelines for the Management and Restoration of Cumberland Plain Bushland* (DEC 2005). DECCW is currently preparing the Cumberland Plain Endangered Ecological Communities Recovery Plan (DECCW 2009), which should be adopted in future vegetation management plans when it is finalised.

The key steps according to the Best Practice Guidelines (DEC 2005), and the way in which this Plan achieves these steps, are outlined below.

1. Retain all existing native vegetation

Both defined areas will be retained in accordance with the Consent Conditions.

2. Protect any retained native vegetation from further degradation by fencing. Consolidate areas of native vegetation by linking remnants

Both areas will be fenced or otherwise protected from further degradation in accordance with the Consent Conditions.

Since the two areas are distinct, widely separated by cleared land, and of different vegetation communities, they cannot be linked. However, since both areas are on the boundary of the property, any development of land adjoining the property should consider linking to these areas. For example, the Riparian Habitat on this land is part of a Riparian Corridor across adjoining properties including the Hanson site to the south east defined in Section 5.0 of SEPP 59 (Blacktown City Council 2005).

3. Actively manage all retained and protected native vegetation. Active management should include activities to suppress weeds, control feral animals and encourage regeneration of native plants. It may also include the linking of remnant vegetation by corridors, increasing the size of remnants through the planting of local native species or the planting of supplementary understorey and groundcover species.

This Plan specifies active management of weeds, feral animals and natural regeneration. Linking the two areas within the property is not possible as outlined above. Increasing the size of the areas is not required under the Consent Conditions.

Planting of supplementary species is not appropriate since it should only occur when natural regeneration is not expected or possible, and all attempts to trigger natural regeneration of soil-stored seed have failed (DEC 2005, NPWS 2004). This Plan outlines methods to encourage and stimulate natural regeneration.

The primary objective of the Plan is to manage the land in a way that protects its natural values. The dominant purpose of management is therefore to protect and maintain the natural ecosystems that are present on the land.

Subsidiary objectives of the Plan are:

- a) to inform Council and the Department of Planning of the way in which the land is to be managed
- b) to achieve the specific objectives and works identified in the Plan
- c) to provide for the Plan's periodic review
- d) to simplify the process of management as far as possible.

2. Natural Resource Information and Site History

The two management areas have been the subject of previous surveys (AMBS 2002) which have informed SEPP 59, and more recent detailed Flora and Fauna Study (Ashby 2007).

2.1 Conservation Area

This area contains Cumberland Plain Woodland (Shale Plains Woodland) which is an endangered ecological community (EEC) listed under the TSC Act (1995) and EPBC Act (1999). Cumberland Plain Woodland has also had a preliminary determination to be listed as Critically Endangered, which was gazetted and exhibited from 21/11/08 to 23/1/09 (DECCW 2008).

Although it was earlier assessed as having high ecological importance due to its size, connectivity with other remnants, structural diversity and the potential or realised habitat for threatened species, it has been cleared and disturbed, it has very few large mature trees with hollows, has many young trees, little understorey, many weed species and a canopy of almost exclusively *Eucalyptus moluccana* (Grey Box). While several threatened plant species were expected to occur in this area, only potential habitat, not the actual species, were found during the recent survey (Ashby 2007).

At the time of the site visit for this report, the vegetation in this area was observed to range from open grassy woodland (Figure 3) to woodland with dense young tree regrowth (Figure 4). Few middle layer shrubs were observed (Figure 1) but this may not be a deficiency as this community is characterised by a grassy and herbaceous understorey (DEC 2005). While a variety of weeds were widespread and scattered throughout the area, the only dense infestation observed was a thicket of African Boxthorn (*Lycium ferocissimum*) in south east corner of the area (Figure 6). The dam in west of the area supported a range of native and exotic aquatic and wet area plants (Figure 7).

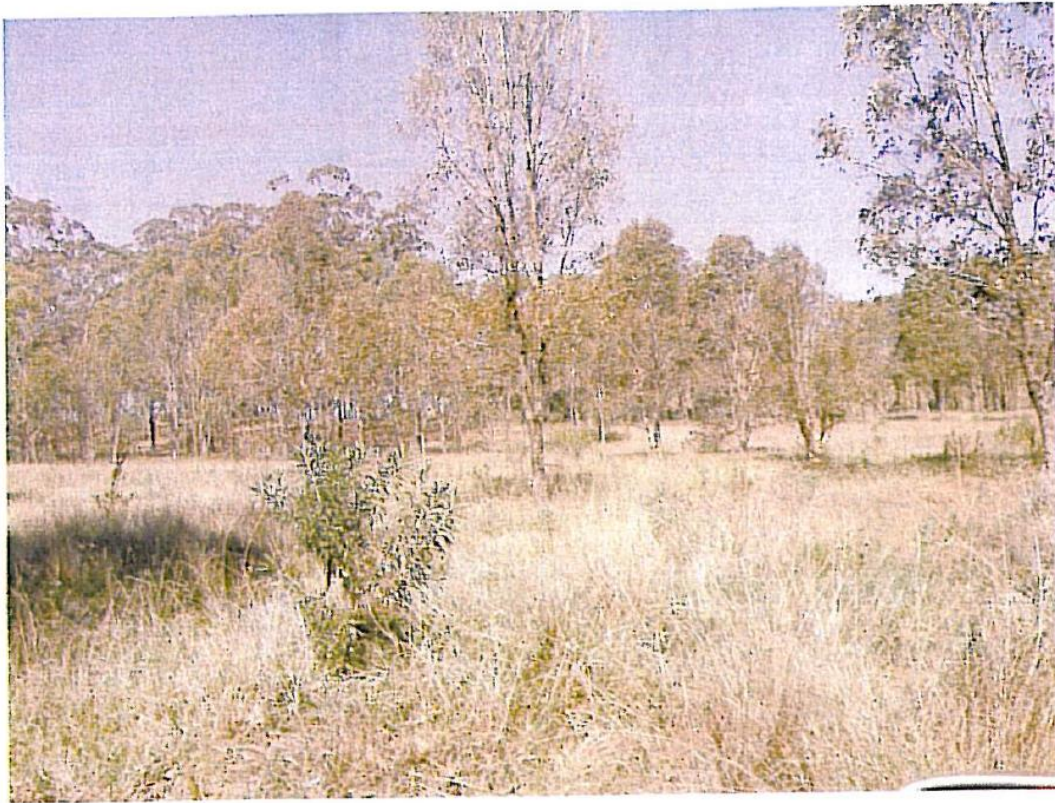


Figure 3. Conservation Area - open woodland



Figure 4. Conservation Area - dense tree regrowth



Figure 5. Conservation Area - grassy understorey



Figure 6. Conservation Area - Boxthorn thicket



Figure 7. Conservation Area - Dam

2.2 Riparian Habitat

This area is a shallow valley close to the southern boundary of the property directing water from east to west into Ropes Creek, which is identified in SEPP 59 (Blacktown City Council 2005) under Section 5.2.3 as the Ropes Creek Tributary Catchment, and in Figure 11 and 12 as a Riparian Corridor (Figure 15).

Some water collects from the surrounding land from rainfall, but water is also intermittently discharged from the Overflow Dam on the Hanson site on the eastern boundary (Figure 8), which is pumped from the bottom of the quarry, and for which Hanson have an EPA licence. This discharge will cease when the quarry becomes landfill.

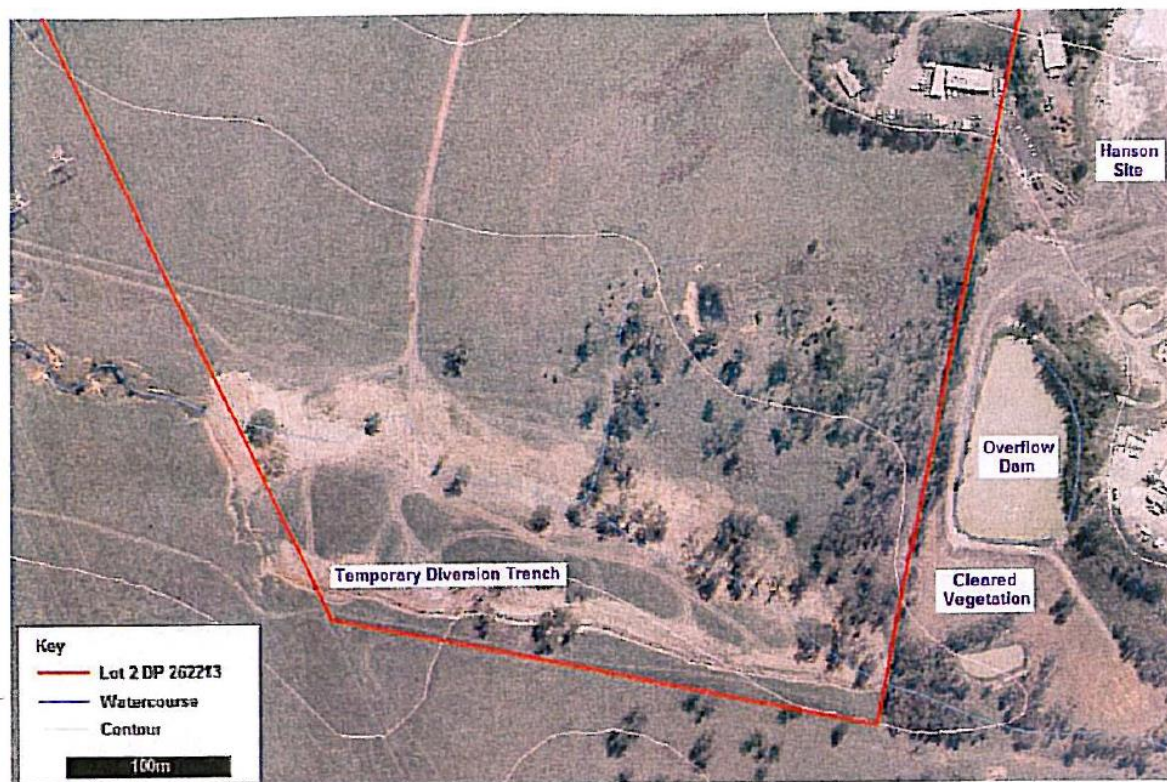


Figure 8. Riparian Habitat - remediation

The south east part of this area contains River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (formerly known as Sydney Coastal River-flat Forest) which is an endangered ecological communities listed under the TSC Act (1995). It was earlier assessed as having moderate ecological importance because of its connectivity to other remnants to the east and connectivity to Ropes Creek in the west.

At the time of the flora survey (Ashby 2007) the main tree species was *Casuarina glauca* (Swamp Oak) with occasional *Eucalyptus moluccana* (Grey Box), the rest of the vegetation was dominated by noxious and other weeds, and the creek line was eroded and sedimented.

In about 2007 Hanson cleared vegetation and constructed an unauthorised dam on their site, causing sludge to discharge into the Riparian Habitat. Works were therefore undertaken in the Riparian Habitat to create a temporary diversion trench on the south boundary of the property (Figure 8), correct scour and erosion, and remove noxious weeds in accordance with the Noxious Weeds Act (1993).

Following a notice to remediate and reinstate the creek being issued by DEECW, a Remediation Plan was prepared and executed to restore the watercourse to its original location, fill in the diversion trench, and re-instate groundcover by spray seeding (Site Image Landscape Architects). Native vegetation was not removed, and the riparian zone was restored to its previous state to the satisfaction of a subsequent DECCW inspection.

At the time of the site visit for this report, the vegetation in this area was observed to range from a rocky creek bed with minimal grass in the west (Figure 9), a shallow grass layer with some reeds and sedges in the centre (Figure 10), through to a *Casuarina* forest with grassy understorey in the east (Figure 11).



Figure 9. Riparian Habitat - west boundary looking west



Figure 10. Riparian Habitat - centre looking east



Figure 11. Riparian Habitat - east boundary looking north

A dense growth of the weed *Juncus acutus* was observed on the upstream end of creek on the east boundary of the property shared with the adjacent Hanson site (Figure 12). This thicket spread into the adjacent Hanson site, on which other weed species were also observed growing. Therefore until the upstream source of weeds is eliminated, ongoing management will be required to remove weeds spread from upstream onto this and other downstream sites.



Figure 12. Riparian Habitat - *Juncus acutus* thicket on east boundary

3. Management issues

Management of the land must take into account the Plan's primary objective, that is, to manage the land in a way that protects its natural values. This entails consideration of the following specific issues:

- a) biodiversity conservation
- b) vegetation management and weeds
- c) fauna
- d) bushfire
- e) streams and stormwater management
- f) activities and maintenance
- g) pollution control
- h) access and occupation
- i) administration
- j) other issues

Section 4 describes, in relation to each management issue, management guidelines that are to be applied and desired outcomes that must be achieved.

The management issues addressed by this Plan can be grouped into three categories relating to:

- a) **protection of natural ecosystems** on the land and their ability to be self-sustaining
- b) **activities carried out on the land** which may adversely affect natural ecosystems on the land
- c) **activities carried out on nearby land** which may adversely affect natural ecosystems on the land.

Some issues may fall into more than one category.

This Plan primarily relates to the first two categories. Issues relating to the latter category are primarily regulated through the process of assessment and determination of development applications under the Environmental Planning and Assessment Act 1979.

4. Management guidelines

4.1 Biodiversity conservation

Biodiversity - refers to the considerable variety of native flora and fauna that occurs in the area. This is important for ecological reasons and also has cultural and social significance.

Diversity - refers to the variety of species and vegetation communities present. An objective of management is to retain the diversity of natural areas.

Rare and threatened plants - no threatened plant species were found on the site in the latest flora survey (Ashby 2007), so no special measures beyond protection of both areas of land is required.

Fragmentation of natural areas - since both portions of land are intact areas to be preserved, and no roads are planned within either area, no extra measures are required to prevent further fragmentation.

4.2 Vegetation Management and Weeds

The aim of vegetation management is to retain the distribution, abundance and diversity of native species and communities presently existing on the land, and to improve the quality of existing vegetation where possible.

The Riparian Habitat is to be periodically inspected and noxious weeds removed. Since weeds in the Conservation Area are widespread and scattered throughout the area at a relatively low density apart from the Boxthorn thicket, the aim should be to progressively control all weeds, not just noxious weeds, to improve the quality of the Cumberland Plain Woodland vegetation.

Dominant species - management is to retain dominant native species and allow natural processes to continue. Natural vegetation communities, whilst self-sustaining, vary over time in response to changes in factors such as climate, bushfire or other disturbances. Communities are generally described in terms of dominant species (especially trees).

Fire sensitivity of plant species - different species have varying sensitivity to fire and may require varying fire frequencies and intensities for survival. This is to be considered in undertaking any management activities involving the use of fire.

Weeds - for the purpose of vegetation management in natural areas, a weed is regarded as any non-indigenous plant.

Weed control - refers to control of non-indigenous native plants in natural areas. Measures are to be implemented to control and manage existing and future processes leading to weed invasion and sources of weeds which are invasive of natural areas. An important element of weed control is an understanding the causes of weed invasion and taking measures to minimise these causes.

Weed monitoring

Monitoring is to be undertaken to identify and respond to the occurrence of plant species which pose a potential threat to natural areas, and to measure the success of weed control measures. The checklists and forms in *Guidelines For Monitoring A Bushcare Project* (HNCMT 2000) may be a useful resource for monitoring.

The following monitoring locations are to be defined (Figure 13 and Figure 14):

- The boundaries of the Conservation Area.
- Two diagonal transects across the width of the Conservation Area, one from the north west to south east corner, and one from the south west to north east corner.
- The perimeter of the dam in the Conservation Area.
- A 20 x 20m quadrat in the boxthorn thicket in south east corner of Conservation Area
- Transects following the approximate line of the watercourses in the Riparian Habitat

All transects are to be visually inspected at the intervals specified in the Activity Schedule, and a record made of the abundance and distribution of weeds along each transect checked against the Flora List and added to the periodic report. The property boundary should also be inspected to monitor rubbish dumping.

The following photo monitoring points are to be set up:

- 1 points at the dam in the Conservation Area
- 1 points in the quadrat in the boxthorn thicket in south east corner of Conservation Area
- 1 point in the middle of the Conservation Area.
- 1 point in the middle of each of the perimeter transects (4 photo points).
- 6 points along the length of the Riparian Habitat

All monitoring points are to be photographed at the intervals specified in the Activity Schedule, and added to the periodic report.

The periodic report is to be prepared and presented to the relevant stakeholders.

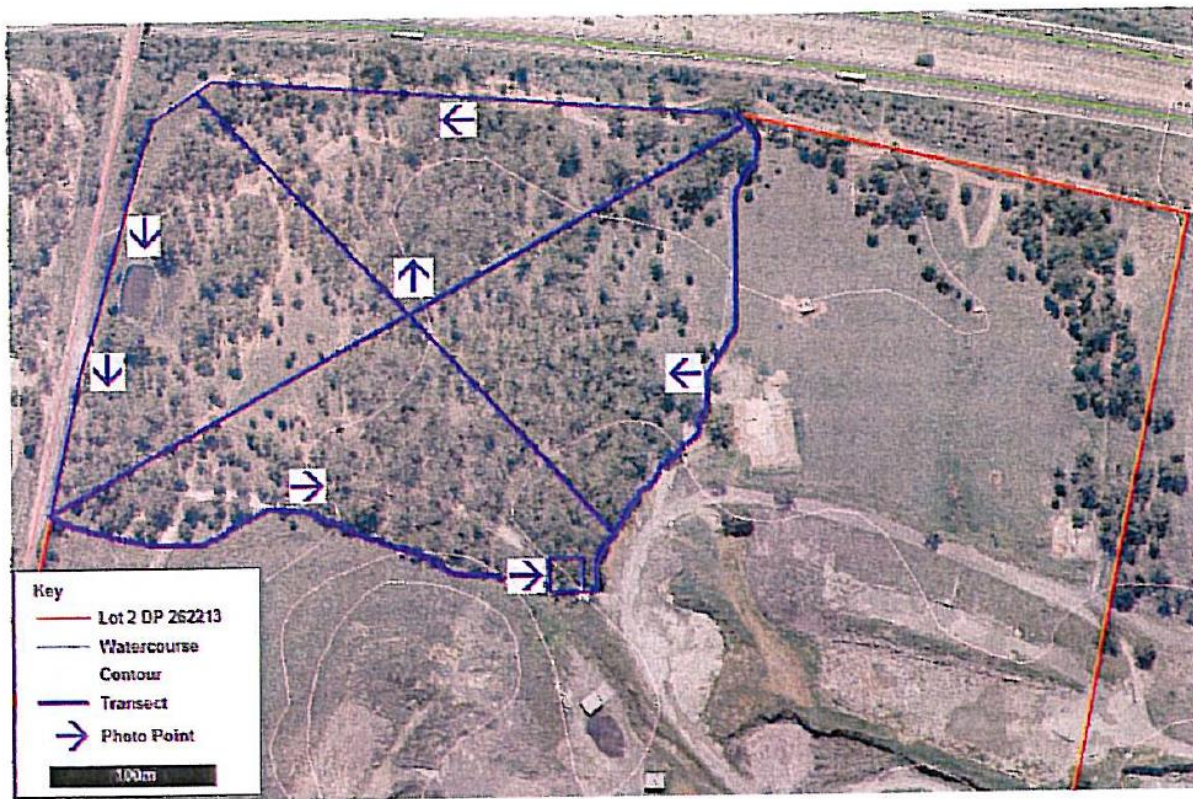


Figure 13. Conservation Area - Monitoring Points

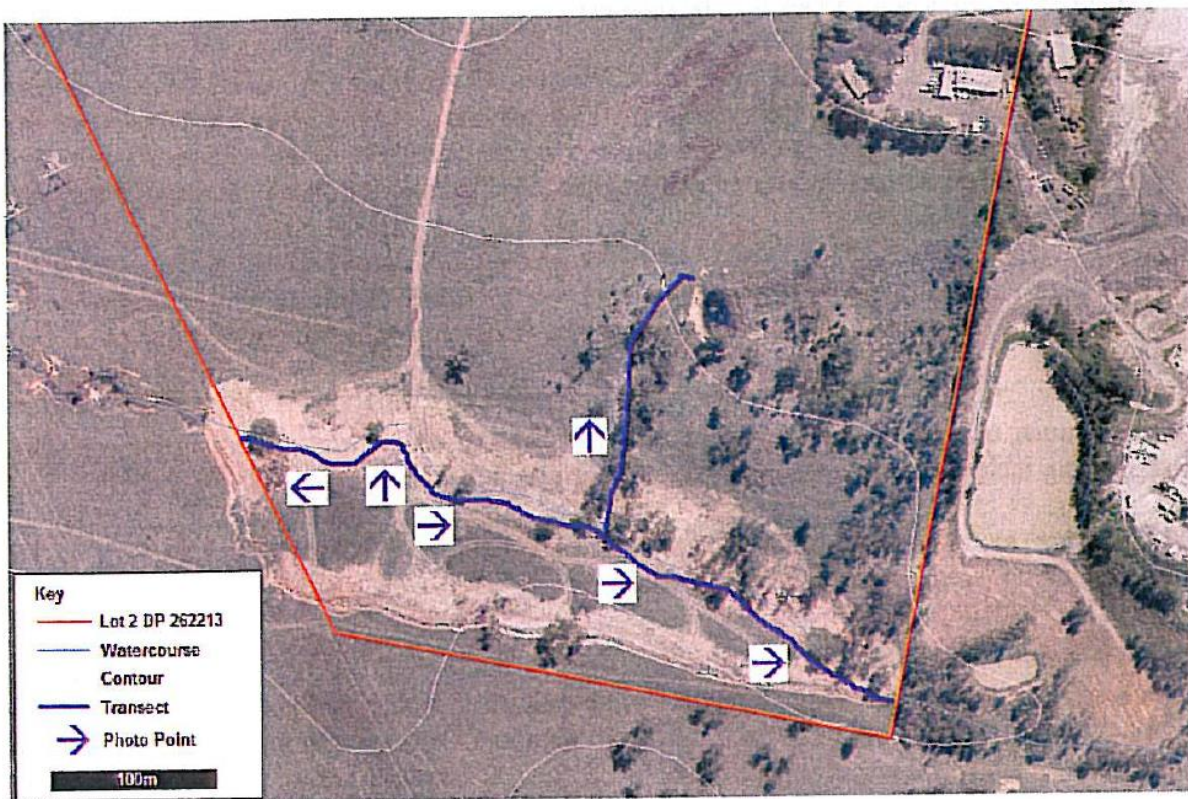


Figure 14. Riparian Habitat - Monitoring Points

Weed control techniques - weed control is to be carried out in a manner that minimises negative environmental impacts. Different techniques are required in varying situations, especially along watercourses, which are very sensitive to pollution impacts. See *Appendix 4 General Guidelines for Weed Control*.

Weed invasion - occurs in natural areas mainly as a result of the following factors:

- a) physical disturbance due to construction activity, clearing, or mowing
- b) increased soil moisture due to runoff
- c) increased nutrients from runoff or waste dumping
- d) increased light levels due to clearing or dieback
- e) increase in weed propagules and seed dispersal agents.

Measures are to be taken to prevent the occurrence of factors leading to weed invasion. Typically, weeds move into bushland from adjoining urban or other modified areas. The main entry locations are stormwater drains, roads and tracks and from over the back fences of individual residential properties. Weeds tend to spread most rapidly downslope along watercourses, roads and tracks, and then move slowly into adjacent bushland.

Noxious weeds - these are plants posing a threat to agriculture, the environment or the community, and are formally declared under the Noxious Weeds Act 1993. Some categories of noxious weeds are legally required to be removed as soon as possible. See *Appendix 1 Noxious Weeds in the Blacktown LGA*.

Regeneration and rehabilitation - where land disturbance occurs, bush regeneration is the preferred method of rehabilitation.

Fauna habitat - vegetation management is to have regard to the value of the vegetation as fauna habitat. In particular, old trees (both living and dead) and a diverse vegetation structure maintaining understorey species is to be retained.

Hollow-bearing trees should not be removed from anywhere on the site unless there is a safety imperative that has been determined by a qualified arborist. If such a tree must be removed for reasons of safety, then it must be felled in the presence of and under the advice of a suitably-qualified experienced zoologist or animal handler to minimise harm to any fauna that may use the hollow (Ashby 2007).

Vegetation removal - native vegetation must not be removed from the site. Any non-native vegetation which is removed is to be disposed of away from bushland to avoid spread of seed or nutrients.

Disturbance to vegetation - measures are to be taken to prevent disturbance to existing vegetation, including roots, water regime, and surrounding soil.

Vegetation along watercourses - vegetation and natural hydrological processes is to be retained along watercourses as far as possible.

4.3 Fauna

Native fauna populations and habitats are to be protected, maintained and enhanced. Impacts on wildlife and habitat are to be taken into consideration whenever any management activity is proposed (such as bushland regeneration, weed control, bushfire hazard reduction, recreation activities, etc.).

Threatened fauna - the only threatened species of native fauna found on the site was the Cumberland Plain Large Land Snail in the Conservation Area (Ashby 2007). Any activities undertaken on the land shall be carried out in a manner that ensures that such animals are not adversely affected by the activity.

Other native fauna - the presence of any native fauna is to be taken into account in the management of the land.

Introduced fauna - control of feral animals (foxes, wild dogs, feral cats, rabbits, etc.) can be undertaken as required in conjunction with wider regional programs. Note that such control measures and fencing will not completely or permanently exclude feral animals from either area.

Domestic animals - the use of the land for exercising, training or grazing of domestic animals (e.g. horses, sheep, goats, dogs, cats, etc.) is incompatible with the protection and management of native fauna and habitat, and must not be permitted or carried out. Stray domestic animals are to be excluded from both areas by appropriate fencing (See *Section 4.8 Access and occupation*).

4.4 Bushfire

The site has been subject to a detailed bushfire hazard assessment (Holmes Fire & Safety 2008) from which the following information and recommendations are taken:

- a. The Conservation Area was classified as Woodland vegetation on the basis of percentage foliage cover, growth form and height, and sparse understorey, and assessed to have a Low to Moderate level of threat. A total Asset Protection Zone of 20m (20m IPA and 0m OPA) was recommended due to the small size and isolated nature of this remnant, non-habitable nature of the proposed development, and the future proposed presence of the 20m wide Precinct Road around the south and east perimeter.
- b. The Riparian Habitat was assessed to have a Low bushfire threat even after replanting due to its narrow width and linear nature. A total Asset Protection Zone of 20m (20m IPA and 0m OPA) was recommended.

Neither area is Bushfire Prone Land according to Section 8.4.3 of SEPP 59 (Blacktown City Council 2005).

Management of both areas is to take reasonable measures to prevent damage to life and property from bushfires and to ensure that as far as possible, bushfire management is compatible with the other objectives of this Plan of Management.

Bushfire hazard reduction - is to be undertaken where there is an identified high hazard to buildings or other improvements on the land or on surrounding land. As far as possible, bushfire hazard reduction is to be by mechanical means, and is to be undertaken along property boundaries. Hazard reduction programs are to be implemented in a manner that protects biodiversity.

Fire trails - the existing fire trails in the Conservation Area are to be left untouched. No new trails are to be constructed.

Emergencies - this Plan authorises any necessary activities to be carried out during declared bushfire emergencies. Following the carrying out of any works, periodic monitoring will be undertaken, and rehabilitation works undertaken if necessary.

4.5 Streams and stormwater management

The prime objective is to promote the protection of stream habitats, ecosystems and amenity.

Note that both areas may be impacted by the following possible future stormwater detention basins:

- a. As defined in Figure 11 of SEPP 59 (Blacktown City Council 2005):
 - a. On the east end (upstream source) and north edge of the Riparian Habitat (Ropes Creek Tributary Catchment).
 - b. On the northern boundary of the Conservation Area.
- b. As planned for the development, on the east side of the Conservation Area to collect water from the regraded berm (ERMA 2008).

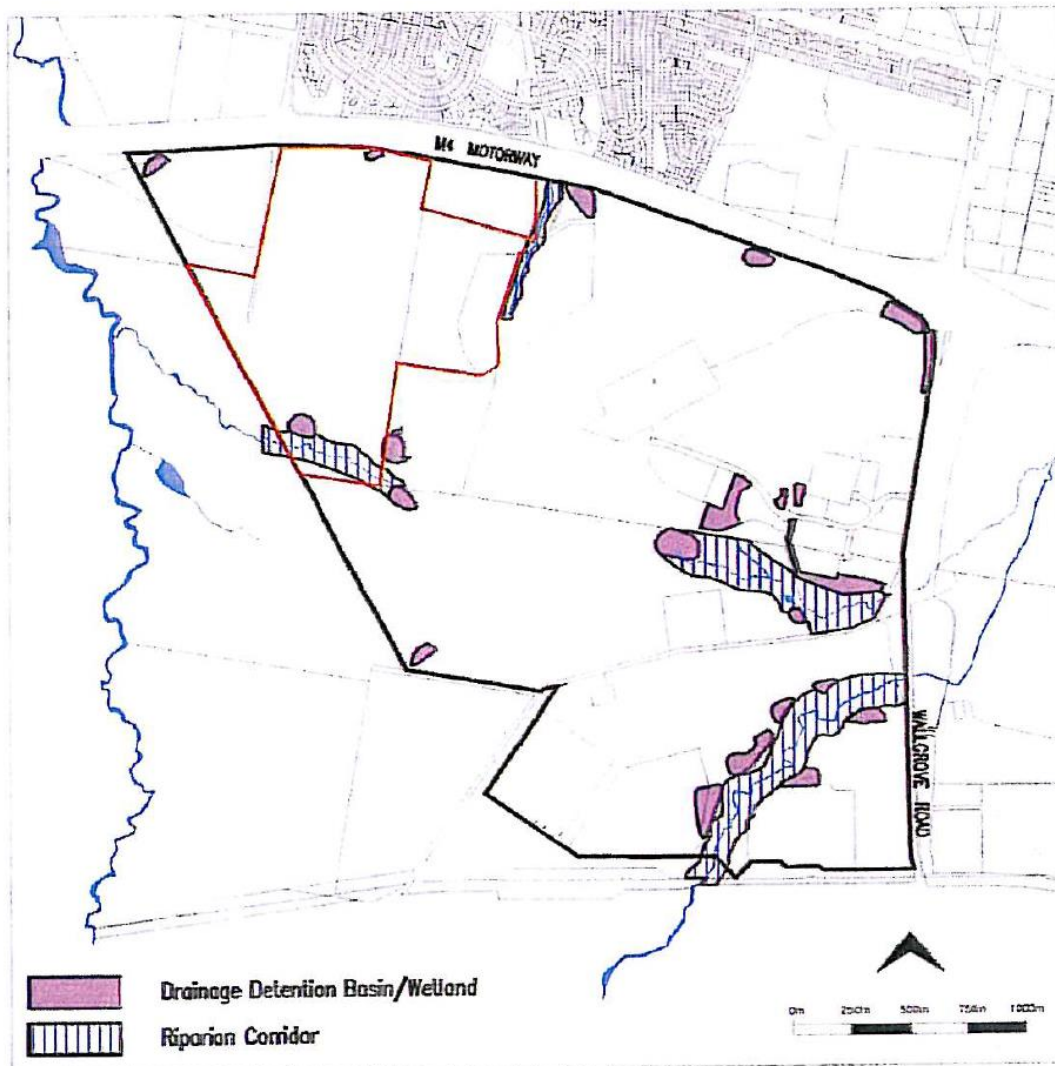


Figure 15. Stormwater Basins

Map from Figure 11 *Stormwater Management Plan* in *State Environmental Planning Policy No. 59 – Central Western Sydney Economic and Employment Area, Eastern Creek Precinct Plan* (Blacktown City Council 2005)

The following general principles apply in addition to the details specified and complied with in the *Light Horse Business Centre Restoration of the Riparian Zone Management Plan* (Site Image Landscape Architects).

Note however, we have defined the watercourses on site according to the Prospect 9030-2N Third Edition Topographic & Orthophoto Map rather than as described in Figure 15 above.

Watercourses - natural hydrological processes are to be maintained where possible, including natural vegetation and the flow regimes to maintain creek line stability and health of terrestrial and aquatic plant communities.

Drainage, runoff and stormwater - water quality entering natural areas is to be maintained at a level which is acceptable for sustainable natural area management, and as far as possible, is to maintain pre-development conditions. Additional runoff is not to discharge into bushland areas. Permeable ground surfaces are to be maintained as far as possible and on-site disposal of stormwater is to occur.

Habitat protection - existing natural habitats are to be maintained.

Water quality - activities along streams are to be strictly controlled with the objective of maintaining a level of water quality suitable for fish and other aquatic life.

Stream bank erosion - measures are to be taken to prevent stream bank erosion.

Watercourses - natural vegetation, and aquatic communities are to be retained along watercourses as far as possible.

Filling and draining - reclamation, filling, draining or other works that results in any loss of, or disturbance to wetlands or other associated natural habitat must not be carried out. The fauna habitat value of wetlands and associated surrounding natural areas is to be maintained, and where possible, enhanced.

4.6 Activities and maintenance

Acceptable activities - This Plan of management authorises the activities as listed below, in cases where the activities do not compromise the identified dominant use of the land as a natural area:

- a) Weed management

Unacceptable activities - Activities interfering with the peace and ecological diversity of natural areas are generally discouraged, unless specific provision has been made for them.

Activities which are not authorised include:

- a) general recreation
- b) use of powered vehicles (other than essential service vehicles)
- c) horse riding
- d) hunting or interference with fauna
- e) the presence of pets and domestic animals
- f) collection of flora, rocks, soil, timber (alive or dead) or leaf litter

4.7 Pollution control

Pollution is a major factor in weed invasion and in the degradation of natural areas. Management must seek to ensure that no pollution is generated on the land, and that adequate measures are taken to prevent adverse impacts from adjoining land.

Environment protection (noise control, dust, chemicals, etc.) - measures are to be taken during any bush regeneration activities to ensure and comply with normal environmental protection, pollution control and health guidelines.

Rubbish dumping - is a risk on the external perimeter of the Conservation Area. Any garden waste dumped on the site or at its edges should be periodically collected and disposed off-site to prevent invasion by any non-native plant. Fencing the Conservation Area should help prevent rubbish dumping (See Section 4.8 Access and occupation).

4.8 Access and occupation

The Plan seeks to ensure that essential pedestrian and vehicular access through or into natural areas minimises the impact on the area. Non-essential pedestrian and vehicular access shall be prevented.

Existing Roads

The existing unmade roads in the Conservation Area are to be left untouched as fire and general access trails, but are to be closed with locked gates at the perimeter of the area to prevent any public access.

There are no roads in the Riparian Habitat. The existing stony creek crossing is to be retained to permit inspection and maintenance vehicular access to the south boundary of the property.

Track closure

All existing narrow trail bike tracks in the Conservation Area are to be closed and covered with loose earth, brush matting, or leaf litter to inhibit motor bike and pedestrian use.

Illegal and Public Access

Measures are to be taken to cease or prevent unauthorised or public access across the land.

Fencing

Fencing is to be constructed to restrict access in accordance with any adopted standards or guidelines and as provided for in the Dividing Fences Act 1991.

The location of the Conservation Area in a relatively deserted location on the north west boundary of the property adjacent to the closed section of Archbold Road present current and historical problems of trail bike access, with regular damage to existing fences. The aims of enabling native animal access while restricting access of pedestrians, trail bikes and domestic animals lead to the following options:

- a) High security fence, for example, 2m high chain link with barbed wire top. This would restrict human, domestic, and native animal access. Such a fence is less vulnerable to cutting.
- b) Low barbed/wire fence with or without rabbit mesh. This would limit bike but not pedestrian access, permit native animal access, and exclude domestic and feral animals. Such a fence is vulnerable to cutting.
- c) Rock barrier. This would inhibit but not prevent bike access and have little effect on human or animal access.
- d) Vegetative barrier. This would inhibit pedestrian and bike access but have little effect on domestic or native animals. Since the aim is to preserve and improve the quality of vegetation within the areas, use of anything except indigenous local vegetation for this purpose would not be recommended.

If the overall intention is to completely exclude the public from the entire site, the perimeter fence will extend to protect the external (north and west boundary) of the Conservation Area, while a lower security fence such as low wire could be used on the internal perimeter (south and east boundary adjacent to future Precinct Road). In the interim, repair or replacement of the existing low barbed wire fence around the entire Conservation Area is recommended.

Note that no fence is completely impervious to determined cutting or damage, and that fencing and gating is unlikely to be able to completely exclude most feral animals.

The Riparian Area on the southern boundary of the site has limited public accessibility and is bounded by a considerable distance of open field to the north, so does not need fencing beyond inspection, maintenance and repair of the existing wire fence on the east, south and west boundaries to prevent stock wandering into the area.

4.9 Administration

Administrative issues have an important influence on the way in which the land is managed.

Staff resources - the management authority shall provide adequate staff resources for the management of the land in accordance with this Plan. Staff shall have appropriate qualifications and experience.

Environmental impact assessment of activities - the environmental impact of activities carried out on the land will be assessed having regard to the requirements of the *Environmental Planning and Assessment Act 1979*.

Other authorities - other government authorities (for example, National Parks and Wildlife Service, Dept Land and Water Conservation) may have responsibilities or involvement in the management of the land or of immediately adjacent land. Where appropriate, consultation is to be undertaken with relevant authorities.

Activities carried out by other authorities - where activities are carried out on the land by other authorities, the management authority is to make such authorities aware of the provisions of this Plan and, as far as possible, is to seek to ensure that any activities are compatible with the objectives and guidelines of this Plan.

Contract labour - in managing the land the management authority may use contract labour, but shall ensure that supervisors have appropriate qualifications and experience, and are made aware of the requirements of this Plan.

Delegation of management responsibilities - where responsibilities are delegated by the management authority, a requirement of the delegation shall be compliance with the provisions of this Management Plan.

4.10 Other issues

Adjoining development - the management authority is to take into account the effect of development and management activities carried out on adjoining land. Activities of concern include discharge of stormwater, clearing, unauthorised filling. As far as possible, adjoining development is to make provision for buffer zones on the adjoining land. Joint boundary management programs with adjacent landholders is encouraged.

These issues relate to the Riparian Habitat, future development of adjacent properties adjoining the south boundary, and Hanson site to the east (see *Section 2.2 Riparian Habitat*).

Emergencies - this Plan authorises any necessary activities to be carried out during an emergency.

5. Management Zones

Both management zones will be managed to protect existing vegetation, restrict human and vehicular access, and control animal and weed pests in accordance with the Consent Conditions. Differences in management objectives are outlined below.

5.1 Conservation Area

This area will be managed as a bush regeneration zone, which has the objective of returning bushland and its ecosystem processes to a natural condition.

Natural regeneration methods will be used, which rely on natural germination and resprouting of plants and focuses on weed removal, management of disturbance, the maintenance of natural processes, and the limited use of fire. It does not include replanting of vegetation.

5.2 Riparian Habitat

This Plan provides current measures to protect and conserve the existing Riparian Habitat pending any future development in this area, it therefore does not specify measures to reconstruct or revegetate the area.

As specified in the *Light Horse Business Centre Restoration of the Riparian Zone Management Plan* (Site Image Landscape Architects), silt fences will be maintained, water quality will be periodically tested and reported, and the creek line periodically inspected and treated to remediate any scour.

The following issues will impact the area, change environmental conditions and must be addressed in the future in any new management plans:

- a. Cessation of pumping from the Overflow Dam on the Hanson site and consequent changes in water flows
- b. Development of adjacent properties adjoining the south and east boundaries.

6. Implementation

6.1 Application of management policies and guidelines

The management policies and guidelines specified by this Plan:

- a) must be taken into consideration by the management authority when making management decisions, and
- b) must be complied with by the management authority when implementing those decisions.

6.2 Action plan

This Plan specifies performance targets and priorities for actions to be taken in relation to the land.

Evaluation of achievement of the objectives of the Plan is to be periodically undertaken. A summary of indicators and targets for major objectives is as outlined in the table below.

6.3 Administration

The management authority is responsible for implementing and reviewing the provisions of this Plan.

6.4 Review of Plan

The Plan applies for a period of five years commencing on 1 October 2009, after which period the Plan shall be reviewed.

The management authority is to commence a review of the Plan at least one year prior to the date on which it lapses. The review is to include all relevant background information, including updated ecological information and details of proposed works and expenditure.

Table 1. Indicators and Performance Targets

Objective	Indicators	Performance Target
Biodiversity conservation	Area of endangered ecological communities	No reduction in mapped reserve area or degradation of endangered ecological communities.
Vegetation management and weeds	Presence of weed species, regeneration of native species	Reduction of weed species by 5% each year.
Activities and maintenance	Regularity of inspection and cleaning, number of incidents of dumping	Compliance with Plan guidelines
Access and occupation	Construction of fencing on external boundaries to Conservation Area.	No dumping of refuse on site. No use of the Conservation Area by recreational users such as motorcycle riders or 4WDs.
Information, Monitoring and Research	Indicators to be monitored, documentation of areas and condition	Regular monitoring frequency.
Administration	Number of staff employed, qualified staff in bushland management	Compliance with Plan guidelines

7. Schedule of Works

Time Frame	Objective	Activity	Responsibility	Indicators	Performance target
Once-off Activities					
As required	Fence Riparian Habitat	Inspect, maintain and repair existing wire fence on the east, south and west boundaries.	Contractor		Boundary fence intact
As required	Fence and gate Conservation Area	Install new fence, or inspect, maintain and repair existing fence around Conservation Area. Install locked gates across all access roads.	Contractor		Conservation Area fenced and gated
As required	Close single file tracks in Conservation Area	Close and cover all existing single bike tracks. Scarify or cover with loose earth, brush matting, or leaf litter to inhibit motor bike and pedestrian use.	Contractor		Tracks closed and covered
As required	Secure boundaries of conservation area from trail bikes. Provide structural habitat for fauna.	Place felled trees from elsewhere into the conservation area.	Contractor	Physical barrier to trail bike riders. Logs on ground for fauna habitat.	Boundary secured from trespassers. Structural fauna habitat.
Scheduled Activities					
Month 1 (early spring)	Set up monitoring points and transects	Set up photo monitoring points and transects	Ecologist		Photo monitoring points and transects marked and recorded
Month 1 (early spring)	Primary weeding of boxthorn thicket in Conservation Area	Poison boxthorn in thicket in south east corner of Conservation Area. Leave any cut plants on site.	Certified contractor	Weeding as per best practice	All Boxthorn plants treated
Month 1 (early spring)	Primary weeding of rest of Conservation Area	Remove noxious weeds from rest of Conservation Area. Removal of exotic weeds	Certified contractor	Weeding as per best practice	No noxious weeds within Conservation Area. Twenty percent reduction in exotic weeds.
Month 1 (early spring)	Primary weeding of dam in Conservation Area	Remove exotic, noxious and non-local vegetation from dam in Conservation Area	Certified contractor	Weeding as per best practice	Dam clear of noxious weeds. Twenty percent reduction in exotic weeds and non-local vegetation.
Month 6	Secondary weeding of boxthorn thicket in Conservation Area	Kill remaining or regrowth boxthorn in thicket in south east corner of Conservation Area	Certified contractor	Weeding as per best practice	All Boxthorn plants treated

Time Frame	Objective	Activity	Responsibility	Indicators	Performance target
Month 6	Pile dead boxthorn in thicket in Conservation Area	Pile dead boxthorn plants in south east corner of Conservation Area ready for pile burn	Certified contractor		Dead boxthorn piled for burn
Month 6	Secondary weeding of rest of Conservation Area	Inspect areas already subject to primary weeding. Remove any exotic, noxious and non-local vegetation that has re-emerged using appropriate methods.	Certified contractor	Weeding as per best practice	No noxious weeds within Conservation Area. Twenty percent reduction in exotic weeds
Month 12	Follow up weeding of Riparian Habitat	Inspect and remove noxious weeds from Riparian Habitat	Certified contractor	Weeding as per best practice	Riparian Habitat clear of noxious weeds. Twenty percent reduction in exotic weeds. Note well the site to the East is a source of exotic weeds and these will continue to invade the site. Future developments of the easterly adjoining site should also undertake weed control.
Month 12	Follow up weeding of entire Conservation Area	Inspect areas already subject to secondary weeding. Remove, noxious any exotic and non-local vegetation that has re-emerged using appropriate methods.	Certified contractor	Weeding as per best practice	Conservation Area clear of noxious weeds. Twenty percent reduction in exotic weeds
Month 12	Pile burn boxthorn thicket	Burn dead piled boxthorn in thicket to stimulate native regeneration	Certified contractor / RFS		Dead boxthorn pile burnt
Month 18	Check regeneration at site of pile burn	Check if native plants, particularly shrubs, have been stimulated to regenerate by pile burn	Certified contractor		Native regeneration
Month 18	Follow up weeding of entire Conservation Area	Inspect areas already subject to secondary weeding. Remove any exotic, noxious and non-local vegetation that has re-emerged using appropriate methods.	Certified contractor	Weeding as per best practice	Conservation Area clear of Noxious weeds. Twenty percent reduction in exotic weeds
Regular Periodic Activities					
6 monthly intervals	Monitor transects	Record weeds, observations and take photos from monitoring points	Ecologist	Assessment and reporting of site condition	Presentation of report to stakeholders
6 monthly intervals	Follow up weeding of Riparian Habitat	Inspect and remove noxious weeds from Riparian Habitat	Certified contractor	Weeding as per best practice	Riparian Habitat clear of noxious weeds

Time Frame	Objective	Activity	Responsibility	Indicators	Performance target
6 monthly intervals	Check perimeter of Conservation Area for dumping	Check north and west perimeter of Conservation Area for evidence of rubbish and vegetative waste dumping and remove all waste or notify Council for removal.	Certified contractor	Removal of rubbish	Perimeter of Conservation Area clear of rubbish and waste
6 monthly intervals	Manage weed incursion on perimeter of Conservation Area	Check north and west perimeter of Conservation Area for evidence of weed incursion and control any weeds.	Certified contractor	Weeding as per best practice	Perimeter of Conservation Area clear of weeds
6 monthly intervals	Check property boundary fencing	Check and repair any damage to property boundary fencing.	Certified contractor		Boundary fence intact

8. References

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- Site Image Landscape Architects (Undated) Light Horse Business Centre Restoration of the Riparian Zone Management Plan.

Appendix 1. Noxious Weeds in the Blacktown LGA

Note

- This list applies to **Baulkham Hills, Blacktown, Hawkesbury and Penrith** LGA's.
- It is the responsibility of a Local Council (Noxious Weeds Act 1993 (ss 10, 12-14, 35, 4) to issue a Weed Control Notice (Noxious Weeds Act 1993 (ss 18(1), (2) and 22(1)).

Extracted from Weed Control Orders No. 20, New South Wales Government Gazette No. 110, 31 August 2006 (as amended, Weed Control Orders Nos. 21 & 22, February 2007 and No. 23, October 2008).

* = Aquatic Weeds - = not noted on site

R = present in Riparian Habitat

C = present in Conservation Area (Ashby 2007)

Category	Species	Common Name	Status
Class 1	<i>Acacia karoo</i>	Karoo Thorn	-
	<i>Acacia nilotica</i>	Prickly Acacia	-
	<i>Annona glabra</i>	Pond Apple	-
	<i>Asystasia gangetica</i> subsp. <i>micrantha</i>	Chinese Violet	-
	<i>Bassia scoparia</i> except <i>B. scoparia</i> subsp. <i>trichophylla</i>	Kochia	-
	<i>Centaurea maculosa</i>	Spotted Knapweed	-
	<i>Centaurea nigra</i>	Black Knapweed	-
	<i>Chromolaena odorata</i>	Siam Weed	-
	<i>Cryptostegia grandiflora</i>	Rubber Vine	-
	<i>Eichhornia azurea</i> *	Anchored Water Hyacinth	-
	<i>Equisetum</i> spp.	Horsetail	-
	<i>Gymnocoronis spilanthoides</i>	Senegal Tea Plant	-
	<i>Hieracium</i> spp.	Hawkweed	-
	<i>Hygrophila polysperma</i> *	East Indian Hygrophila	-
	<i>Hymenachne amplexicaulis</i>	Hymenachne	-
	<i>Lagarosiphon major</i> *	Lagarosiphon	-
	<i>Limncharis flava</i>	Yellow Burrhead	-
	<i>Miconia</i> spp.	Miconia	-
	<i>Mimosa pigra</i>	Mimosa	-
	<i>Myriophyllum spicatum</i>	Eurasian Water Milfoil	-
	<i>Nassella tenuissima</i>	Mexican Feather Grass	-
	<i>Orobancha</i> spp. except <i>O. cernua</i> var. <i>australiana</i> and <i>O. minor</i>	Broomrapes	-
	<i>Parthenium hysterophorus</i>	Parthenium	-
	<i>Pistia stratiotes</i> *	Water Lettuce	-
	<i>Stratiotes aloides</i> *	Water Soldier	-
	<i>Striga</i> spp.	Witchweed	-
	<i>Trapa</i> spp. *	Water Caltrop	-
Class 2	<i>Hygrophila costata</i>	Hygrophila	-
Class 3	<i>Alternanthera philoxeroides</i>	Alligator Weed	-
	<i>Bryophyllum</i> sp. and hybrids	Mother-of-millions	-
	<i>Cestrum parqui</i>	Green Cestrum	-
	<i>Eichhornia crassipes</i> *	Water Hyacinth	-

Category	Species	Common Name	Status
	<i>Ludwigia peruviana</i> *	Water Primrose	C
	<i>Salvinia molesta</i> *	Salvinia	-
	<i>Sporobolus fertilis</i>	Giant Parramatta Grass	-
Class 4	<i>Ageratina adenophora</i>	Crofton Weed	R
	<i>Cenchrus incertus</i>	Spiny Burrgrass	-
	<i>Cenchrus longispinus</i>	Spiny Burrgrass	-
	<i>Cortaderia</i> spp.	Pampas Grass	R
	<i>Cuscuta campestris</i>	Golden Dodder	-
	<i>Cylindropuntia</i> spp.	Prickly Pear	-
	<i>Echium</i> spp.	Paterson's Curse, Vipers Bugloss, Italian Bugloss	-
	<i>Harrisia</i> spp.	Harrisia Cactus	C
	<i>Hypericum perforatum</i>	St John's Wort	R
	<i>Ligustrum lucidum</i>	Privet (Broad Leaf)	-
	<i>Ligustrum sinense</i>	Privet (Narrow-Leaf)	-
	<i>Ludwigia longifolia</i> (* moist areas)	Long-leaf Willow Primrose	-
	<i>Lycium ferocissimum</i>	African boxthorn	C, R
	<i>Nassella neesiana</i>	Chilean Needle Grass	-
	<i>Nassella trichotoma</i>	Serrated Tussock	-
	<i>Opuntia</i> spp. except <i>O. ficus-indica</i>	Prickly Pear	-
	<i>Parietaria judaica</i>	Pellitory	R
	<i>Rubus anglocandicans</i> (includes <i>R. fruticosus</i> agg. spp.)	Blackberry	-
	<i>Sorghum halepense</i>	Johnson Grass	-
	<i>Sorghum x alnum</i>	Columbus Grass	-
	<i>Toxicodendron succedaneum</i>	Rhus Tree	-
	<i>Xanthium</i> spp.	Bathurst/Noogoora/Californian/Cockle Burrs	-
Class 5	<i>Achnatherum brachychaetum</i>	Espartillo	-
	<i>Ambrosia artemisiifolia</i>	Annual Ragweed	C, R
	<i>Ambrosia confertifolia</i>	Burr Ragweed	-
	<i>Argemone mexicana</i>	Mexican Poppy	-
	<i>Asparagus asparagoides</i>	Bridal Creeper	R
	<i>Avena strigosa</i>	Sand Oat	-
	<i>Brassica barrelieri</i> subsp. <i>oxyrrhina</i>	Smooth-stemmed Turnip	-
	<i>Cabomba caroliniana</i> *	Cabomba	-
	<i>Carthamus glaucus</i>	Glaucous Star Thistle	-
	<i>Cenchrus biflorus</i>	Gallon's Curse	-
	<i>Cenchrus brownii</i>	Fine-bristled Burrgrass	-
	<i>Cenchrus echinatus</i>	Mosman River Grass	-
	<i>Cynara cardunculus</i>	Artichoke Thistle	-
	<i>Cyperus esculentus</i>	Yellow Nutgrass	-
	<i>Egeria densa</i> *	Leafy Elodea Dense Waterweed	-
	<i>Gaura parviflora</i>	Egeria	-
	<i>Helianthus ciliaris</i>	Clockweed	-
	<i>Lantana camara</i>	Texas Blueweed	-
	<i>Oryza rufipogon</i>	Lantana	-
	<i>Oxalis</i> spp. except <i>O. chinoides</i> ,	Red Rice	-
		Oxalis	-

Category	Species	Common Name	Status
	<i>O. exilis</i> , <i>O. perennans</i> , <i>O. radicata</i> , <i>O. rubens</i> and <i>O. thompsoniae</i>		
	<i>Pennisetum macrourum</i>	African Feather Grass	-
	<i>Pennisetum setaceum</i>	Fountain Grass	-
	<i>Picnemon acarna</i>	Soldier Thistle	-
	<i>Romulea</i> spp.	Onion Grass	-
	<i>Sagittaria montevidensis</i> *	Arrowhead	-
	<i>Sagittaria platyphylla</i> *	Sagittaria	-
	<i>Salix</i> spp. (* moist areas)	Willow	-
	<i>Scolymus hispanicus</i>	Golden Thistle	-
	<i>Sisymbrium runcinatum</i>	African Turnip Weed	-
	<i>Sonchus arvensis</i>	Corn Sowthistle	-
	<i>Stachytarpheta cayennensis</i>	Cayenne Snakeweed	-
	<i>Tamarix aphylla</i>	Athel Tree/Pine	

Weed Control Classes

- Class 1** - State Prohibited Weeds. *"The plant must be eradicated from the land and the land must be kept free of the plant."*
- Class 2** - Regionally Prohibited Weeds. *"The plant must be eradicated from the land and the land must be kept free of the plant."*
- Class 3** - Regionally Controlled Weeds. *"The plant must be fully and continuously suppressed and destroyed."*
- Class 4** - Locally Controlled Weeds. *"The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority."*
- Class 5** - Restricted Plants. *"The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with."*

Control objectives

The control objectives for each class is as follows:

- Class 1** is to prevent the introduction and establishment of those plants in NSW.
- Class 2** is to prevent the introduction and establishment of those plants in parts of NSW.
- Class 3** is to reduce the area and the impact of those plants in parts of NSW.
- Class 4** is to minimise the negative impact of those plants on the economy, community or environment of NSW.
- Class 5** is to prevent the introduction of those plants into NSW, the spread of those plants within NSW or from NSW to another jurisdiction.

Class 5 weeds are predominately weeds listed under the old Seeds Act, which has been repealed. There is no obligation to control Class 5 weeds. However Class 5 weeds are notifiable weeds. This means that the plant, or any animal or thing, which has the weed on it or in it, cannot be sold, purchased or offered for sale in NSW. It cannot be removed from any land to another place and it cannot be scattered on land or water.

'Sell' includes:

- (a) barter, offer or attempt to sell, receive for sale, have in possession for sale, expose for sale, send, forward or deliver for sale or cause or permit to be sold or offered for sale, or
- (b) sell for resale.

Appendix 2. Treatment of Cumberland Plain Weeds

The tables below are reproduced from Appendix 4 of *Recovering Bushland on the Cumberland Plain: Best Practice Guidelines for the Management and Restoration of Bushland*. © Department of Environment and Conservation (NSW) 2005.

Method: H (hand remove) C (cut and paint) S (scrape and paint) I (stem injection)
 Spray Rate: for Roundup Biactive®

Herbaceous Weeds and Grasses

Common name	Scientific name	Method	Spray Rate	Possible selective herbicide and other techniques
African Love Grass	<i>Eragrostis curvula</i>	H	1:100	Slash or mow, spray regrow with Roundup.® Spot-spray also possible.
Alligator Weed	<i>Alternanthera philoxeroides</i>		1:100	
Amaranth	<i>Amaranthus</i> sp.	H C	1:100	
Asparagus Fern	<i>Asparagus aethiopicus</i>	H	1:75	Brush-off
Asthma Weed	<i>Parietaria judaica</i>	H	1:100	
Black Thistle	<i>Cirsium vulgare</i>	H C	1:100	
Blackberry Nightshade	<i>Solanum nigrum</i>	H C	1:100	
Cobbler's Peg	<i>Bidens pilosa</i>	H C	1:100	
Common Couch	<i>Cynodon dactylon</i>	H	1:75	
Creeping Buttercup	<i>Ranunculus repens</i>	H	1:100	
Crofton Weed	<i>Ageratina adenophora</i>	H	1:100	
Drain Sedge	<i>Cyperus eragrostis</i>	H	1:100	
Ehrharta	<i>Ehrharta erecta</i>	H	1:100 - 1:500	
Fat Hen	<i>Chenopodium album</i>	H C	1:100	
Fennel	<i>Foeniculum vulgare</i>	H		
Fireweed	<i>Senecio madagascariensis</i>	H	1:100	
Flatweed	<i>Hypochaeris radicata</i>	H	1:100	
Fleabane	<i>Conyza</i> spp.	H C	1:100	
Giant Bamboo	<i>Bambusa</i> sp.	C		
Giant Reed	<i>Arundo donax</i>	C		
Guinea Grass	<i>Panicum maximum</i>	H	1:75	
Ink Weed	<i>Phytolacca octandra</i>	H C	1:100	
Johnson's Grass	<i>Sorghum halpense</i>	H		
Kikuyu	<i>Pennisetum clandestinum</i>	H	1:100	
Ludwigia	<i>Ludwigia peruviana</i>	H C	1:100	
Mist Flower	<i>Ageratina riparia</i>	H	1:100	
Needle Grass	<i>Nassella</i> sp.	H		
Paddy's Lucerne	<i>Sida rhombifolia</i>	H C	1:100	Grazon, Garlon®
Pampas Grass	<i>Cortaderia selloana</i>	H C	1:75	

Paspalum	<i>Paspalum dilatatum</i>	H	1:100	
Patterson's Curse	<i>Echium sp.</i>	H	1:100	
Plantain	<i>Plantago lanceolata</i>	H	1:100	
Prairie Grass	<i>Bromus catharticus</i>	H	1:100	
Prickly Lettuce	<i>Lactuca serriola</i>	H	1:100	
Quaking Grass	<i>Briza sp.</i>	H	1:100	
Rhodes Grass	<i>Chloris gayana</i>	H	1:100	
Ryegrass	<i>Lolium perenne</i>	H	1:100	
Salvinia	<i>Salvinia molesta</i>		1:100	
Sowthistle	<i>Sonchus oleraceus</i>	H	1:100	
Spider Plant	<i>Chlorophytum comosum</i>	H	1:75	
Spiny Rush	<i>Juncus acutus</i>	H	1:75	
St John's Wort	<i>Hypericum perforatum</i>	H		Garlon®, Grazon
Summer Grass	<i>Digitaria sanguinalis</i>	H	1:100	
Wandering Jew	<i>Tradescantia fluminensis</i>	H	1:75	Starane; other techniques include raking where no native groundcovers are present
Veldt Grass	<i>Ehrharta longiflora</i>	H	1:100	
Wild Oats	<i>Avena sp.</i>	H	1:100	
Water Hyacinth	<i>Eichhornia crassipes</i>	H		

Vines

Common name	Scientific name	Method	Spray Rate	Possible selective herbicide and other techniques
Turkey Rhubarb	<i>Acetosa sagittata</i>	H	1:100	Starane
Madiera Vine	<i>Anredera cordifolia</i>	H S	1:75	Starane
Moth Vine	<i>Araujia sericifera</i>	H S	1:50	
Balloon Vine	<i>Cardiospermum grandiflorum</i>	H C S	1:100	
Cape Ivy	<i>Delairea odorata</i>	H	1:75	
English Ivy	<i>Hedera helix</i>	H S	1:100	
Coastal Morning Glory	<i>Ipomoea cairica</i>	H S	1:100	
Morning Glory	<i>Ipomoea indica</i>	H S	1:100	Garlon®
Honeysuckle	<i>Lonicera japonica</i>	H S	1:75	
Bridal Creeper	<i>Asparagus asparagoides</i>	H	1:75	Brush-off used under permit is effective. Must apply herbicide at flowering. Note some natives, e.g. Bursaria, are sensitive to Brush-off. Spray in combination with hand removal.

Woody Weeds

Herbicide: Garlon® or Access preferred herbicide

Woody weed seedlings can often be treated by spot spraying with a Roundup Biactive® solution (check herbicide label for dilution rates). The addition of a surfactant can improve results. Additionally, several selective herbicides can also be used in this way.

Medium-sized woody weeds can be treated using a technique known as basal spraying. A prescribed solution of diesel and selective herbicide (often Garlon®) is applied to the leaves and stems. This can be an effective treatment but consideration must be given to the risk of off-target damage and the impacts on future regeneration. This method should not be used in areas where native regeneration is expected.

Common name	Scientific name	Method	Herbicide	Possible selective herbicide and other techniques
African Box Thorn	<i>Lycium ferocissimum</i>	H C I	Yes	The use of Garlon® and diesel is a very effective herbicide for this species.
African Olive	<i>Olea europaea subsp. Africana</i>	H C I	Yes	The use of Garlon® and diesel is a very effective herbicide for this species. Best techniques are cut and paint.
Boneseed	<i>Chrysanthemoides monilifera subsp. Monilifera</i>	H C I		
Blackberry	<i>Rubus fruticosus</i>	H C S	Yes	Hand prune or slash to encourage new growth, spray new growth with herbicide. Follow-up may be needed.
Briar Rose	<i>Rosa rubiginosa</i>	C		
Box Elder	<i>Acer negundo</i>	H C I		
Camphor Laurel	<i>Cinnamomum camphora</i>	H C S		For small plants apply herbicide by vertically scraping the stem with a knife blade and applying herbicide.
Cassia	<i>Senna pendula</i>	H C I		
Castor Oil Plant	<i>Ricinus communis</i>	H C		
Coral Tree	<i>Erythrina xysykesii</i>	H C I		
Cotoneaster	<i>Cotoneaster glaucophyllus</i>	H C I		
Cox's Coral Tree	<i>Erythrina crista-galli</i>	H C I		
English Broom	<i>Cytisus scoparius</i>	H C I		
Gleditsia	<i>Gleditsia tricanthos</i>	C I		Stem injection best from early spring to autumn.
Gorse	<i>Ulex europaeus</i>	C		
Green Cestrum	<i>Cestrum parqui</i>	H S I	Yes	Garlon® and diesel is a very effective herbicide for adults of this species. Some degree of reshooting may occur with all treatments requiring follow-up.
Hackberry	<i>Celtis occidentalis</i>	H C I	Yes	
Indian Hawthorn	<i>Raphiolepis indica</i>	H C I		
Broad-leaved Privet	<i>Ligustrum lucidum</i>	H C I		
Montpellier Broom	<i>Genista monspessulana</i>	H C I		
Mulberry	<i>Morus alba</i>	H C I		
Ochna	<i>Ochna serrulata</i>	S I		
Pittosporum	<i>Pittosporum undulatum</i>	H C I		
Radiata Pine	<i>Pinus radiata</i>	H C I		
Rhus Tree	<i>Toxicodendron succedaneum</i>	H C I		
Narrow-leaved Privet	<i>Ligustrum sinense</i>	H C I		

Wild Tobacco	<i>Solanum mauritianum</i>	H C		
Tree-of-Heaven	<i>Ailanthus altissima</i>	S I	Yes	Tordon is effective in treating this species using the cut and paint technique. Basal bark application of Garlon® and diesel also effective.
Willow	<i>Salix spp.</i>	H C S I		
Willow Leaf Wattle	<i>Acacia saligna</i>	H C I		

Appendix 3. Notes on Specific Weed Control

African Boxthorn

African Boxthorn (*Lycium ferocissimum*) is a tough thorny shrub forming dense thickets adapted to a number of habitats and found during the flora survey on both reserve areas on this site. Plants can become dormant during long dry spells and winter, but flower and fruit profusely at any time of year in favourable conditions. Seeds are dispersed by birds, foxes, reptiles, water and machinery, with germination possible at any time of the year but peaking in spring and summer. Plants can reshoot from the base or suckers, with broken branches and stems remaining alive for months (Muyt 2001).

Boxthorn is widespread on the Cumberland Plain, and although it can be effectively treated by basal spraying with a prescribed solution of diesel and Garlon®, this method should not be used in areas where native regeneration is expected (DEC 2005) so should be avoided in both reserve areas on this site.

Infestations on this site should be treated by spraying with selective herbicide during active growth, not during drought dormancy or cold winter. In addition, since the plant provides fauna understorey habitat, treatment during peak breeding season (late spring or summer) should be avoided. The preferred treatment time is early spring.

Larger individual plants should be treated by stem injection, and smaller individual plants by the cut and paint method.

All treated thickets and large individual plants must be followed up at 6 monthly intervals to eradicate seed regrowth and reshooting (Muyt 2001).

Appendix 4. General Guidelines for Weed Control

General

- a) Comprehensive treatment of all weeds in an area is to be carried out prior to planting.
- b) Maintenance weeding of all areas is to be carried out prior to seed set.
- c) All weed propagules are to be bagged and removed from site.

Herbicide use

The manufacturers' safety and application directions must be followed at all times. Contractors are required to obtain all necessary approvals and complete all necessary notifications before using herbicides, particularly near waterways.

Hand Removal

The removal of weeds by hand is the preferred method and is most suitable for the removal of seedlings, herbaceous weeds, and many grasses. Always place seeds and or fruit into a plastic bag before pulling out the rest of the plant. Dispose of the contents of the bag and the plant off-site to avoid the further spread of the weed. Wherever possible take advantage of favourable seasonal conditions, e.g. work after good rain when soil moisture conditions allow for easier removal.

Treatment of weeds with underground reproductive parts

The most effective treatment for weeds with underground reproductive parts is to carefully dig up the entire plant with all tubers, bulbs and corms intact. The reproductive parts must then be bagged and removed from site.

Spraying with herbicide can be employed where no native species are present. This will kill above ground vegetative growth and some underground reproductive parts but subsequent hand removal of the remaining underground parts is often necessary.

Spraying with herbicide is most effective between flowering and seed set.

Treatment of exotic vines

Most exotic vines can either be dug up by hand or sprayed with herbicide to remove vegetative growth above the ground and then followed up with hand removal of re-shooting nodes.

Treatment of exotic grasses and herbs

Most exotic grasses and herbs can be hand removed or 'crowned' with a knife. Where no native species are present they can be sprayed with diluted herbicide.

The slashing of tall herbaceous weeds and the spraying of regrowth can also be used to reduce the amount of herbicide used. Debris from slashing will contain weed propagules and must be raked up and removed from site.

Some exotic grasses and herbs can be extremely difficult to eradicate by hand removal. It is important that these species are controlled prior to planting, as the ability to spray herbicide after planting will be greatly reduced.

Cut and paint treatment for woody weeds

The following cut and paint treatment is appropriate for most woody weeds:

- a) Woody weeds are to be cut as close to the ground as possible and at an angle horizontal to the ground to prevent herbicide running off the stump.
- b) Undiluted herbicide must be applied to the stumps immediately.
- c) On large stumps only the outer (sapwood) rim of the stump requires poisoning.

Debris from woody weeds that is capable of re-shooting (e.g., Small Leaf Privet) must never be left in contact with the ground. Such debris is either to be removed from site or piled on temporary 'rafts' until dead.

Scrape and poison treatment for woody weeds

Scrape and poison treatment is required for weeds where relatively small stem diameters do not permit enough herbicide to penetrate large rootstock for cut and poison treatment to be effective.

- a) Long scrapes are to be made with a knife along either side of each stem to expose the sapwood.
- b) Care must be taken not to scrape around the entire stem.
- c) Undiluted herbicide is to be applied to scrapes immediately.
- d) Plants must then be left *in situ* until dead.

Herbicide injection of large trees

Herbicide injection of large trees must, ideally, occur during periods of active growth (Spring). For deciduous trees treatment must occur between late Summer and early Autumn to ensure an effective 'take-down' of herbicide.

Only adequately trained and experienced personnel are permitted to carry out this procedure to ensure safe and effective treatment.

- a) Holes are to be drilled into the base of the tree trunk at 10 cm intervals, evenly spaced around the entire trunk and at a downwards angle to hold the herbicide.
- b) Holes must be drilled to penetrate the phloem (sapwood) of the tree and no further.
- c) Herbicide must be applied to the holes immediately after drilling.

Injected trees must be left undisturbed for at least six months to ensure an effective 'kill'.

Appendix 5. Company Profile

Abel Ecology has been in the flora and fauna consulting business since 1991, starting in the Sydney Region, and progressively more state wide in New South Wales since 1998, and now also in Victoria. During this time extensive expertise has been gained with regard to Master Planning, Environmental Impact assessments including flora and fauna, bushfire reports, Vegetation Management Plans, Management of Threatened Species, Review of Environmental Factors, Species Impact Statements and as Expert Witness in the Land and Environment Court. We have done consultancy work for industrial and commercial developments, golf courses, civil engineering projects, tourist developments as well as residential and rural projects. This process has also generated many connections with relevant government departments and city councils in NSW. Our team consists of four scientists and two administrative staff, plus casual assistants as required.

Licences

NPWS s132C Scientific licence number is S10557 expires 22 Jan 2010

NPWS GIS data licence number is CON95034

DG NSW Agriculture Animal Care and Ethics Committee approval AW 95/082

DG NSW Agriculture Animal Research Authority AW 95/082

The Consultancy Team

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- Consulting Planners Bushfire Training Course (Planning Institute of Australia, 2003)
- M.A. (Macquarie University, 1991)
- Wildlife Photography Certificate (Sydney Technical College, 1987)
- Herpetological Techniques Certificate (Sydney Technical College, 1986)
- Applied Herpetology Certificate (Sydney Technical College, 1980)
- Dip Ed. (University of New England, 1978)
- B.Sc. (University of New England - Triple Majors in Zoology, incl. Ecological Zoology, 1974)

Mark Sherring

- Consulting Planners Bushfire Training Course (Planning Institute of Australia, 2003)
- Certificate of Horticulture (Richmond TAFE, 1995)
- Bush Fire Operations modules (Mt. Riverview Fire Brigade, 1993)
- Certificate of Permaculture (Hazelbrook)
- Certificate of Bush Regeneration (Nepean TAFE, 1992)
- Certificate of Rural Operations. (Nepean TAFE, 1992)
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