# Flora and Fauna Management Plan

## Newnes Kaolin Mine, Newnes Junction


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# Executive Summary

Newnes Kaolin Pty Ltd, trading as Sydney Construction Materials (SCM) has approval to construct a construction sand, specialty sand and kaolin extraction operation at Newnes Junction near Lithgow. As part of the conditions of consent for the project a Flora and Fauna Management Plan (FFMP) is to be created and enacted. The FFMP broadly covers strategies such as vegetation clearing protocols, a compensatory habitat management plan, a pest and weed management plan and a flora and fauna monitoring program.

Mitigation of the impact of the Newnes Junction development will be provided by both on-site and off-site offsets. The intention is to ensure that the final result of the operations produce a net gain for the community and the environment.

On-site offsets include innovative rehabilitation and final landform design that will be employed to create an area which is aesthetically pleasing and consistent with the surrounding landscape in terms of native flora occurrence and subsequent flora and fauna habitat. This design is modelled on the local natural feature known as Gooches Crater.

Three separate offset projects will be undertaken off-site:

- A nearby area of Newnes Plateau Shrub Swamp (NPSS) will be rehabilitated. NPSS is an Endangered Ecological Community (EEC) listed within the NSW Threatened Species Conservation Act (1995). NPSS is also a component of Temperate Highland Peat Swamps on Sandstone (THPSS) which is an Endangered Ecological Community (EEC) listed within the commonwealth Environment Protection and Biodiversity Conservation Act (1999).
- A local area of scenic and historically significant bushland known as Dargan's Creek Reserve will be rehabilitated and managed. This area is currently Vacant Crown Land.
- An area of approximately 24.28 hectares of undisturbed eucalypt vegetation habitat similar to vegetation occurring within the proposed mine site is subject to an Agreement in Principle to be purchased at Mount Wirraba and transferred to National Parks Estate as compensatory habitat as required under Condition 25 of the Conditions of Consent and as agreed with the Office of Environment and Heritage (OEH) and Department of Planning (DoP) (see Appendix 2).

The final objective of projects 1 and 2 is to have them classified as Reserve Crown Land (or general environmental protection) while project 3 will add 24.28 hectares to the National Parks estate in the region.

- A fourth project involves the funding of the existing Lithgow and Districts Community Nursery to provide native plant stock for the extractive operations rehabilitation, and to supply the community with a variety of locally occurring native flora.

SCM will provide upfront funding for these offsets and will continue to fund them for the life of the project. It is agreed that the Hawkesbury-Nepean Catchment Management Authority (HNCMA) becomes the Scheme Manager, holding and dispersing the funds, and using its existing standard reporting processes to report to the company, government departments and other relevant stakeholders (See Appendix 2).

Monitoring of the retained 100m buffer to establish baseline data has begun. The baseline data collected from the 10 monitoring sites will be used to compare data collected in future years and to establish any impacts and / or management requirements in consultation with relevant stakeholders.

This document provides the strategies and general guidelines regarding flora and fauna management works and processes necessary to successfully undertake the offset projects, onsite and offsite management and rehabilitation.

# Contents

# Tables



# Figures



# Appendices

# 1.0 Introduction

Newnes Kaolin Pty Ltd, trading as Sydney Construction Materials (SCM) has approval to construct a construction sand, specialty sand and kaolin extraction operation at Newnes Junction near Lithgow. This Flora and Fauna Management Plan (FFMP) consists of several sections dealing with a number of general strategies to ensure that the proposed mine does not negatively impact on the surrounding vegetation and habitat values within the adjoining Blue Mountains World Heritage Area (BMWHA) and other surrounding areas. This document is in several sections with each section dealing with separate environmental issues as required by the Conditions of Consent for DA 329-7-2003 issued by the Minister for Planning.

These conditions are required in order to:

- Prevent, minimise, and/or offset adverse environmental impacts;
- Set standards and performance measures for acceptable environmental performance;
- Require regular monitoring and reporting; and
- Provide for the on-going environmental management of the development.
- The following headings provide a general synopsis of each strategy required by the Conditions of Consent for this FFMP.

## 1.1 Vegetation Clearing Protocol

This protocol has been formulated to ensure that the vegetation clearing required for the proposed development will be undertaken in an environmentally sensitive manner. It includes pre-clearance surveys to manage environmentally important attributes such as Hollow-bearing Trees and other habitat attributes which could be providing nesting or breeding habitat for a range of flora and fauna species. This protocol includes the progressive clearing of vegetation throughout the life of the mine, fauna management, conservation and storage of topsoil, seed collection from the site and managing waste vegetation.

## 1.2 Compensatory Habitat Management Plan

Three separate offset projects will be undertaken off-site:

- A nearby area of Newnes Plateau Shrub Swamp (NPSS) will be rehabilitated. NPSS is an Endangered Ecological Community (EEC) listed within the NSW Threatened Species Conservation Act (1995). NPSS is also a component of Temperate Highland Peat Swamps on Sandstone (THPSS) which is an Endangered Ecological Community (EEC) listed within the commonwealth Environment Protection and Biodiversity Conservation Act (1999).
- A local area of scenic and historically significant bushland known as Dargan's Creek Reserve will be rehabilitated and managed. This area is currently Vacant Crown Land.
- An area of approximately 24.28 hectares of undisturbed eucalypt vegetation habitat similar to vegetation occurring within the proposed mine site is subject to an Agreement in Principle to be purchased at Mount Wirraba and transferred to National Parks Estate as compensatory habitat as required under Condition 25 of the Conditions of Consent and as agreed with the Office of Environment and Heritage (OEH) and Department of Planning (DoP) (see Appendix 2).

The final objective of projects 1 and 2 is to have them classified as Reserve Crown Land (or environmental protection).

- A fourth project involves the funding of the existing Lithgow and Districts Community Nursery to provide native plant stock for the extractive operations rehabilitation, and to supply the community with a variety of locally occurring native flora.

## 1.3 Pest and Weed Management Plan

This plan has been created to manage any existing or possible occurrence of pest species such as foxes, rabbits or other fauna species as well as noxious weeds or other exotic flora species capable of invading the bushland on or adjoining the proposed mine site. The methods employed are to be environmentally sensitive and humane throughout the operation of this plan and its required works.

## 1.4 Flora and Fauna Monitoring Program

A Flora and Fauna Monitoring Program is required to initially provide baseline data regarding the flora and fauna composition currently present within the subject site, the habitats present within the adjoining Greater Blue Mountains World Heritage Area and habitats present along the Wollangambe River and tributaries. The initial survey provides baseline data to be used for comparison with other data gathered via regular monitoring during and subsequent to the mine operations. Baseline data includes structural and floristic vegetation descriptions, hydrological observations, occurrence and extent of weeds, presence or absence of pests or introduced fauna.

# 2.0 Overview

## 2.1 Description of the Proposed Development

The purpose of the mine is for the extraction of friable sandstone for processing into building materials, specialty sands and kaolin. The mine design is based on maintaining substantial buffers to the Newnes Junction residents and National Park, reducing disturbance to the marginal Newnes Plateau Shrub Swamp vegetation to the southwest of the site, and having sufficient area for the required infrastructure. The pit depth is variable as it is located on the side of a hill and ranges from 80 m on its western wall to only a few metres in the east. The maximum pit dimensions are 750 m in length north-south by 460 m in width. The final wall slope has a 2 m wide berm every 3 m in vertical height providing regular terraces for planting of vegetation as part of the progressive rehabilitation and eventual screening of walls.

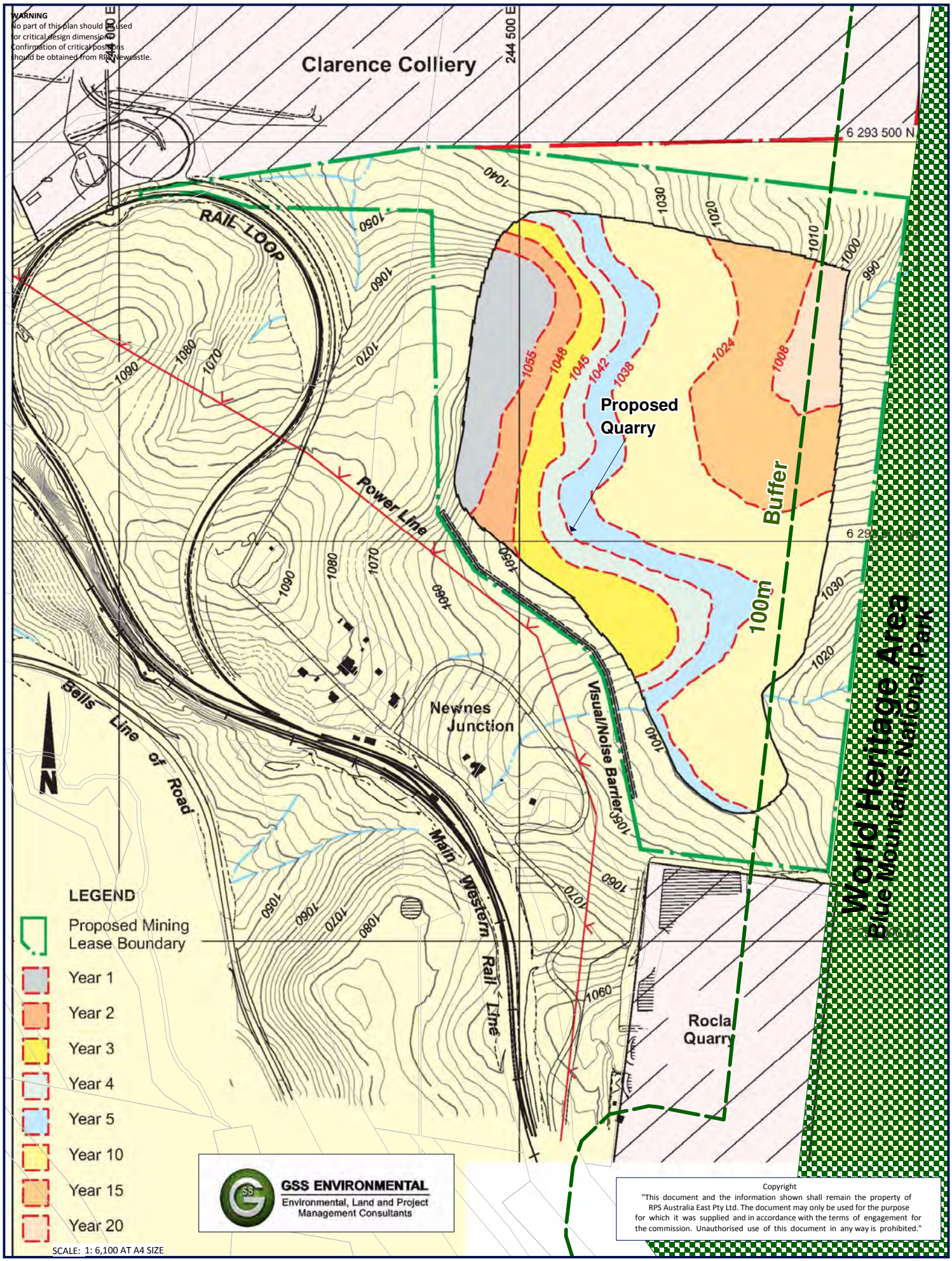
The site development will take place in three stages: site preparation and construction; quarry development and operations; and final rehabilitation. The main activities of each are described below.

Figure 2-1 illustrates the proposal and context.

### 2.1.1 Site Preparation and Construction

This primary stage includes construction of an acoustic barrier along the south-western boundary of the site to mitigate any noise created within the site from impacting on the township of Newnes Junction. This stage includes construction of infrastructure such as access roads, office and parking facilities, a stockpiling conveyor and hopper, maintenance facilities, a flat pad for the setup of the surface mining machine and flow controls for dirty and clean water including detention ponds and a water treatment plant.

The site preparation for surface miner use involves establishing an area of sufficient width and length to allow the surface miner to operate efficiently. Wirtgen (the manufacturers of the surface mining machine) recommend for standard applications in soft material that the minimum cutting length be nominally 300 m. The surface miner working bench will be established by ripping and dozing with a small dozer and removal of material by scrapers. The excavated friable sandstone will be required for test work in commissioning the process plant; incorporated in site infrastructure activities or stockpiled, and railed from site for processing. Topsoil stripped will be placed adjacent to the acoustic barrier to allow a visual screen of native trees to be established to further shield the barrier and quarry operation from the residents.




TITLE: FIGURE 2-1 THE PROPOSAL | LOCATION: CLARENCE, NSW | DATUM: N/A | PROJECTION: MGA ZONE 56 (GDA 94) | DATE: 4/11/2011 | PURPOSE: ENVIRONMENT | LAYOUT REF: | VERSION (PLAN BY): A A4 (TL)

CLIENT: NEWNES SAND & KAOLIN
JOB REF: 105716

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### 2.1.2 Quarry Development and Operation

The quarrying method involves extracting the material in horizontal layers from the upper most quarry bench to its base over the full width and length of each successive bench. This method meets the requirements of the surface mining machine, which prefers to operate over large, relatively flat areas for maximum efficiency. As the excavation expands, final slope batters and berms are formed into terraces and progressively rehabilitated. Also, residences will be increasingly shielded from the development by the final pit walls. The working benches will have a slight grade to direct surface run-off away from the pit crest to the northwest area of the excavation. Quarrying below 1002 mRL will involve maintaining a minimum 2 m high wall on the western side to prevent outflow of water into the National Park and significantly increase the void's water storage capacity. The pit base is planned to be approximately 990 mRL.

An important characteristic of the quarry development will be the early and progressive rehabilitation of the open cut berms or terraces. As the bench height is only 3 m, the wall will form a series of small terraces relative to typical quarry operations. Vegetation growth will hence shield the walls with the intention of screening the open cut void and reducing the visual impact ("terrace landscaping"). Rehabilitation will involve:

- surface preparation of the area by light ripping;
- placement of topsoil on an area 2m wide around the edge of the pit; and
- planting of locally occurring native shrubs and trees on the topsoiled bench.

The site topography will allow for continued access to all benches.

The mine will progress from the higher areas (approximately 1070 mRL in the north-west parts of the site) and progress downwards and to the east in stages spread over a period of approximately 20 years. The final depth of the mine will be at 990 mRL and will be approximately 25 hectares in size.

### 2.1.3 Final Rehabilitation

The final quarry void will contain a large number of small benches forming a terraced, vegetated landscape. The base of the pit will be graded to be free-draining with all disturbed areas to be top-soiled and re-vegetated. A small free draining wetland will result in the area occupied by the final retention pond.

The quarry design enables all water flows at the completion of quarrying to be contained within the quarry void for a period. When the final rehabilitation is complete, and vegetation well established and the landform stable, it will be possible to place a channel from the near quarry floor to the small creek channel in the north to re-establish flows directly to the water course. Previously, no direct flows other than those discharged by the water treatment plant would have taken place. Also on completion of quarrying, all buildings, infrastructure and stockpiles will be removed from the pit and processing areas leaving them to be shaped and re-vegetated.

## 2.2 Conditions of Consent

The following Table 1 lists the Conditions of Consent as set out in DA 329-7-2003. Only those conditions pertinent to this Flora and Fauna Management Plan are listed

**Table 1 Conditions of Consent and location of relevant documentation**

| Condition | Section of this Document |
|---|---|
| **FLORA AND FAUNA**<br>**Compensatory Habitat**<br>25. The Applicant shall:<br>a) implement the offset measures identified in the Supplementary Report (Document F – Newnes Plateau Conservation, Restoration and Enhancement Project), including:<br>▪ assistance in rehabilitation and conservation of Newnes Plateau Shrub Swamp, located north of Lithgow;<br>▪ assistance in rehabilitation and conservation of the Dargans Creek Crown Lands, located to the south of the site;<br>▪ establishment and maintenance of a community nursery; and<br>b) establish, conserve and maintain an additional area of at least 25 hectares of eucalypt vegetation habitat within proximity to the Greater Blue Mountains World Heritage Area, to the satisfaction of the Director-General. | Section 4 |
| **FLORA AND FAUNA**<br>**Flora and Fauna Management Plan**<br>26. Prior to carrying out any development, the Applicant shall prepare and subsequently implement a Flora and Fauna Management Plan for the development, to the satisfaction of the Director-General, the DEC and the DEH. This plan must be prepared by a suitably qualified ecologist whose appointment has been endorsed by the DEC and the DEH, and include:<br>a) a Vegetation Clearing Protocol;<br>b) a Compensatory Habitat Management Plan;<br>c) a Pest and Weed Management Plan; and<br>d) a Flora and Fauna Monitoring Program.<br><br>Note: The Department accepts that the initial Flora and Fauna Management Plan may not include a detailed Compensatory Habitat Management Plan. However, if this occurs, a concept Compensatory Habitat Management Plan must be provided along with a timetable for timely finalisation of the plan. | This Document<br><br>Section 3<br>Section 4<br>Section 5<br>Section 6 |
| 27. The Vegetation Clearing Protocol shall:<br>a) delineate the areas of vegetation to be cleared; and<br>b) describe the procedures that would be implemented for:<br>▪ pre-clearance surveys;<br>▪ progressive clearing;<br>▪ fauna management;<br>▪ conserving and reusing topsoil;<br>▪ collecting seed from the site;<br>▪ salvaging and reusing material from the site;<br>▪ managing waste vegetation; and<br>▪ controlling weeds. | Section 3<br>S. 3.1<br><br><br>S. 3.2<br>S. 3.3<br>S. 3.4<br>S. 3.5<br>S. 3.6<br>S. 3.7<br>S. 3.8<br>S. 3.10 |

| Condition | Section of this Document |
|---|---|
| 28. The Compensatory Habitat Management Plan shall be prepared in consultation with the HNCMA, Council and applicable landowners, and shall:<br>a) describe the compensatory vegetation proposal, including the requirements of condition 25 above;<br>b) justify why the proposed areas are suitable for the compensatory vegetation proposal, including how the areas will integrate with existing habitat areas on and near the site, including the Greater Blue Mountains WHA;<br>c) establish baseline data for the existing habitat in the proposed areas;<br>d) describe how the compensatory vegetation proposal would be implemented;<br>e) set assessment and completion criteria for the compensatory vegetation proposal;<br>f) describe how the performance of the compensatory vegetation proposal would be monitored over time; and<br>g) describe how conservation of the compensatory vegetation proposal would be secured over the long term. | Section 4 |
| 29. The Pest and Weed Management Plan shall:<br>a) identify potential terrestrial and aquatic pests and weeds that may be expected on and adjacent the site;<br>b) describe the measures that would be implemented to prevent the occurrence of pests and weeds on and adjacent the site;<br>c) include a program for monitoring the occurrence of pests and weeds on and adjacent the site, including the Greater Blue Mountains WHA and the Wollangambe River and its tributaries;<br>d) include detailed procedures for the management and eradication of pests and weeds identified on and adjacent the site. | Section 5<br>S. 5.1<br>S. 5.2<br>S. 5.3<br>S. 5.4 |
| 30. The Flora and Fauna Monitoring Program shall include:<br>a) detailed baseline data on the flora and fauna on the site and adjacent the site, including habitat present in the Greater Blue Mountains WHA and along the Wollangambe River and its tributaries;<br>b) detailed flora and fauna impact assessment criteria;<br>c) a program to monitor flora and fauna and habitat health on and adjacent the site, including within the Greater Blue Mountains WHA and along the Wollangambe River and its tributaries; and<br>d) a protocol for the investigation, notification and mitigation of identified non-compliances with the flora and fauna impact assessment criteria. | Section 6 |

## 2.3 Requirements to Assist in Rehabilitation and Conservation

### 2.3.1 Objectives

The overall objectives of the rehabilitation and conservation strategies is to enable the rehabilitation and maintenance of disturbed or degraded sites within the locality. These sites will have similar, or like characteristics to the land affected by the mine. The projects will mitigate, or offset the disturbance created by the Newnes Junction development. The projects will result in a ‘net gain’ with regard to the size and quality of habitat within the locality. The objectives for these projects are shown in Table 2.

**Table 2 Offset strategy objectives and criteria**

| No. | Objective |
|---|---|
| 1 | Environmental impacts are avoided using all cost-effective measures available with offsets used only to address remaining impacts |
| 2 | Regulatory requirements are to be met, and offsets are to be consistent with government policy |
| 3 | There is to be a net environmental improvement, i.e. "like for like" or better in terms of:<br>▪ Quantity: area of community/habitat to be retained, revegetated and rehabilitated<br>▪ Quality: species diversity; vegetation density; age/maturity; vegetation health; level of disturbance by weeds; presence/abundance of feral animals; specific habitat details for each key species<br>▪ Physical: biological and chemical constraints; erosion; soils; surface and groundwater; topography |
| 4 | No permanent environmental costs due to time lag in establishing offset |
| 5 | Offset to be developed and have systems put in place that provide for conservation management of the area in perpetuity |
| 6 | Impacts and benefits are readily identifiable and quantifiable |
| 7 | Offsets are located appropriately – offset and impact located in the same area |
| 8 | Offset areas are supplementary beyond existing requirements i.e. must be in addition to existing offset areas |
| 9 | Minimise risk and threats:<br>▪ Enforceable and legally secure<br>▪ threats from future development and land use conflicts<br>▪ adequate resources for management and monitoring, including best practice, adaptive management, open and accountable administration such as advisory panel and public annual report |

SCM 2005. Supplementary Report, Document F – Newnes Plateau Conservation, Restoration and Enhancement Project,

### 2.3.2 Funding

SCM will make an up-front contribution to establish required infrastructure, materials, initial project management and will continue to fund the scheme for the life of the mine. It is estimated that an up-front amount of $50,000 will allow the projects to be adequately resourced from the beginning of the development. Following this, an amount of approximately $30,000 per annum will allow for on-going project management, implementation, and maintenance (the equivalent of a part-time care-taker). (SCM 2005 - Supplementary Report (Document F – Newnes Plateau Conservation, Restoration and Enhancement Project)) (Also See Appendix 2).

This funding will be provided to Hawkesbury-Nepean Catchment Management Authority (HNCMA) for the implementation of the Compensatory Habitat project, excluding the additional minimum 25ha requirement included in the conditions. HNCMA has indicated its willingness for this to occur – refer to the HNCMA letter in Appendix 2. Provision of the 25ha will be implemented by SCM as a separate process and the identified land near Mount Wirraba will be transferred to National Parks Estate.

### 2.3.3 Scheme Manager

It is proposed (and has been agreed) that the HNCMA be the Scheme Manager, holding and disbursing the funds provided by SCM, and using its standard project reporting process to report to the company, any government departments and to other stakeholders.

This will not include the additional conditioned 25ha offset as this will become part of National Park Estate.

HNCMA has indicated that it is prepared to act as the scheme manager to deliver the Off-site Offsets Measures (excluding purchase of additional offset land) as listed in the Conditions of Consent. HNCMA has agreed to oversee offset measures (See Appendix 2) including:

- Assistance in rehabilitation and conservation of Newnes Plateau Shrub Swamp located north of Lithgow;
- Assistance in rehabilitation and conservation of the Dargans Creek Crown Lands, located to the south of the site; and
- Establishment and maintenance of a Community Nursery (or funding direction to the Lithgow Nursery).

Alternatively SCM, subject to DoP approval, could use this funding to allow a private contractor or the "Save Our Swamps" group which is co-ordinated by Lithgow and Blue Mountains Councils to undertake the works.

## 2.4 Offsets

### 2.4.1 On-site Offsets

#### 2.4.1.1 Progressive rehabilitation

An innovative site rehabilitation technique is to be employed for the progressive rehabilitation of the extraction pit area. Terraced landscaping will be created down the mine walls by the surface mining machine. As the surface miner progresses down through the resource, 2 metre wide benches will be left at every 3 metres of depth to provide a horizontal platform on which native flora species will be planted. Irrigation will be provided from mine seepage water. At the end of the mine life, an area of free draining wetland will be created at the bottom of the workings.

The reasons for employing this method of terraced rehabilitation include:

- To mitigate the visual impact of the mine throughout its life by providing a vegetated wall at all times,
- To reduce the rehabilitation task that would otherwise result at the end of the developments life,
- To allow for enhanced integration into the surrounding vegetation, and
- To minimise erosion and ensure landscape stability.

The progressive terraced landscaping of the walls will ensure that the rehabilitation will closely follow the extractive phase and will also ensure minimal visual impact throughout the life of the development.

Sydney Construction Materials (SCM) recognises that the site rehabilitation is a condition of consent and as such cannot be included as a form of official green offset, although it will contribute to an improved environmental outcome post-quarrying.

#### 2.4.1.2 Southern Drainage Diversion

At the end of Stage 1 the mining surface will have expanded and will be approaching the drainage line in the southern parts of the mining area. This drainage line discharges into the Wollangambe River and supports a vegetation community that shows some affinity to the endangered community known as Newnes Plateau Shrub Swamp (NPSS). This vegetation community does not contain several key dominant species required for this vegetation to be classified as NPSS. Nevertheless, SCM is cognizant of the importance of this environment and is committed to preserving it. SCM will safeguard the high quality of water that flows within this creekline and has amended the mine plan to ensure there are no uncontrolled discharges into this drainage. At the commencement of Stage 2 this drainage line will be diverted around the southern end of the mine and back into the existing line to ensure continuity of supply. Any surface flow will also be re-directed

into the diversion. Further details on water management (in particular the diversion of the creekline) can be found in the Surface Water Management Plan (Hughes Trueman 2004)) and the Soil and Water Management Plan (GSS, 2004).

#### 2.4.1.3 Final Landform

The subject site and surrounds currently supports eucalypt forest. The broad rehabilitation objective for the post-quarrying landform will be to establish a similar land use. The final landform after cessation of extraction will be an amphitheatre shaped void approximately 450m wide and 400m long at the western edge and 650m long at the eastern edge. The walls will be comprised of a series of 2 metre wide terraces, each terrace will be 3 metres high, giving a final average angle of 50 degrees. The terraces will be progressively revegetated throughout the life of the mine using endemic native species, while the final floor of the void will be reshaped and ripped for topsoiling and re-vegetation with endemic native species to create a stable free-draining wetland. This final landform is modelled on nearby Gooches Crater.

### 2.4.2 Off-site Offsets

#### 2.4.2.1 Newnes Plateau Shrub Swamp

The conditions of consent 25(a) requires "*assistance in rehabilitation and conservation of Newnes Plateau Shrub Swampland, located north of Lithgow*".

Location

The Newnes Plateau Shrub Swamp (NPSS) area is situated on the western edge of the road to Newnes Glow Worm Tunnel, approximately 6km north of Lithgow Township and on Red Hill Road. Other sites are likely to also be chosen and managed for the same purpose as identified by HNCMA.

Area

The site is approximately 5ha. Other sites may also be chosen by HNCMA.

Vegetation

The site contains Newnes Plateau Shrub Swamp (NPSS) which is listed as an Endangered Ecological Community (EEC) within the NSW Threatened Species Conservation (TSC) Act (1995). The NPSS community is also a component of the Temperate Highland Peat Swamps on Sandstone (THPSS) which is an Endangered Ecological Community (EEC) listed within the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act (1999). The NPSS vegetation community is dominated by Tea Trees (*Leptospermum juniperinum* and *Leptospermum lanigerum*), Button Grass (*Gymnoschoenus sphaerocephalus*), Razor Sedge (*Lepidosperma limicola*), *Xyris ustulata* and *Baeckea linifolia.* There are two broad types of these swamp communities – Sedge Swamp and Shrub Swamp, both sharing similar geology and roles in local hydrology. Other sites are likely to be focused on NPSS areas.

Condition

The NPSS area is currently in good condition with a complete suite of indicative species. The biodiversity and structure is typical of this vegetation type. This is an area of high conservation value due to the scarcity of this vegetation type, the habitats it provides for threatened flora and fauna species and the hydrological functions it provides. However, the site is presently being impacted by Radiata Pine (*Pinus radiata*) wildings which are spreading into the site from nearby pine plantations. These pines have the potential to substantially modify this ecosystem and in turn lead to the displacement of significant local flora and fauna.

Works Required

The works required within the NPSS are removal of the Radiata Pines. The potential for complete restoration of the NPSS site is very high as the current impacts from other issues such as erosion, sedimentation, other weeds,are minimal. The works will have a low impact on the native vegetation and recovery is expected to be very good.

Methods

Treatment of the pines via mechanical removal or stem injection, as described in Section 5 is required. This will ensure minimal disturbance, damage or impact to the NPSS community. The trees will be left 'in-situ' as removing them subsequent to treatment will cause physical damage to the NPSS community. Killing mature trees may trigger seed drop from cones and germination in the same swamp. This will therefore require follow up work to remove seedlings.

The entire site should be inspected prior to control works being commenced, in order to determine the extent of Radiata Pine infestations and enable effective planning and coordination of required works.

Reporting

A program of regular site inspections will be developed by HNCMA and implemented for the NPSS community to monitor the health of the area with respect to disturbances such as erosion, sedimentation and weed invasion (in particular to determine the rate of recruitment of pines) and to initiate control actions when necessary. Regular reports regarding the conditions within the site and any actions required or taken will be organised by HNCMA.

#### 2.4.2.2 Dargan's Creek Crown Lands

The conditions of consent 25(a) requires "*assistance in rehabilitation and conservation of the Dargan's Creek Crown Lands, located to the south of the site*".

Location

The site is located on the southern side of the Bells Line of Road near the village of Clarence approximately 10-15km east of Lithgow Township. Specifically, the Lots are 266, 239, 234, 250, 251, 82, 248, 235, 246, 244, 261 and adjoining un-numbered crown parcels. The site is located at the most north-eastern extremity of the Cox's River Catchment.

Area

The Dargan's Creek Crown Lands occupy a total of approximately 864 hectares.

Vegetation

The site characteristics are similar to the proposed mine site with numerous plant communities ranging from eucalypt woodlands and open forest through to montane heathlands and sedge swamps.

Benson and Keith (1990) in their vegetation mapping for the Wallerawang 1:100,000 map sheet recognise the following vegetation communities within or close to the Dargans Creek area:

9j Montane Gully Forest (*Eucalyptus fastigata, E. cypellocarpa and E. dalrympleana*),

10f Newnes Plateau Woodland (*Eucalyptus sieberi, E. oreades, E. dives*),

21c Montane Heath (*Allocasuarina nana, Banksia ericifolia, Leptospermum attenuatum, Phyllota squarrosa),*

20a Newnes Plateau Shrub Swamp.

Closed Heath - (Leptospermum *Grandifolium, Baeckea linifolia, Grevillea acanthifolia*),

Sedgeland – (*Gymnoschoenus sphaerocephalus, Xyris ustulata*),

21d Pagoda Rock Complex,

Open Heath - (*Allocasuarina nana, Leptospermum arachnoides, Lepidosperma viscidum*),

Open Scrub – (*Eucalyptus laophila*),

Woodland – (*E. piperita, E. rossii*).

In 2006 the NSW Department of Environment and Conservation (now NSW Department of Environment and Climate Change) produced a map of *The Vegetation of the Western Blue Mountains*. The following vegetation communities were mapped within or in proximity to the Dargan's Creek Crown Lands:

8 Newnes Sheltered Peppermint – Brown Barrel Shrubby Forest,

26 Newnes Plateau Narrow-leaved Peppermint – Silvertop Ash Layered Open Forest,

26a Newnes Plateau Gum Hollows Variant: Brittle Gum, Mountain Gum, Snow Gum Open Shrubby Forest,

28 Sandstone Plateau and Ridge Scribbly Gum – Silvertop Ash Shrubby Woodland,

29 Sandstone Slopes Sydney Peppermint Shrubby Forest,

30 Exposed Blue Mountains Sydney Peppermint, Silvertop Ash Shrubby Woodland,

43 Pagoda Rock Sparse Shrubland,

44 Sandstone Plateaux Tea Tree – Dwarf Sheoak – Banksia Rocky Heath,

46 Newnes Plateau Dwarf Sheoak – Banksia Heath,

50 Newnes Plateau Shrub Swamp,

51 Newnes Plateau Hanging Swamp,

62 Cleared and Severely Disturbed Lands.

Condition

The site was reserved for public recreation until May 12th 2000 when the reservation status was revoked. The land then became vacant crown land, and as such has not been actively managed since that time.

Two dams were constructed in the upper section of Dargan's Creek as a water supply for steam trains. These dams are currently used for recreational swimming. Abseiling and adventure companies and schools have also been known to take groups into the area on a regular basis. Rock climbing, picnicking, camping, four-wheel driving, trail bike riding and bushwalking are other common recreational pursuits undertaken within the site.

These recreational pursuits have had an impact within the subject site as evidenced by compaction of soft swamp soils, the formation of tracks, re-routing of water flows, erosion, bushrock removal, removal of dead wood and trees for firewood and weed invasion (particularly by Radiata Pine wildings, Blackberry, Scotch Broom and Gorse).

### Works Required

Some areas within the Dargans Creek Crown Lands are affected by exotic species such as Radiata Pine wildings, Blackberry, Gorse, Scotch Broom and others. Control of these exotic plants is required via a coordinated plan that includes regular inspections, works and follow up inspections to confirm the effectiveness of the program.

In order to rectify duplicated, heavily eroded access tracks, those required for future access need to be identified in consultation with parties that have an interest. It is proposed that identification and rationalisation directly necessary for access, power-line maintenance, fire fighting and railway maintenance be undertaken. All unnecessary tracks will be revegetated and any areas of erosion re-contoured.

### Methods

The Radiata Pine wildings will be treated via mechanical removal or stem injection, as described in Section 5. These methods will ensure minimal damage to other plants. Other weed species will be identified and weed control enacted.

The duplicated bush tracks to be retained will be defined in consultation with State Rail, Rural Fire Service, other Emergency Services, TransGrid and Lithgow City Council. All duplicated or unnecessary tracks will be machine ripped and brush-matted to stabilise and promote re-vegetation. These proposed works will see the duplicated tracks reduced to walking tracks or fully revegetated. This will also reduce vehicular accessibility within the site and in conjunction with public education; fencing and signage will ameliorate illegal rubbish dumping. All dumped rubbish will be removed and taken to the correct facility as part of the rehabilitation and management of the Dargans Creek Area.

Any areas of erosion will be rehabilitated using methodology approved by council. It is suggested that rehabilitation and soil stabilisation works be undertaken in accordance with the methodology outlined in the "Blue Book" - Managing Urban Stormwater (MUS): Soils and Construction by Landcom.

The following activities will be undertaken by the HNCMA with support from SCM:

- Stakeholder liaison;
- Coordination of a Reserve Lands Trust community committee;
- Development of a Plan of Management.

Reporting

A program of regular site inspections will be developed for the Dargan's Creek Crown Lands to monitor the health of the area with respect to disturbances such as rubbish dumping, erosion, compaction of soft swamp soils, re-routing of water flows, sedimentation and weed invasion (in particular to determine the rate of recruitment of pines) and to initiate control actions when necessary. Regular reports regarding the conditions within the site and any actions required or taken will be provided to the HNCMA.

#### 2.4.2.3 Establishment and Maintenance of a Community Nursery

The conditions of consent 25(a) requires that the company "*assists with establishment and maintenance of a community nursery*"

Location

Initially it was thought that starting a new nursery at Newnes Junction would provide the best location for native plant propagation to be used in the quarry restoration and for the community in general. However it is now considered more cost-effective to provide equivalent funding to the Lithgow and Districts Community Nursery in Lithgow. This will enable the funds to be used for plant propagation rather than set-up costs for a new smaller nursery.

Purpose

The purpose of the community plant nursery is to provide a local source of native flora for Newnes Junction, Bell, Clarence and Lithgow residents. The nursery will collect seed, propagate and supply locally occurring (endemic) native plants for use by local residents and for the rehabilitation or re-vegetation works within the mine and offset areas.

Funding

A start-up payment of $50,000 will be made by SCM to the scheme manager (HNCMA), and approximately $30,000 per annum will be provided for on-going project management, implementation, and maintenance.

Proposed Works

The proposed works will involve those activities necessary for the part-operation of the Lithgow and Districts Community Nursery in Lithgow. These may include site establishment, construction and maintenance of new nursery facilities, such as:

- Polyhouse and Shadehouse,
- Watering System,
- Seedbank collection and storage, and
- Propagation facilities.

The final use of the funds would be determined by the HNCMA and the nursery. It is preferred to direct the funds to plant propagation at Lithgow and Districts Community Nursery in Lithgow.

Operator

The nursery will be staffed by the local community with supervision and resources provided by Lithgow and District Native Plant Community Nursery.

Timing

SCM is to provide support to the community plant nursery for the life of the mine.

#### 2.4.2.4 Compensatory Area

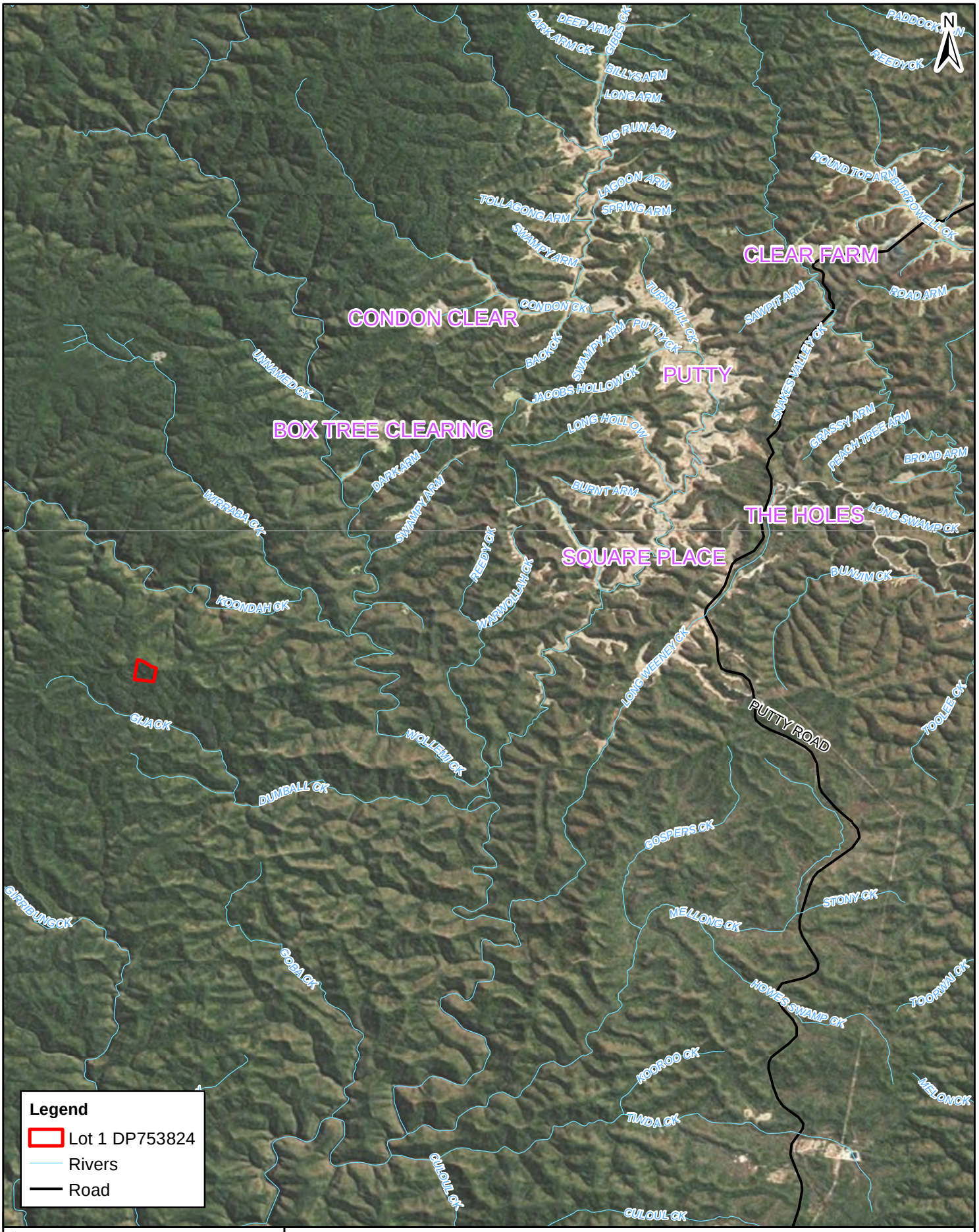
Clause 25(b) of the Conditions of Consent require that the applicant shall "*establish, conserve and maintain an additional area of at least 25 hectares of eucalypt vegetation habitat within proximity to the Greater Blue Mountains World Heritage Area, to the satisfaction of the Director-General*".

Location

The location of the area of undisturbed Eucalypt forest adjoining the GBMWHA has been identified in consultation with the OEH and DoP as Lot 1 DP 753824. There is an Agreement in Principle for SCM to purchase this land and at a later date transfer the land for incorporation into the Wollemi National Park Estate as the Compensatory Habitat as required in Condition 25 of DA 329/7/2003 (see Appendix 2). This area of 24.28 ha is located immediately west of Mount Wirraba approximately 14 km west of Putty Road, and is described as an isolated inholding surrounded by Wollemi National Park which forms part of the Greater Blue Mountains World Heritage Area. Appendix 2 provides the agreement letters from relevant departments. The location of the undisturbed eucalypt forest Offset Area is shown in Figure 2-2.

Reporting

The additional Offset Area stipulated in Clause 25(b) of the Conditions of Consent is now subject to an Agreement in Principle to be purchased by SCM and at a later date transferred to be incorporated into the surrounding National Park Estate. Given the proposal to add the block to Wollemi NP and integrate its management into the reserve and the GBMWHA, the requirement for preparation of a Compensatory Habitat Management Plan under Condition 28 could be considered to be covered by the Plan of Management for Wollemi NP (see OEH letter in Appendix 2).




| | |
|---|---|
| Client: Newnes Kaolin | **Agreed Offset / Compensatory Habitat Area** |
| Compiled by: glenn jeffs — Date: 22/08/2012 | |
| Approved by: Toby Lambert — Date: 22/08/2012 | **Figure 2-2** — Project: Newnes Kaolin FFMP |

0 1,500 3,000 6,000 m

Datum: GDA94

Source:
Bing Maps 2011
Client provided 2012
Lands Dept 2009
RPS 2011

RPS

Tracking number: JN103669 22/08/2012 *Path: J:\JOBS\103k\103669 Newnes Junction\10- Drafting\ArcGIS_map_documents\103669_Figure2_Agrees_Offset_A4P_20120822.mxd*

# 3.0 Vegetation Clearing Protocol

## 3.1 Areas to Be Cleared

The total area to be cleared will be approximately 25 hectares. The surface mining machine extracts approximately 0.3 metres of material vertically per pass. Vegetation clearing and topsoil removal will occur in advance of the mining process in a manner that will be staged in a similar manner to the mining.

## 3.2 Pre-Clearance Surveys

Prior to any vegetation clearing the area to be cleared will be subject to a pre-clearance survey to identify any areas containing threatened species or habitat for fauna. To date no threatened flora species have been observed within the subject site. Given that the proposed life of the mine will be twenty years, it is possible that threatened flora species may colonise parts of the site during the life of the mine. In addition, the site provides suitable habitat for a wide variety of threatened and non-threatened fauna species.

Pre-clearance surveys by qualified ecologists are required prior to clearing operations to determine the presence or absence of suitable habitat for threatened and non-threatened flora and fauna species. These surveys will target areas of suitable habitat for threatened flora species known in the local area and also the habitat attributes of the area to be cleared with respect to the provision of habitat suitable for threatened fauna species. Habitat likely to be encountered may be rock shelves supporting numerous reptiles, hollow bearing trees supporting arboreal mammals, birds, microchiropteran bats or reptiles and foraging or breeding habitat for a wide variety of birds, reptiles, amphibians and mammals.

Pre-clearance surveys will investigate the areas proposed for clearing and will provide a report on the habitat values and presence or absence of threatened species. This FFMP also recommends the actions to be taken if habitats such as hollow bearing trees are found.

### 3.2.1 Habitat / hollow-bearing tree survey and marking

The pre-clearance survey will include a search within the proposed area to be cleared for habitat / hollow bearing trees. When hollow bearing trees are found they will be marked all the way around the trunk at a height of approximately 1.5 metres with a band and a ‘H’ on no fewer than three sides using fluorescent spray marking paint. This is to ensure that the hollow bearing tree markings are clearly visible from all directions. All hollow bearing trees will be plotted using a D-GPS accurate to less than two metres and notes will be made regarding the number and size of the hollows within each tree and whether any fauna are using the hollows (see section 3.4 regarding felling protocols for hollow bearing trees).

### 3.2.2 Threatened Species Searches

Comprehensive searches will be undertaken by suitably qualified Ecologists within areas designated as the next stage of vegetation removal. These searches will target suitable habitat areas for threatened flora and fauna species that are known to occur within the local area. Lists of threatened flora and fauna species within the area are derived from locality searches on the NSW Wildlife Atlas database and also the Protected Matters Search Tool (SEWPAC website). These searches are combined to produce a list of threatened species listed within the TSC Act (1995) and the EPBC Act (1999) that are known in the local area.

As at 5 July 2010 the following threatened species and Ecological Communities are known within 10km of the subject site:

**Table 3 Threatened Species and Ecological Communities of the locality**

| Scientific Name | TSC Act | EPBC Act | Common Name |
|---|---|---|---|
| **Flora** | | | |
| *Acacia bynoeana* | E | V* | Bynoe's Wattle |
| *Acacia flocktoniae* | V | V* | - |
| *Apatophyllum constablei* | | E* | - |
| *Asterolasia buxifolia* | E | | - |
| *Boronia deanei* | V | V* | Deane's Boronia |
| *Caesia parviflora* var. *minor* | E | | Small Pale Grass-lily |
| *Caladenia tessellata* | E | V* | Thick-lipped Spider Orchid |
| *Derwentia blakelyi* | V | | - |
| *Eucalyptus aggregata* | V | | Black Gum |
| *Eucalyptus pulverulenta* | V | V* | Silver-leafed Gum |
| *Haloragodendron lucasii* | E | E* | - |
| *Isopogon fletcheri* | V | V* | Fletcher's Drumsticks |
| *Lastreopsis hispida* | E | | Bristly Shield Fern |
| *Persoonia acerosa* | V | V* | Needle Geebung |
| *Persoonia hindii* | E | | - |
| *Prasophyllum fuscum* | V | | Slaty Leek Orchid |
| *Pultenaea glabra* | V | V* | Smooth Bush-pea |
| *Thesium australe* | V | V* | Austral Toadflax |
| *Zieria murphyi* | V | | Velvet Zieria |
| AMPHIBIANS | | | |
| *Heleioporus australiacus* | V | V* | Giant Burrowing Frog |
| *Pseudophryne australis* | V | | Red-crowned Toadlet |
| *Litoria booroolongensis* | E | E* | Booroolong Frog |
| *Litoria littlejohni* | V | V* | Littlejohn's Tree Frog |
| **Birds** | | | |
| *Hieraaetus morphnoides* | V | | Little Eagle |
| *Oxyura australis* | V | | Blue-billed Duck |
| *Callocephalon fimbriatum* | V | | Gang-gang Cockatoo |
| *Calyptorhynchus lathami* | V | | Glossy Black-cockatoo |
| *Climacteris picumnus* | V | | Brown Treecreeper |
| *Daphoenositta chrysoptera* | V | | Varied Sitella |
| *Melanodryas cucullata* | V | | Hooded Robin |
| *Petroica boodang* | V | | Scarlet Robin |
| *Petroica Phoenicia* | V | | Flame Robin |
| *Pomatostomus temporalis temporalis* | V | | Grey-crowned Babbler (eastern subspecies) |
| *Anthochaera phrygia* | E | E* | Regent Honeyeater |
| *Glossopsitta pusilla* | V | | Little Lorikeet |
| *Lathamus discolor* | E | E* | Swift Parrot |
| *Ninox strenua* | V | | Powerful Owl |

| Scientific Name | TSC Act | EPBC Act | Common Name |
|---|---|---|---|
| *Tyto novaehollandiae* | V | | Masked Owl |
| *Rostratula australis* | E | V* | Australian Painted Snipe |
| **Insects** | | | |
| *Paralucia spinifera* | E | V* | Bathurst Copper Butterfly |
| *Petalaura gigantea* | E | | Giant Dragonfly |
| **Mammals** | | | |
| *Cercartetus nanus* | V | | Eastern Pygmy Possum |
| *Dasyurus maculatus* | V | E* | Spotted-tailed Quoll |
| *Petaurus australis* | V | | Yellow-bellied Glider |
| *Petrogale penicillata* | E | V* | Brush-tailed Rock-wallaby |
| *Petaurus norfolcensis* | V | | Squirrel Glider |
| *Pseudonomys fumeus* | | E* | Smoky Mouse |
| *Pteropus poliocephalus* | V | V* | Grey-headed Flying-fox |
| *Pascolarctos cinereus* | V | | Koala |
| *Potorous tridactylus tridactylus* | V | V* | Long-nosed Pottoroo |
| *Chalinolobus dwyeri* | V | V* | Large-eared Pied Bat |
| *Scoteanax rueppellii* | V | | Greater Broad-nosed Bat |
| REPTILES | | | |
| *Eulamprus leuraensis* | E | E* | Blue Mountains Water Skink |
| *Hoplocephalus bungaroides* | E | V* | Broad-headed Snake |
| **Ecological Communities** | | | |
| Temperate Highland Peat Swamps on Sandstone (EEC*) | | | Equivalent to Newnes Plateau Shrub Swamp (EEC) |
| White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Grasslands (EEC, EEC*) | | | |
| Newnes Plateau Shrub Swamp (EEC) | | | Equivalent to Temperate Highland Peat Swamps on Sandstone (EEC*) |

Further species, populations or ecological communities may be added to the TSC Act (1995) or the EPBC Act (1999) during the estimated 20 year life of the mine. Therefore, before any pre-clearance searches are undertaken an updated list of known threatened species etc. is to be generated.

Pre-clearance surveys may require 'stagwatching' or monitoring of hollow bearing trees to determine if these trees are providing nesting or roosting habitat for a range of fauna species such as birds, nocturnal arboreal mammals or microchiropteran bats.

### 3.2.3 Pre-clearance Reporting

A report detailing the survey times, effort and results of the pre-clearance survey will be submitted to the client for distribution to any regulatory authorities as required.

## 3.3 Progressive Clearing

Clearing of vegetation within the subject site will be undertaken in a staged manner. This staged clearing will precede the proposed stages of the mine expansion. It is anticipated that each stage will require a separate area of clearing, resulting in between 8 and 12 separate clearing stages.

### 3.3.1 Timing

Timing of the clearing is to precede any expansion of the mining area. It is likely that pre-clearing surveys will require a lead time of approximately four weeks to schedule and undertake the surveys and to produce a report.

### 3.3.2 Extents of stages

Stages within the mine pit itself will be in the form of progressively forming benches each of which will be two metres wide and three metres high. As the mine is proposed to remove material from 1070 to 990 mRL the maximum depth of the pit will be 80 metres. This will result in a total of 27 benches being formed at the highest point. The average slope over most of the proposed mine area is approximately 15% or 8.5 degrees. This will result in approximately 20 metres width (measured horizontally) of vegetation to be cleared for each 3m high bench.

It may or may not be practical or economical to stage the clearing and mine expansion in 20 metre horizontal increments, therefore it is expected that the mine expansion will proceed on an ‘as required’ timetable and area.

## 3.4 Fauna Management

Fauna management is required within the subject site in order to protect any fauna that may be encountered during operation of the mine, especially when removing vegetation in preparation for regular staged expansion of the mine. Management will require protocols for the removal of vegetation in an environmentally aware manner in order to protect and allow fauna to evacuate the site voluntarily. Failing this, the fauna are to be protected during the vegetation removal phase via the implementation of protocols such as for felling hollow bearing trees, removing displaced fauna and treating injured fauna if required.

### 3.4.1 Habitat/hollow-bearing Tree Felling Protocol

Habitat trees are to be clearly marked as described in Section 3.2.1 prior to vegetation clearing commencing. Any trees with fauna known to be in residence are to be noted and treated with the utmost circumspect to protect the fauna and allow them to vacate the tree.

Hollow bearing trees are to be cleared after all other vegetation has been removed. It is generally considered good practice to remove all other vegetation several days in advance of hollow tree removal in order to make the hollow bearing trees less suitable as nesting or roosting sites due to the lack of cover and foraging habitat nearby. Animals will frequently vacate dens and nests in this way.

Hollow bearing trees are to be felled using the following protocol in association with the presence of a qualified ecologist:

1 Plant equipment such as an excavator or front-end loader is to be used. The plant is to be of sufficient size, weight and power to achieve this with a large margin of safety.

2 Each individual hollow bearing tree is to be gently 'tapped' twice with the machine,

3 The operator is to wait for approximately one minute to see if any fauna appear,

4 A second series of slightly harder 'taps' is to be delivered to the hollow bearing tree

5 Wait for another minute, watching for the appearance of fauna,

6 If fauna appears from within the tree every effort should be made to encourage and assist the animal/s to vacate and relocate to nearby bushland.

7 If no fauna appears, the tree is to be pushed over as slowly or gently as possible.

8 After the felled tree has settled, an ecologist is to inspect the hollows and any other part of the tree for the presence of fauna.

9 If any fauna are found within the tree they are to be allowed to relocate to nearby bushland if they are uninjured, if they are injured the ecologist is to either transport the animal to a vet for treatment or perform euthanasia (in a humane manner consistent with the guidelines produced by the Animal Research Authority licensing agreement held by the ecological company) upon the animal if it is obvious that the animal has no chance of survival.

### 3.4.2 Displaced Fauna

Fauna that has been displaced by the removal of vegetation or the felling of hollow bearing trees is to be allowed to find its way to any nearby area of bushland. If the animal requires assistance to do so (such as not knowing which way to go, or getting caught in fences etc) then assistance to achieve removal of the animal is to be given. This assistance is to be as non-invasive as possible and is to be carried out in the gentlest or least traumatic possible way.

### 3.4.3 Injured Fauna

Injured fauna is to be assessed by a vet or other person with suitable knowledge to determine survivability. If the animal is likely to survive it is to be captured and taken to a local vet in the first instance, with post veterinary care to be undertaken by local WIRES or similar organisation until the animal is healthy enough for release into habitat as near as possible to the site of capture.

If it is considered that the animal has been mortally injured or is unable to move or feed then the ecologist is to euthanase the animal in a humane manner consistent with the guidelines produced by the Animal Research Authority licensing agreement held by the ecological company.

## 3.5 Conserving and Re-using Topsoil

Topsoil is the uppermost layer of soil which is present over most areas. This layer is very important from an ecological perspective as it contains a higher amount of nutrients, vegetative matter, microorganisms and also dormant seeds of plants. The conservation and handling of topsoil is important when undertaking developments because it is irreplaceable when undertaking landscaping or re-vegetation activities.

### 3.5.1 Seedbank

Topsoil contains various amounts of dormant seeds from the vegetation which occupies the site. This 'seedbank' contains propagules from most of the plants that naturally occur within that area. Therefore it is

highly advantageous to conserve this seedbank in order to re-use it at a later time when landscaping or rehabilitating disturbed areas.

The seedbank within topsoil is usually kept viable by regular deposits of new seeds each year. If topsoil is to be removed and stored then the seedbank is not replenished and will eventually die if it is not allowed to germinate. Different seeds have different dormancy rates and therefore some species seeds will die sooner than others.

Another factor in the viability of a seedbank is the way in which the topsoil is stored, if it is stored in one large or deep stockpile then the centre of the pile will become compacted and the permeability of the central portions of the pile will decrease. This permeability applies to oxygen and water.

Impermeable soil will decrease the amount of oxygen available for the seeds to use (anoxia) and even though the seed is dormant it still requires oxygen to survive, therefore the seeds in an anoxic environment will die much sooner.

Impermeable soil will also upset the availability of water or moisture which is present in all topsoil. Impermeability may result in too much water (waterlogging) or too little water (dessication) of the seeds. This also severely limits the viability or longevity of a seedbank.

To provide a suitable environment for the seedbank within topsoil it is recommended to store topsoil in such a manner as to limit impermeability. Some general strategies are:

- Use the topsoil as soon as possible
- Aerate the topsoil at regular intervals during storage (by moving it or otherwise with a machine),
- Store topsoil in shallow or small piles or windrows (to allow oxygen and moisture to penetrate).

### 3.5.2 Topsoil removal

Topsoil is to be removed from the newly cleared areas using self filling scrapers. The topsoil will then be stockpiled for later use or re-used immediately for landscaping and / or rehabilitation works on the mine terraces.

### 3.5.3 Topsoil stockpiling, location, method

Stockpiling of topsoil is to be kept to a minimum as it is detrimental to the native plant seedbank it contains. Given that the mine is to be expanded on a regular or staged timetable it is expected that the topsoil removed at each stage will be used to rehabilitate areas from the previous stage.

The location of any topsoil stockpile is yet to be determined. However, it is likely that as the mine development progresses the areas available for stockpiling will become more available.

Topsoil stockpiling is best done in small piles or windrows to facilitate the permeability required to provide adequate moisture and oxygen for the seedbank. It is possible to spread the topsoil out as part of a temporary landscape and let it germinate naturally, however if it needs to be removed and relocated then it will require clearing and re-scraping again. If this is to occur it is recommended that some topsoil is left in situ to avoid creating a ‘scalped’ area which will not regenerate very well.

### 3.5.4 Sediment control

Topsoil stockpiles will need to have erosion and sediment controls in place at least until the stockpile is used or it re-vegetates naturally. Sediment controls shall be installed in accordance with EPA standards and also in accordance with Lithgow City Council requirements

Erosion and sediment control measures shall be implemented to minimise adverse effects as a result of increased likelihood of erosion and sediment transportation. Erosion and sediment control measures include:

- Identification of potential erosion areas;
- Installation and maintenance of flow, erosion, sediment and nutrient control structures;
- Control of sediment through construction of sediment basin/s;
- Control of nutrients through construction of drains and nutrient basin/s;
- Separation of Dirty mine water from the Clean natural overland flow water;
- Construction of adequate Dirty Water collection and processing infrastructure
- Diversion of clean water around site and back into natural flow channels;
- Coordinated work practices aimed at minimising land disturbance;
- The minimisation of groundcover disturbance through the dedication of vegetation protection zones in areas designated as Buffers;
- Routine site inspections of drains, channels, sediment control structures and water quality;
- The safe disposal of all waste products; and
- The disposal of 'clean' water off site.

The minimisation of soil erosion will be achieved through soil stabilisation measures. These measures may include strategies or methods such as spray seeding, sediment fencing and water control techniques.

Soil stabilisation measures which may be implemented include, immediate re-vegetation of cleared surfaces via seeding, planting of native species, mulching or the installation of biodegradable blankets.

## 3.6 Collecting Seed from the site

Collecting seed from the site is recommended to provide adequate numbers of tube stock to re-vegetate the mine terraces and to rehabilitate the mine floor when the mine ceases operation. Under Section 132C of the NSW National Parks and Wildlife Act 1974 it states that:

> *"Picking of any protected native plant, or any plant that is a threatened species or is part of an endangered population or an endangered ecological community. You will need a licence if you plan to collect voucher specimens for identification purposes, pick cuttings or whole plants, or collect seed."*

Therefore, necessary permits associated with the collection of seed from protected native plants or EECs are to be obtained prior to the commencement of seed collection. Necessary permits are likely to include a Section 91 Application to OEH.

### 3.6.1 Collecting seed

Seed collection can be undertaken by duly licensed personnel within the site prior to the staged removal of vegetation. It could also occur as native vegetation is cleared as seeds of many species will be held inside closed capsules for a short period following felling. This could provide for increased speed of seed collection. It is recommended that seed be collected from the site to preserve the local provenance of the seed and to ensure the viability of tube stock to be used in the regeneration works to be undertaken within the mine site and surrounds throughout the life of the mine and for the final rehabilitation when the mine ceases operation.

### 3.6.2 Integration with the proposed setup of community nursery

It is expected that the seed collected will be propagated in the local native nursery which is to be funded as part of this development. This nursery will provide sufficient tube stock of locally occurring native tree, shrub and groundcover species to supply the entire staged re-vegetation program for the life of the mine and for the final rehabilitation works.

SCM will fund the plant nursery activities for the life of the project.

### 3.6.3 Seed collection Personnel

Seed collection is to be undertaken by or under the direction of a qualified Bush Regenerator who must have completed a TAFE Conservation and Land Management course or equivalent, and have suitable field experience (e.g. Minimum 200 hours prior employment as a bush regenerator) or a suitably qualified ecologist or mine environmental officer. It would be advantageous for the bush regeneration supervisor to have experience in regenerating bushland in the Lithgow area.

## 3.7 Salvaging and re-using material from the site

Salvaging and re-using material from the site is an ecologically sound strategy to minimise waste and to recycle materials that may otherwise end up in landfill.

### 3.7.1 Dead timber or trees

Dead timber or trees not containing hollows will be salvaged and re-distributed within Buffer or other areas outside of the proposed mine site. Dead wood provides food and nesting habitat for a number of insects and reptiles which in turn provide food for other fauna.

### 3.7.2 Hollow trees / logs

Hollow trees when felled can be cut into manageable pieces and reused. Hollow logs can be relocated and placed on the ground within Buffer areas to retain or enhance the natural bushland habitat values.

Smaller hollow branches will be re-used to replace arboreal habitat identified as being lost from the impact zone (i.e. hollow-bearing trees) by fastening them in retained trees for use as replacement nests or dens by birds or arboreal fauna.

### 3.7.3 Mulch

At least 80% of the cleared vegetation will be mulched and re-used throughout the site to assist with vegetation regeneration works. When used in this way mulch helps to ameliorate the effects of drying and assists with the retention of moisture in the soil. Mulch also assists in the stabilisation of soil and helps minimise soil erosion and sedimentation.

Noxious or weed species are to be excluded from the mulching process. Mulch containing weed fragments or propagules would increase the incidence of weeds within any area where the mulch is spread.

## 3.8 Managing Waste Vegetation

It is anticipated that cleared vegetation will be mostly recycled or re-used within the site. Hollow logs and branches are to be re-used as habitat within buffers or other areas not subject to direct mining. The majority of the tree crowns can be mulched and re-used in the re-vegetation or rehabilitation works associated with the regular staged expansion of the mine.

As most of the vegetation is to be recycled and used within the subject site it is anticipated that the waste vegetation will consist of larger commercially or otherwise useful timber trunks, tree stumps which are not suitable for mulching and any vegetation waste derived from noxious or weed species.

### 3.8.1 Tree trunks

Wherever possible, dead or hollow-bearing tree trunks from the impacted area will be used to enhance habitat within the areas that will not be quarried. These trunks and hollows can be placed on the ground to provide food and nesting habitat for a variety of insects and reptiles which provide food for other fauna. Alternatively, non-hollow bearing timber can be re-used as firewood, sold to mills, used as barriers or to cordon off rehabilitation areas.

Some tree trunks may be suitable for commercial or other uses and can be recycled in this manner.

### 3.8.2 Stumps

Tree stumps are generally difficult to mulch and therefore require disposal. It is recommended that tree stumps be collected and transported to a green waste collection facility for disposal.

### 3.8.3 Noxious or weed vegetation

Vegetative matter derived from or containing weed material in the form of propagules such as seeds, suckers, bulbs or cuttings and any other parts of weed material capable of striking roots or shoots will be collected and transported to a green waste collection facility where it will be destroyed. This will help prevent the spread of weeds in the vicinity of the mine site and the adjoining buffers and GBMWHA.

Disposal of weed material via burns piles is generally discouraged, however it may be permitted only after approval has been obtained from the relevant authorities. Any burning must be carried out as advised by the Environment Protection Authority and NSW Fire Brigade.

## 3.9 Progressive Rehabilitation

Progressive rehabilitation will be undertaken in conjunction with the planned or staged expansion of the mine. The mine is to be expanded by working from the higher areas over a smaller pad size and progressively removing material at deeper and wider areas as the topography allows. Each expansion will produce a bench on the mine wall of approximately two metres width and three metres in height. These benches will have a slight slope so that they drain into a detention basin system that collects the runoff which will then be treated and clean water disposed of offsite. Due to the topography all of the benches will be accessible at one or more ends from the natural ground level. As the next level of material is mined the remaining bench will be ripped by a small machine and topsoil and mulch will be placed on the bench surface. The topsoil / mulch will then be planted out with tube stock and seeds from the nursery.

## 3.10 Controlling Weeds

Weed control is an important part of vegetation management. Weeds by their very nature are usually very good at reproducing or otherwise occupying large areas in a short time. This is due to the fast and highly opportunistic reproductive capability of the weed species or its ability to grow at a faster rate than its competitors and thereby crowding out other species. Weed control is a major component of vegetation management strategies, therefore it is dealt with in its own section within this Flora and Fauna Management Plan (see Section 5 – Pest and Weed Management Plan).

# 4.0 Compensatory Habitat Management Plan

## 4.1 Background

Condition 25 of the Consent requires that offset measures as identified in the Supplementary Report (Document F – Newnes Plateau Conservation, Restoration and Enhancement Project) are implemented.

It should be noted that, in consultation with DoP, OEH and HNCMA, the requirements of that document have been amended slightly. The main amendment is that compensatory funds previously outlined as going towards a new nursery to be established at Newnes Junction will now be directed towards the already established Lithgow Community Nursery. This will ensure more efficient use of the funds toward plant propagation rather than set-up costs to replicate a facility that already exists nearby.

In addition, the 25ha offset area to be purchased by SCM and as agreed with determining authorities will become part of Wollemi National Park and a specific management plan for this isolated location is not considered to be required.

## 4.2 Compensatory Habitat Sites

### 4.2.1 Newnes Plateau Shrub Swamp

#### 4.2.1.1 Site location and description

The Newnes Plateau Shrub Swamp (NPSS) site is located on the western edge of the road to the Newnes Glow Worm Tunnel, approximately 6 km north of Lithgow township and on Red Hill Road. It is approximately 5 ha in area.

This site on Crown land consists of a unique ecological community, known as a Newnes Plateau Shrub Swamp (Benson and Keith 1990). It is dominated by Tea Trees (*Leptospermum juniperinum* and *Leptospermum lanigerum*), Button Grass (*Gymnoschoenus sphaerocephalus*), Razor Sedge (*Lepidosperma limicola*), *Xyris ustulata* and *Baeckea linifolia*.

There are two broad types of these swamp communities – Sedge Swamp and Shrub Swamp, both sharing very similar geology and roles in local hydrology. They are separated by the make-up of their vegetative components.

The site provides the potential to be habitat for the Blue Mountains Swamp Skink (*Eulamprus leuraensis*), listed on the TSC Act. To date, five locations on the Newnes Plateau have had recordings of the Blue Mountains Swamp Skink. Plant species that are recognised as threatened and which occur in the habitat of the Blue Mountains Swamp Skink include the vulnerable species *Pultenaea glabra*.

Regionally significant plant species include *Xyris ustulata* (endemic from Mt Coricudgy to the Budawangs), *Almalaea incurvata* (endemic to Central Tablelands), and *Grevillea acanthifolia* subsp. *acanthifolia* (endemic to Central Tablelands over 450 m elevation) (NPWS Atlas of NSW Wildlife).

The diversity of vegetation contained within the swamp community and adjoining Eucalypt woodlands has the potential to provide habitat for both common and vulnerable wildlife.

Apart from the Blue Mountains Swamp Skink, other threatened fauna species occurring in the same habitat include the endangered Giant Dragonfly (*Petalura gigantea*) and vulnerable Giant Burrowing Frog (*Heleioporus australiacus*) and Red-crowned Toadlet (*Pseudophryne australis*). The swamps also provide

habitat for three regionally significant fauna species, the Southern Emu-wren (*Stipiturus malachurus*), Lewin's Rail (*Dryolimnas pectoralis*) and Buff-banded Rail (*Gallirallus philippensis*) (Washington 1999).

#### 4.2.1.2 Impacts on Site

This Shrub Swamp community is presently being impacted by Radiata Pine (*Pinus radiata*) wildlings, which are spreading into the site from nearby pine forests. These pines have the potential to substantially modify this ecosystem and in turn lead to the displacement of significant local flora and fauna.

#### 4.2.1.3 Proposed works

The proposed works would see treatments of these pines through stem injection and cut and paint techniques in order to ensure there is minimal damage to the Shrub Swamp community.

The potential for complete restoration of this site is very high. The works proposed would also see an area of high conservation value within the catchment being targeted.

Once restoration of this area has reached an adequate level according to the Scheme Manager (HNCMA), the Company will investigate the feasibility of this land reverting back to Crown land reserve status, or being rezoned under the Lithgow LEP for environmental protection. It is expected that the level of protection afforded by any future re-classification would be consistent with an environmental protection zoning. This will be discussed with the relevant stakeholders as part of the management process. Required resources and final management responsibility will be identified as part of this process.

### 4.2.2 Dargan's Creek Crown Lands

#### 4.2.2.1 Site location and description

The site is located on the southern side of the Bells Line of Road at Clarence approximately 10-15km east of the Lithgow township – see Figure 4-1.

The site is located at the most north-eastern extremity of the Cox's River Catchment.

The subject site is approximately 864 hectares. It comprises numerous parcels of crown land, which were reserved for public recreation until May 12th 2000. In the Government Gazette of that date, the Reservation status was revoked, with the land becoming vacant crown land, and as such has not been actively managed since that time.

The land slopes significantly towards the Hartley Valley to the south, from the plateau edge at approximately 1100m down to 800m in the valley. Dargan's Creek is one of three main headwaters that drain south into the Hartley Valley into the Lett River. This in turn has an eventual confluence with the Cox's River approximately 20km downstream.

Site characteristics are similar to those at the proposed Mine site. The site flora consists of numerous plant communities ranging from Eucalypt based Woodlands/Open Forest, through to Montane Heathlands and Sedge Swamps. The diversity of vegetation types and their distribution has resulted directly from the varied make up of the local geology, which is part of the Triassic Banks Wall Sandstone, and its associated hydrology.

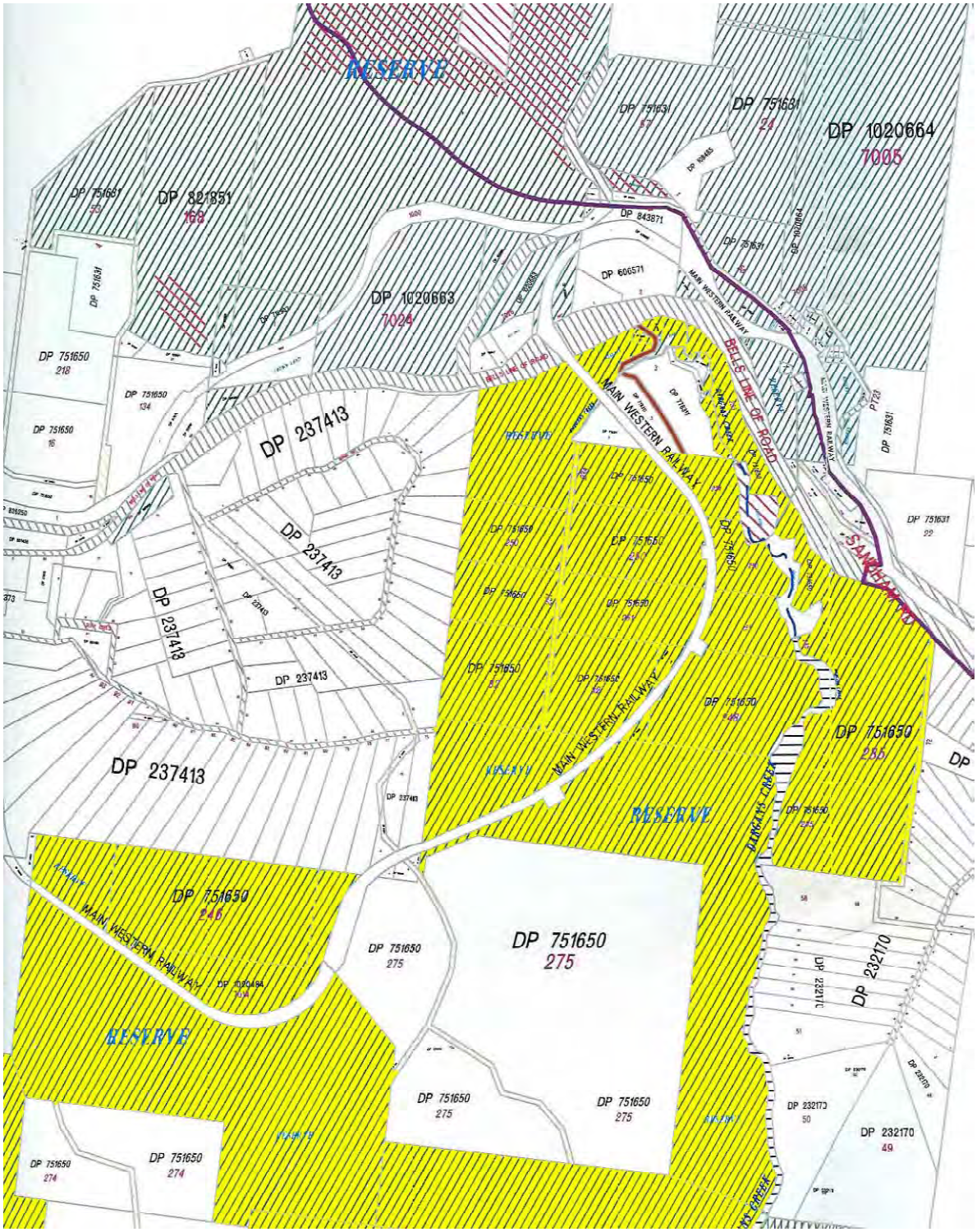



**Figure 4-1: Dargan's Creek Crown Lands. Yellow area denotes location of offset area (from figure 13 [Doc F]) subject to restorative actions**

The site, as with that described in Project 1, has the potential to be habitat for the Blue Mountains Swamp Skink (*Eulamprus leuraensis*). Plant species that are recognised as threatened and occur in this type of habitat include the vulnerable species *Pultenaea glabra,* currently listed as Vulnerable on the TSC Act.

Regionally significant plant species include *Xyris ustulata* (endemic from Mt Coricudgy to Budawangs), *Almalaea incurvata* (endemic to Central Tablelands), and *Grevillea acanthifolia* subsp. *acanthifolia* (endemic to Central Tablelands over 450 m) (NPWS Atlas of NSW Wildlife). Further, the site contains other significant plant species such as Snow Daisy (*Celmisia longifolia*), Oak–leaved Daisy (*Olearia quercifolia*), *Acacia meiantha*, *Dillwynia stipulifera*, and *Eriostemon obovalis*.

According to Briggs and Leigh (1996), the area accounts for a number of species that are listed as having particular conservation significance (ROTAP). It is highly likely that additional and comprehensive ground-truthing of the reserve would reveal additional locations of species of significance, of both flora and fauna.

#### 4.2.2.2 Impacts on Site

Two dams were constructed in the early 20th century in the upper section of Dargan's Creek as a water supply for steam trains. Recreation is a major land use in the area and includes swimming at Dargan Creek dams, rock climbing and camping. The area has always been a popular swimming hole in summer for locals, and was once a well-kept secret, ensuring that overuse, rubbish, traffic, and pedestrian and vehicular encounters were not an issue.

The site is being and for some time has been impacted primarily by fragmentation from vehicle tracks, which in some locations is leading to substantial erosion problems.

Swamps are particularly sensitive to impacts created by weeds, vehicles, and access tracks. Roads, which cut across and interrupt areas of subsurface water flow, may lead to drying of swamps if residual water flow is insufficient to sustain the swamp. Tracks can alter the hydrology by redirecting water away from dependent downstream vegetation and fauna species, allowing normally moist areas to dry out. Likewise, rerouted waters can have deleterious impacts on adjacent vegetation communities.

Reduced infiltration may lead to lowering of the water table and drying of swamps. Clearing of areas adjacent to or above swamps may result in water being channelled into creeks rather than infiltrating the soil and recharging the groundwater feeding the swamps. Channelling also results in higher velocity discharge, which may cause erosion.

Vehicular access is contributing to the compaction of soft swamp soils, and effectively dividing vegetation communities on the site. Where boggy patches occur, excavations have been undertaken to empty puddles and drain still standing pools of water, thus channelling water away from its natural course and distribution through vegetation.

The site is increasingly being used throughout the year, particularly in the warmer months for swimming, picnicking, and camping. Abseiling and adventure companies and schools have also been known to take groups into the area on a regular basis. Trail bike riding and four wheel driving activities are becoming more commonplace.

State Rail has attempted to restrict access with the erection of initially one gate approximately 20m into the area adjacent to the railway line. Repeated vandalism of the gate to gain access, and the establishment of semipermanent occupation of the site by State Rail staff undertaking railway upgrading, has led to the installation of a series of cyclone gates erected at intervals along the railway line. Access is required by State Rail Authority and Transgrid in order to access powerlines that transverse the site on adjacent lands north of the dams.

Ranges of plant communities are being impacted by Radiata Pine wildings, which are spreading into the site from nearby pine forests. These pines have the potential to substantially modify the various ecosystems and in turn lead to the displacement of significant local flora and fauna. There are also minor infestations of Blackberry, Scotch Broom and Gorse.

#### 4.2.2.3 Proposed works

The proposed works would see treatment of pines through stem injection and cut and paint techniques to ensure there is minimal damage to the other plant communities. Other weed species will be identified and a weed management plan drawn up and implemented.

In order to resolve the problem of duplicated, heavily eroded access tracks, those required for future access to the land need to be identified in consultation with State Rail, Emergency services, Transgrid and Lithgow City Council. It is proposed that identification and rationalisation of tracks directly necessary for access, maintenance of power lines, firefighting purposes, and railway maintenance be conducted. All duplicated or unnecessary tracks will be machine-ripped and brush-matted to stabilise and revegetate them. The proposed works would see these duplicated tracks reduced to walking track scale where vehicle access was no longer necessary.

The site is also subject to rubbish dumping and these works would also reduce access to these sorts of activities through fencing and public education. Further, through this Project, the rubbish dumped will be removed and properly discarded.

Once restoration of this area has reached an adequate level according to the Scheme Manager (Hawkesbury-Nepean Catchment Management Authority), the Company will investigate the feasibility of this land reverting back to Crown land reserve status, or being rezoned under the Lithgow LEP for environmental protection. All of the preceding proposed works would be carried out for the preparation and execution of a Plan of Management for the site that would be required were it to be reclassified as Reserved Crown Land.

### 4.2.3 Establishment and maintenance of a community nursery

#### 4.2.3.1 Location

SCM will provide the funding for the Lithgow and District Native Plant Community Nursery in Coalbrook Street, Lithgow. The nursery will provide the supervision and resources funded by this strategy.

The purpose of the community plant nursery is to provide a local source of native flora for Newnes Junction, Bell, Clarence and Lithgow residents. The nursery will collect seed, propagate and supply locally occurring (endemic) native plants for use by local residents and for the rehabilitation or re-vegetation works within the mine and offset areas.

### 4.2.4 Establish, conserve, maintain additional area of at least 25ha

Clause 25(b) of the Conditions of Consent require that the applicant shall “establish, conserve and maintain an additional area of at least 25 hectares of eucalypt vegetation habitat within proximity to the Greater Blue Mountains World Heritage Area, to the satisfaction of the Director-General”.

This area is in addition to the other actions as described above and as to be funded to the HNCMA.

The location of the area of undisturbed Eucalypt forest adjoining the GBMWHA has been identified in consultation with the OEH and DoP as Lot 1 DP 753824. There is an Agreement in Principle for SCM to purchase this land and at a later date transfer the land for incorporation into the Wollemi National Park Estate as the Compensatory Habitat as required in Condition 25 of DA 329/7/2003 (see Appendix 2). This

area of 24.28 ha is located immediately west of Mount Wirraba approximately 14 km west of Putty Road, and is described as an isolated inholding surrounded by Wollemi National Park which forms part of the Greater Blue Mountains World Heritage Area. Appendix 2 provides the agreement letters from relevant departments. The location of the undisturbed eucalypt forest Offset Area is shown in Figure 2-2.

The additional Offset Area stipulated in Clause 25(b) of the Conditions of Consent is now subject to an Agreement in Principle to be purchased by SCM and at a later date transferred to be incorporated into the surrounding National Park Estate. Given the proposal to add the block to Wollemi NP and integrate its management into the reserve and the GBMWHA, the requirement for preparation of a Compensatory Habitat Management Plan under Condition 28 could be considered to be covered by the Plan of Management for Wollemi NP (see OEH letter in Appendix 2).. In any event it will be managed entirely for conservation and in perpetuity.

## 4.3 Comparison of Compensatory Area/s and Quarry Site

A detailed comparison of all the compensatory areas with the quarry site will be undertaken once the additional minimum 25 ha site is finalised and surveyed (to date the site has not been specifically surveyed for comparison).

The information on which the consideration and assessment of flora and vegetation on the quarry site at Newnes Junction was based is provided in the Supplementary Submission to DIPNR (*Document C – Flora and Fauna Issues,* 2004). This includes:

- the original investigations of native flora and vegetation conducted for the EIS (International Environmental Consultants (IEC), 2003). It should be noted that the IEC investigations also included the consideration of information contained in other reports on sites in the immediate vicinity, as well as published scientific papers and other available information;
- data and information contained in submissions on the proposed mining operation and EIS; and
- other supplementary investigations for flora and vegetation were undertaken specifically for the proposed development at Newnes.

#### 4.3.1.1 Vegetation community comparison

A detailed comparison of the vegetation communities of all the compensatory areas with the quarry site will be undertaken once the additional minimum 25 ha site is chosen. It is expected that this site will have very similar vegetation community types as that described below for the quarry site.

Quarry site

As indicated in the detailed report by HWR Pty Ltd (2004) and in the submission by P & J Smith (2003), the site is predominantly characterised by an open forest/woodland community of Silvertop Ash and Sydney Peppermint. This community is also described as Blue Mountains Sandstone Plateau Forest (BMSPF), and was mapped as that community in the original vegetation mapping provided in the EIS by IEC (2003). However, there are small patches of other vegetation communities present on the subject site, including:

- a small area of Newnes Plateau forest in the south-western part of the site (HWR 2004);
- an area of open forest with a higher density of Scribbly Gums (a variant of the BMSPF) in the northern part of the site (HWR 2004);
- some riparian vegetation along the narrow drainage lines which traverse the site. This vegetation type is a variant of the sandstone ridge top vegetation community, with a component of riparian or moister plant types; and

- small areas of swamp or near-swamp communities within the drainage lines, although these are generally of very restricted distribution. The relatively steep slopes and rapid draining characteristics of the site are not conducive to the establishment of extensive swamp communities. Nevertheless, some small patches of shrub swamp vegetation are present in isolated locations.

Most of the vegetation on the subject site is of an open forest or woodland structure, and may be described as a dry sclerophyll community, which is characterised by relatively dry soils, an open to moderate dense shrub layer, and a sparse (but locally dense) understorey layer. This type of vegetation is generally adapted to relatively dry or xeric conditions, such as are typical of the rapidly draining nature of the site and of the soils.

The vegetation mapping by HWR (2004) identifies the presence of riparian or swampy vegetation along two drainage lines, which traverse the site. Of these, the northern (central) drainage line is relatively narrow and steep, and supports only very small, isolated, and limited areas of swampy or moister riparian vegetation. This community is regarded as a variant of the drier eucalypt forest vegetation on the site. The southern drainage line, conversely, supports a somewhat broader area of moister vegetation, although the abiotic and floristic characteristics of that area do not identify it as a swamp.

#### 4.3.1.2 Comparison of swamp on Quarry site with Newnes Plateau Shrub Swamp site

Amongst the issues raised in the submissions on the development application and EIS for the proposed development was that related to the possible presence of the Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion (NPSS) EEC on the subject land.

This EEC is dominated by shrubs and sedges on sites with impeded drainage in low slope headwater valleys on the Newnes Plateau in the upper Blue Mountains (NSW Scientific Committee 2005). It occurs in narrow, elongated swamps formed in low-slope headwaters of the Newnes Plateau, in predominantly sandstone catchments of Triassic Narrabeen Group geology, at approximately 900-1200 m elevation on deep sandy organic sediments that are permanently to periodically waterlogged (NSW Scientific Committee 2005). These elements of the community are significant in distinguishing NPSS from other moist or riparian habitats in the locality.

The supplementary flora investigations of the site have included specific investigation of this plant community and its presence (or otherwise) on the quarry site. Consideration of the characteristics of the NPSS community, and of vegetation on the quarry site and the physical features of those portions of the landscape, has resulted in the conclusions that:

- the drainage line which traverses the central part of the subject site, whilst supporting very small and isolated patches of swampy vegetation, does not support the association identified as the NPSS community. This drainage line:
  - is very narrow and relatively steep;
  - does not support areas of long-term moist soil (other than potentially in extremely small areas);
  - does not contain the characteristic floristics of the NPSS community; and
  - contains scattered medium to large eucalyptus trees.

This vegetation, therefore, has been designated riparian (swampy) vegetation in the report prepared by HWR and the southernmost drainage line through the site supports a small area of relatively moist soil with a sparse tree canopy. This area is characterised as a shrubland dominated by the Tea-tree (*Leptospermum trinervium*), and supports a number of the plant species identified in the description of the NPSS community.

However, few of the plant species present are indicated as dominant within the NPSS community, and the vegetation present is regarded at best as a marginal example of that community or a variant thereof.

Nevertheless, the vegetation in that portion of the site is considered as having some affinities to the Newnes Plateau Shrub Swamp community.

#### 4.3.1.3 Fauna Habitat Comparison

A detailed comparison of the fauna habitat of all the compensatory areas with the quarry site will be undertaken once the additional minimum 25 ha site is chosen.

#### 4.3.1.4 Flora Habitat Comparison

A detailed comparison of the flora habitat of all the compensatory areas with the quarry site will be undertaken once the additional minimum 25 ha site is chosen.

The number of species and composition of the species assemblage is indicative of the characteristics and condition of the flora habitat.

## 4.4 Integration of Compensatory Area

The compensatory area (Dargan's Creek Reserve) was originally Reserve Crown Land, however this classification expired in 2000 and the area reverted to Vacant Crown Land. As a result, the area has undergone minimal management or works since 2000. It is proposed to integrate the compensatory area by having the area re-classified as Reserve Crown Land or other environmental protection tenure subsequent to rehabilitation.

## 4.5 Establishment of Baseline Data within Compensatory Areas

The establishment of a comprehensive set of baseline data will assist in the monitoring of the Compensatory Habitat. This will be achieved through regular repeatable surveys which will be set up at several locations throughout the Compensatory Habitat sites, with those being the shrub swamp and Dargan's Creek. Monitoring of the 25ha area is not considered to be required, given its isolated location and due to the site falling under management of the Wollemi National Park Plan of Management. This will be the responsibility of SCM and its consultants.

The repeatability of the regular monitoring will allow comparisons through time at the compensatory habitat site and will also allow comparisons between the mine site and the compensatory habitat. If the mine site and the compensatory habitat site are similar then a direct comparison can be made before, during and after the rehabilitation has been completed on the mine site. If the two sites are dissimilar then comparisons can still be made with regard to habitat values and the greater or lesser ecological value of the mine or compensatory sites.

While baseline data has not been collected for this FFMP, the following sections outline the approach and parameters that might be taken and recorded as part of the compensatory habitat area monitoring.

### 4.5.1 Monitoring Strategy

The initial monitoring strategy will be to collect a comprehensive set of data to act as a baseline to enable comparison to data from subsequent surveys. Comparison of data from subsequent surveys will highlight any deviation from the baseline data and will be useful for monitoring the health, diversity and structure of the site with respect to flora and fauna.

The overall strategy will be to undertake a series of easily repeatable surveys that will gather a comprehensive set of data each time. Ideally this data gathering will follow a set of easily understood guidelines to simplify the task and to ensure that the data is collected in a similar manner each time.

A standard set of proformas will be used to gather the information.

### 4.5.2 Baseline data collection

Baseline data will be required to be collected at each of the Compensatory Habitat areas. The baseline and subsequent ecological data will be undertaken in accordance with Draft Threatened Species Survey and Assessment (DEC 2004).

This will include:

#### 4.5.2.1 Flora

- Vegetation community types;
- Vegetation community structure & floristics;
- Flora Species list;
- Photos (cardinal points at each site);
- Prevalence of weeds, disturbance; and
- Threatened species and habitat presence.

#### 4.5.2.2 Fauna

- Habitat characteristics (such as litter, rocks, watercourses. waterbodies, hollows, sedgelands);
- Diurnal bird surveys; and
- Evidence of vertebrate pest species.

### 4.5.3 Survey Methods

#### 4.5.3.1 Flora

The following parameters will be collected:

(1) Flora species diversity;
   (a) Total number of flora species
   (b) Number and percent of native flora species
   (c) Number and percent of introduced flora species

(2) Flora species abundance (Modified Braun-Blanquet 1-6); and

(3) Vegetation height of each vegetation layer in metres.

#### 4.5.3.2 Fauna

Bird Survey Plots

Methods adopted for bird surveys are to include:

- Discrete 1 ha survey plots; and

- Surveys conducted for a period of twenty (20) minutes.

Bird surveys will be performed at bird census plots as established during the commencement of the fauna monitoring program. The number has not yet been determined as this can only be determined once the additional minimum 25ha site has been identified. Bird diversity provides a good indication of the health of habitats and related habitat diversity.

### 4.5.4 Survey timing

Surveys will be undertaken annually in Spring or Summer to maximise the chances of detection for a majority of species.

### 4.5.5 Setup of Survey Points

Survey points should be determined at the compensatory areas by a qualified ecologist. These should be stratified and represent typical examples of each habitat type in areas to be covered by the compensatory activities. Analogue sites should be selected so that changes in compensatory sites can be measured against natural sites unaffected by anthropogenic influences. The number of sites will be dependent on site attributes and habitat diversity.

Sites should be marked permanently by star pickets, metal tags and bright flagging tape. Their location should be recorded on a GPS for use in mapping to accompany monitoring reports.

## 4.6 Monitoring of compensatory vegetation performance

The first time that the sites are surveyed for flora and fauna will produce baseline data. This baseline data will enable following years to be monitored in terms of habitat diversity, weed diversity and other factors such as the occurrence erosion.

These will be measured against the analogue sites.

An Annual Environmental Monitoring Report will be prepared and submitted to the CMA and other relevant stakeholders.

# 5.0 Pest and Weed Management Plan

## 5.1 Potential Terrestrial and Aquatic Pests and Weeds

### 5.1.1 Recorded and likely pest Fauna species

The location of the subject site is near Newnes Junction urban area and the presence of native vegetation within and adjacent to the site provides a wide variety of potential habitat for pest species. It is considered that the subject site provides suitable habitat for a number of pest fauna species such as Foxes, Rabbits, Cats, Goats, Pigs, and Dogs.

The town of Newnes Junction provides potential habitat in the form of scavenging opportunities and shelter. This type of habitat is well suited to foxes that will scavenge through domestic waste and will also take unattended pet food. It must be noted that 'Predation by the European Red Fox (*Vulpes vulpes*)' has been listed as a key threatening process by both the Federal and NSW Governments. Foxes have been recorded during previous surveys of the study site (Gunninah 2004; Corkery & Co 1993; IEC 2000). Medium to small sized ground dwelling and semi-arboreal native mammals and birds are particularly at risk of predation by the fox, enhancing the importance of their control on the subject site.

Rabbits are a common pest in areas containing large areas of lawn or grass. In urban fringes this species is often quite prevalent. It must be noted that 'Competition and land degradation by feral rabbits' has been listed as a key threatening process by both the Federal and NSW Governments. Rabbits were recorded during previous surveys of the study site (Gunninah 2004; Corkery & Co 1993; IEC 2000).

Feral cats are a major problem in the native bushland as they are reported to have a considerable impact on native fauna. In addition, it is common for domestic cats to be allowed to roam and these cats are no less responsible for impacts on native fauna. It is important to note that "Predation from feral cats" has been listed as a key threatening process by both the Federal and NSW Governments. One feral cat was recorded during 2011 surveys and according to the threat abatement plan for predation by feral cats (2008) they are notably detrimental to the Blue Mountains Water Skink (*Eulamprus leuraensis*) and the Mountain Pygmy Possum *(Burramys parvus)*, both of which could potentially occur on the subject site.

Feral goats and pigs are known to occur within the Greater Blue Mountains World Heritage Area. The subject site and surrounding properties provide suitable habitat for these pests. 'Competition and land degradation by feral goats' has been listed as a key threatening process by both the Federal and NSW Governments.

Wild dogs have been known to occur within the region. These dogs sometimes hunt in packs and can attack livestock. The likelihood of occurrence is low and they have not been previously recorded on site.

### 5.1.2 Weeds of National Significance

Weeds of National Significance (WoNS) are the highest priority species targeted for sustained nationally coordinated action under the Australian Weeds Strategy. This provides for national management to eradicate WoNS species from parts of the country where Australia's productive capacity & natural ecosystems are affected.

Each WoNS has a strategic plan that outlines strategies and actions required to control the weed, and identifies those responsible for each action. Individual landowners and managers are ultimately responsible for managing WoNS species. State and territory governments are responsible for overall legislation and administration.

Ten WoNS species occur in the region. These include Alligator Weed, Boneseed, Blackberry, Bridal Creeper, Cabomba, Gorse, Lantana, Salvinia, Serrated Tussock and Willows. All of these species except Boneseed are listed as Noxious Weeds within NSW.

### 5.1.3 Listed Noxious weeds in Lithgow LGA

The NSW Department of Industry & Investment (NSW D I & I) (formerly the NSW Department of Primary Industries) under the Noxious Weeds Act, (1993) has issued a list of Noxious Weed declarations for all Local Government Areas within the Upper Macquarie County Council which includes Lithgow Local Government Area. These species are listed in Table 4.

**Table 4 Noxious Weeds declared in Lithgow Local Government Area**

| Species | Class | Legal Requirements |
|---|---|---|
| African Boxthorn<br>*Lycium ferocissimum* | 4 | 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 Feathergrass<br>*Pennisetum macrourum* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| African Lovegrass<br>*Eragrostis curvula* | 4 | 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 Turnipweed<br>*Sisymbrium runcinatum* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| African Turnipweed<br>*Sisymbrium thellungi* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Alligator Weed<br>*Alternanthera philoxeroides* | 2 | The plant must be eradicated from the land and the land must be kept free of the plant |
| Anchored Water Hyacinth<br>*Eichornia azurea* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Annual Ragweed<br>*Ambrosia artemisifolia* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Arrowhead<br>*Saggitaria montevidensis* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Artichoke Thistle<br>*Cynara cardunculus* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Athel Pine<br>*Tamarix aphylla* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Bathurst/Noogoora/Hunter/South American/Californian/cockle Burr<br>*Xanthium* spp. | 4 | 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 |

| Species | Class | Legal Requirements |
|---|---|---|
| Bear-skin Fescue<br>*Festuca gautieri* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Black Knapweed<br>*Centaurea nigra* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Blackberry<br>*Rubus fruticosus* (aggregate species)<br>except cultivars Black satin, Chehalem, Chester Thornless, Dirksen Thornless, Loch Ness, Murrindindi, Silvan, Smoothstem, Thornfree | 4 | 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 |
| Bridal Creeper<br>*Asparagus asparagoides* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Broomrapes<br>*Orobache* spp. | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Burr Ragweed<br>*Ambrosia confertifolia* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Cabomba<br>*Cabomba caroliniana* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Cayenne Snakeweed<br>*Stachytarpheta cayennensis* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Chilean Needlegrass<br>*Nasella neesiana* | 4 | 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 |
| Chinese Violet<br>*Asystasia gangetica subsp. micrantha* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Clockweed<br>*Gaura parviflora* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Columbus Grass<br>*Sorghum x almum* | 3 | The plant must be fully and continuously suppressed and destroyed |
| Corn Sowthistle<br>*Sonchus arvensis* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Dodder<br>*Cuscuta* spp.<br>Includes All Cuscuta species except the native species *C. australis*, *C. tasmanica* and *C. victoriana* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| East Indian Hygrophila<br>*Hygrophila polysperma* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |

| Species | Class | Legal Requirements |
|---|---|---|
| English broom<br>*Cytisus scoparius* | 4 | 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 |
| Espartillo<br>*Achnatherum brachychaetum* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Eurasian water milfoil<br>*Myriophyllum spicatum* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Fine-bristled burr grass<br>*Cenchrus brownii* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Fountain grass<br>*Pennisetum setaceum* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Gallon's curse<br>*Cenchrus biflorus* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Glaucous starthistle<br>*Carthamus glaucus* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Golden dodder<br>*Cuscuta campestris* | 4 | 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 |
| Golden thistle<br>*Scolymus hispanicus* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Gorse<br>*Ulex europaeus* | 3 | The plant must be fully and continuously suppressed and destroyed |
| Green cestrum<br>*Cestrum parqui* | 3 | The plant must be fully and continuously suppressed and destroyed |
| Harrisia cactus<br>*Harrisia* spp. | 4 | 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 |
| Hawkweed<br>*Hieracium* spp. | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Hemlock<br>*Conium maculatum* | 4 | 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 |
| Horsetail<br>*Equisetum* spp. | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Hymenachne<br>*Hymenachne amplexicaulis* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Johnson grass<br>*Sorghum halepense* | 3 | The plant must be fully and continuously suppressed and destroyed |
| Karoo thorn<br>*Acacia karroo* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |

| Species | Class | Legal Requirements |
|---|---|---|
| Kochia<br>*Bassia scoparia*<br>except *Bassia scoparia subspecies trichophylla* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Lagarosiphon<br>*Lagarosiphon major* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Lantana<br>*Lantana* spp. | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Leafy elodea<br>*Egeria densa* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Lippia<br>*Phyla canescens* | 4 | 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 |
| Long-leaf willow primrose<br>*Ludwigia longifolia* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Long-style feather grass<br>*Pennisetum villosum* | 4 | 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 |
| Mesquite<br>*Prosopis* spp. | 2 | The plant must be eradicated from the land and the land must be kept free of the plant |
| Mexican feather grass<br>*Nassella tenuissima* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Mexican poppy<br>*Argemone mexicana* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Miconia<br>*Miconia* spp. | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Mimosa<br>*Mimosa pigra* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Mossman River grass<br>*Cenchrus echinatus* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Nodding thistle<br>*Carduus nutans* | 4 | 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 |
| Noogoora burr<br>*Xanthium* spp. | 4 | 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 |
| Onion grass<br>*Romulea* spp.<br>Includes all Romulea species and varieties except *R. rosea var. australis* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |

| Species | Class | Legal Requirements |
|---|---|---|
| Oxalis<br>*Oxalis* spp. and varieties<br>Includes all Oxalis species and varieties except the native species *O. chnoodes, O. exilis, O. perennans, O. radicosa, O. rubens, and O. thompsoniae* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Pampas grass<br>*Cortaderia* spp. | 4 | 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 |
| Parkinsonia<br>*Parkinsonia aculeata* | 2 | The plant must be eradicated from the land and the land must be kept free of the plant |
| Parthenium weed<br>*Parthenium hysterophorus* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Pond apple<br>*Annona glabra* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Prickly acacia<br>*Acacia nilotica* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Prickly pear<br>*Cylindropuntia* spp. | 4 | 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 |
| Prickly pear<br>Opuntia species except *O. ficus-indica* | 4 | 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 |
| Privet (Broad-leaf)<br>*Ligustrum lucidum* | 4 | 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 |
| Privet (Narrow-leaf/Chinese)<br>*Ligustrum sinense* | 4 | 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 |
| Red rice<br>*Oryza rufipogon* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Rhus tree<br>*Toxicodendron succedaneum* | 4 | 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 |
| Rubbervine<br>*Cryptostegia grandiflora* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Sagittaria<br>*Sagittaria platyphylla* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Salvinia<br>*Salvinia molesta* | 2 | The plant must be eradicated from the land and the land must be kept free of the plant |
| Sand oat<br>*Avena strigosa* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |

| Species | Class | Legal Requirements |
|---|---|---|
| Scotch broom<br>*Cytisus scoparius* | 4 | 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 |
| Scotch, Stemless, Illyrian and Taurian thistles *Onopordum* spp. | 4 | 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 |
| Senegal tea plant<br>*Gymnocoronis spilanthoides* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Serrated tussock<br>*Nassella trichotoma* | 4 | 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 |
| Siam weed<br>*Chromolaena odorata* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Silver-leaf nightshade<br>*Solanum elaeagnifolium* | 4 | 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 |
| Smooth-stemmed turnip<br>*Brassica barrelieri subsp. oxyrrhina* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Soldier thistle<br>*Picnomon acarna* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Spiny burrgrass<br>*Cenchrus incertus* | 4 | 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 |
| Spiny burrgrass<br>*Cenchrus longispinus* | 4 | 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 |
| Spotted knapweed<br>*Centaurea maculosa* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| St. John's wort<br>*Hypericum perforatum* | 4 | 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 |
| Star thistle<br>*Centaurea calcitrapa* | 4 | 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 |
| Sweet briar<br>*Rosa rubiginosa* | 4 | 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 |
| Texas blueweed<br>*Helianthus ciliaris* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Tree-of-heaven<br>*Ailanthus altissima* | 4 | 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 |
| Water caltrop<br>*Trapa* spp. | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |

| Species | Class | Legal Requirements |
|---|---|---|
| Water hyacinth<br>*Eichhornia crassipes* | 2 | The plant must be eradicated from the land and the land must be kept free of the plant |
| Water lettuce<br>*Pistia stratiotes* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Water soldier<br>*Stratiotes aloides* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Wild radish<br>*Raphanus raphanistrum* | 4 | 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 |
| Willows<br>*Salix* spp.<br>Includes all Salix species except *S. babylonica, S. x reichardtii, S. x calodendron* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |
| Witchweed<br>*Striga* spp. | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Yellow burrhead<br>*Limnocharis flava* | 1 | The plant must be eradicated from the land and the land must be kept free of the plant<br>This is an All of NSW declaration |
| Yellow nutgrass<br>*Cyperus esculentus* | 5 | The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with<br>This is an All of NSW declaration |

### 5.1.4 Other known or likely weeds

In addition to the above Listed Noxious Weeds for the Upper Macquarie County Council, there are further weed species listed by the Hawkesbury Nepean Catchment Authority (Lithgow Branch) and other sources such as the Blue Mountains Better Living DCP and local Bushcare Groups. The additional weed species that may possibly occur in the locality are listed in Table 5.

**Table 5 Additional Weed species within the Lithgow area**

| Common Name | Scientific Name |
|---|---|
| **Trees** | |
| African Olive | *Olea europaea* spp. *africana* |
| Bird Cherry | *Prunus serotina* |
| Black Locust | *Robinia pseudoacacia* |
| Box Elder Maple | *Acer negundo* |
| Camphor Laurel | *Cinnamomum camphora* |
| Cherry Laurel | *Prunus laurocerasus* |
| Chinese Pistachio | *Pistachia chinensis* |
| Coral Tree | *Erythrina crista-galli* ,and *E. x sykesii* |
| Cootamundra Wattle | *Acacia baileyana* |
| European Nettle Tree | *Celtis australis* |
| Himalayan Strawberry Tree | *Cornus capitata* |
| Holly | *Ilex aquifolium* |
| Honey Locust | *Gleditsia triacanthos* |
| Irish Strawberry Tree | *Arbutus unedo* |
| Large-leaf privet | *Ligustrum lucidum* |
| Mexican Pine | *Pinus patula* |
| New Zealand Pittosporum | *Pittosporum eugenioides* |
| Portuguese Laurel | *Prunus lusitanica* |
| Qld Silver Wattle | *Acacia podalyriifolia* |
| Sweet Pittosporum | *Pittosporum undulatum* |
| Sycamore Maple | *Acer pseudoplatanus* |
| Tree Lucerne / Tagasaste | *Chamaecytisus palmensis* |
| White Poplar | *Populus alba* |
| **Shrubs** | |
| Barberry, Berberis | *Berberis aristata* and *B. darwinii* |
| Boneseed, Bitou Bush | *Chrysanthemoides monilifera* |
| Broom | *Genista* spp. |
| Butterfly Bush | *Buddleja davidii* |
| Montpellier Broom | *Genista monspessulana* |
| Cassia | *Senna pendula var glabrata* |
| Castor Oil Plant | *Ricinus communis* |
| Cestrum—Red flowering | *Cestrum elegans* |
| Cotoneaster | *Cotoneaster franchettii, C. lacteus, C. pannosus, C. glaucophyllus* |
| Firethorn. | *Pyracantha spp* |
| Golden Wreath Wattle | *Acacia saligna* |
| Hawthorn | *Crataegus monogyna* |
| Himalayan Honeysuckle | *Leycesteria formosa* |
| Indian Hawthorn | *Raphiolepis indica* |
| Karo | *Pittosporum crassifolium* |

| Common Name | Scientific Name |
|---|---|
| Madiera Winter Cherry | *Solanum pseudocapsicum* |
| Mickey Mouse Plant | *Ochna serrulata* |
| Sacred Bamboo | *Nandina domestica* |
| Scurf Pea | *Psoralea pinnata* |
| Spanish Heath | *Erica lusitanica* |
| Sweet Pea Shrub | *Polygala myrtifolia* |
| Tree Heath | *Erica arborea* |
| Tutsan | *Hypericum androsaemum* |
| Wild Tobacco | *Solanum mauritianum* |
| **Climbers** | |
| Balloon Vine | *Cardiospermum grandiflorum* |
| Black-eyed Susan | *Thunbergia alata* |
| Blue-bell Creeper | *Sollya heterophylla* |
| Cape Ivy | *Delairea odorata* |
| Cats Claw Creeper | *Macfadyena unguis-cati* |
| English Ivy | *Hedera helix* |
| Japanese Honeysuckle | *Lonicera japonica* |
| Madeira Vine | *Anredera cordifolia* |
| Morning Glory | *Ipomoea indica* |
| Moth Vine | *Araujia sericifera* |
| Passionfruit (Common, Banana, White) | *Passiflora edulis, P. mollisina, P. subpeltata* |
| Turkey Rhubarb | *Acetosa sagittata* |
| White Jasmine | *Jasminum polyanthum* |
| **Perennials and Groundcovers** | |
| Asparagus Fern | *Asparagus aethiopicus* |
| Asthma Weed | *Parietaria judaica* |
| Blue Periwinkle | *Vinca major* |
| Coreopsis | *Coreopsis lanceolata* |
| Creeping Lantana | *Lantana montevidensis* |
| Crofton Weed | *Ageratina adenophora* |
| Fennel | *Foeniculum vulgare* |
| Fireweed | *Senecio madagascariensis* |
| Forget Me Not | *Myosotis sylvatica* |
| Impatiens/Busy Lizzy | *Impatiens balsamina* |
| Mistflower | *Ageratina riparia* |
| Nasturtium | *Tropoleum majus* |
| Ox-eyed Daisy | *Leucanthemum vulgare* |
| Patersons Curse / Viper Bugloss | *Echium spp.* |
| Red Hot Poker | *Kniphofia sp* |
| Seaside Daisy | *Erigeron karvinskianus* |
| Self Heal | *Prunella vulgaris* |
| Wandering Jew | *Tradescantia fluminensis* |

| Common Name | Scientific Name |
|---|---|
| **Lilies and Lily Like Plants** | |
| Agapanthus | *Agapanthus praecox ssp. orientalis* |
| Arumor Calla Lily | *Zantedeschia aethiopica* |
| Canna Lily | *Canna indica* |
| Formosan Lily | *Lilium formosanum* |
| Ginger Lily | *Hedychium gardnerianum* |
| Montbretia | *Crocosmia x crocosmiiflora* |
| Peruvian Lily | *Alstroemeria aurea* |
| Watsonia | *Watsonia meriana, W. bulbillifera* |
| **Grasses And Grass-Like Plants** | |
| Bamboo, Rhizomatous | *Phyllostachys spp.* |
| Brown Top Bent | *Agrostis cappillaris* |
| Cocksfoot | *Dactylis glomerata* |
| Creeping Bent | *Agrostis stolonifera* |
| Ehrharta | *Ehrharta erecta* |
| Giant Parramatta Grass | *Sporobolus fertilis, syn.indicus* |
| Giant Reed | *Arundo donax* |
| Parramatta Grass | *Sporobolus indica* |
| Paspalum | *Paspalum dilatatum* |
| Plume Grass | *Pennisetum setaceum, P. alapecaroides* |
| Prairie Grass | *Bromus catharticus* |
| Red Natal Grass | *Rhynchelytrum repens* |
| Rhodes Grass | *Chloris gayana* |
| Rye Grass | *Lolium perenne, L. multiflorum* and hybrids |
| Spider Plant / Ribbon Plant | *Chlorophytum comosum* |
| Sweet Vernal Grass | *Anthoxanthum odoratum* |
| Tall Fescue | *Festuca elatior* |
| Whiskey Grass | *Andropogon virginicus* |
| Yorkshire / Creeping Fog | *Holcus lanatus, H. mollis* |
| **Ferns** | |
| Fishbone Fern | *Nephrolepis cordifolia* |
| **Cacti And Succulents** | |
| Agave | *Agave americana* |
| Aloe | *Aloe arborescens* |
| Mother of Millions | *Bryophyllum delagoense* |
| Yucca | *Yucca aloifolia* |
| **Aquatic Plants** | |
| Egeria | *Egeria densa* |
| Mexican Water Lily | *Nymphaea mexicana* |

## 5.2 Known weeds

The monitoring program recorded no weed species within the survey areas however two weed species, *Cotoneaster glaucophyllus* and *Hypochaeris radicata*, have been recorded in previous years.

The purpose of monitoring annually is to detect any weed invasions particularly near the boundaries of the subject site so that measures can be taken to prevent spread and control an invasion before it becomes established within the native ecosystems.

The measures outlined in this report discuss the appropriate procedures for the removal of weeds and prevention of their spread in the areas surrounding the subject site.

## 5.3 Preventative measures for Pests and Weeds

### 5.3.1 Pests

#### 5.3.1.1 Foxes

Foxes can be discouraged by limiting the availability of opportunistic or scavenging food sources such as garbage and unattended pet food. The presence of feral rabbits is also an ideal food resource for this species and there is a strong correlation between the presence of rabbits and foxes. Suitable fencing is an effective way of keeping foxes from a property. It is considered that a combination of fencing and discouragement through lack of resources such as garbage and unattended pet food will control this pest species within the site.

#### 5.3.1.2 Rabbits

Preventative measures for rabbits are limited within the proposed quarry area. It is considered that the best preventative measure for rabbits would be to limit or remove any areas of habitat from the site. This may entail the removal or avoidance of creating open grassy areas, suitable burrow habitat and protective shrubbery. Rabbit proof fencing will also have some effect; however rabbits can burrow under almost any fence. Methods to eradicate rabbits include fumigation, baiting and warren ripping. However fumigation and baiting require permits, therefore warren ripping is considered the only other viable alternative. It is considered that a combination of fencing and discouragement through lack of resources will control this pest species within the site.

#### 5.3.1.3 Cats

Measures to prevent feral or roaming domestic cats within the subject site are limited. It is considered that suitable fencing (such as a 2 metre high chain link fence) will limit the access of the site to cats. In addition, limiting the availability of opportunistic or scavenging food sources such as garbage and unattended pet food will assist in discouraging this pest. It is considered that a combination of fencing and discouragement through lack of resources will control this pest species within the site. Alternatively, trapping can be used to capture and dispose of this pest, however it is possible that wandering domestic cats owned by local residents may be also caught. In which case, if is likely that captured cats are wandering locally owned cats then they will be taken to the local pound and dealt with in the usual manner regarding lost or abandoned cats.

#### 5.3.1.4 Goats

It is considered that a suitable (2 metre high chain link) fence would be the best method of preventing goats entering the subject site. Alternatively, trapping can be used to capture, euthanase and dispose of this pest.

#### 5.3.1.5 Pigs

It is considered that a suitable (2 metre high chain link) fence would be the best method of preventing feral pigs from entering the subject site. Alternatively, trapping can be used to capture, euthanase and dispose of this pest.

#### 5.3.1.6 Dogs

It is considered that a suitable (2 metre high chain link) fence would be the best method of preventing wild dogs from entering the subject site. Alternatively, trapping can be used to capture and dispose of this pest, however it is possible that wandering domestic dogs may be also caught. In which case it is likely that captured dogs will be taken to the local pound and dealt with in the usual manner regarding stray, lost or abandoned dogs.

### 5.3.2 Weeds

Preventative measures for weeds are generally limited to control of weed occurrences within the site, prevention of the spread of weeds to other sites and prevention of the transportation of weeds into the site from outside.

Control of weeds within the subject site is the most effective strategy. Weed control within the site is discussed in more detail in Section 5.4.2.

Best practice vehicle hygiene measures will be adopted and implemented to prevent pathogens and seed from weed species being transferred to and from the site. All vehicles will be inspected on a regular basis and any plant material and mud removed from underneath vehicles. This inspection and plant matter removal can be incorporated with the common practice of installing sluice baths, which wash the underside, wheels and wheel arches of trucks and vehicles entering and leaving the site. These sluice baths are also effective in simultaneously removing mud and soil from the vehicles to reduce the spread of soil on roads.

## 5.4 Pest and Weed Monitoring

Refer to Section 6 for monitoring activities. Monitoring of pests and weeds will occur in conjunction with the Flora and Fauna Monitoring Program.

## 5.5 Detailed Procedures for management and eradication of pests and weeds

### 5.5.1 Fauna Pest Control

#### 5.5.1.1 Foxes

Control of foxes is more difficult than for many other species because foxes migrate further, and are more likely to re-infest previously controlled areas from distant uncontrolled areas. Also, shelter or den destruction is not a practical option for fox control. Foxes can be controlled in urban areas by limiting the availability of opportunistic or scavenging food sources such as garbage and unattended pet food and also by the installation of adequate fencing. Despite this, foxes are accomplished hunters and may still survive in the area by hunting and consuming native animals and livestock. The presence of feral rabbits is also an ideal food resource for this species. If limiting the food sources of this species is ineffective then a program of fox baiting may be required. Fox baiting can use a variety of agents (1080, Foxoff®, Den-co-fume© and Econobaits©) but is strictly controlled. Fox poisoning is regulated in NSW by the Pesticide Act 1978 and can be carried out only under the conditions specified in the current Off-label Permit. Rural Lands Protection Boards prepare and supply baits for use by landholders. Alternative fox control measures such as den fumigation, night-shooting and trapping may be important to complement fox baiting in some areas. It must

be noted that 'Predation by the European Red Fox (*Vulpes vulpes*)' has been listed as a key threatening process by both the Federal and NSW Governments.

Initial control of foxes within the site will be through exclusion (fences) and discouragement (lack of resources such as food scraps, garbage or rabbit prey). If foxes are determined to be regularly present then pro-active measures such as baiting, trapping and / or shooting may be applied.

#### 5.5.1.2 Rabbits

Rabbits occasionally reach large numbers when conditions allow. Rabbits have been controlled in the past via the introduction of Myxamatosis or the Calicivirus. However, some rabbit strains are resistant to one or both of these diseases, or, the diseases are not present due to the isolation of the rabbit population in the area. These diseases have resulted in the decreased use of '1080' poison for the control of rabbits in Australia. The control of rabbits is best achieved through an integrated approach comprised of most if not all of the following methods:

- fumigation of warrens;
- suitable fencing;
- destruction of warren systems;
- removal of rabbit shelter; and
- shooting.

It must be noted that 'Competition and land degradation by feral rabbits' has been listed as a key threatening process by both the Federal and NSW Governments. An important consideration to factor in is that rabbits are a primary prey species for foxes. The removal or control of rabbits should coincide with the removal of foxes or native fauna will be placed at a higher risk of predation by foxes due to the rabbits removal.

Initial control of rabbits within the site will be through exclusion (fences) and discouragement (lack of resources such as grassy swathes, warrens and sheltering shrubs). If rabbits persist within the site then pro-active strategies such as baiting, shooting or introduction of rabbit specific pathogens such as Calicivirus are warranted.

#### 5.5.1.3 Cats

Feral cats are consummate hunters and are known throughout the whole of Australia in every habitat. Cats are intelligent and generally avoid humans, which makes them difficult to bait using conventional poisons. Recently devised foothold traps have proven to be the most effective method of eliminating feral cats from small areas (1200 ha) and the most potent method for eliminating cats from islands. Modern humane traps are designed to capture and hold cats without injury. The cats are then euthanized using humane methods.

Initial control of cats within the site will be through exclusion (fences) and discouragement (lack of resources such as food scraps, garbage or prey). If cats persist within the site then pro-active strategies such as trapping using foothold traps and subsequent humane euthanasia will be applied. It must be noted that some domestic cats owned by local residents may be captured. In cases where this is possible, the cats will be taken to the nearest pound.

#### 5.5.1.4 Goats

Feral goats contribute to overgrazing, which can result in soil erosion and other forms of land degradation; they also compete with native and domestic animals for food and resources. Feral goats are rated by the NPWS as a high priority pest issue, because they are capable of decimating areas of native vegetation, they

compete with native animals for food and shelter and they can cause soil erosion through removal of vegetation and soil disturbance.

Some methods employed to control goats include:

- Suitable fencing;
- Mustering of goats for sale as pet meat or for use as livestock;
- Shooting from the ground or (more effectively) from the air;
- Trapping; and
- Radio tracking of a Judas goat – a goat fitted with a radio collar will join the herd when released in an area. This goat can be tracked to the herd and the goats shot. The Judas goat can be allowed to escape to repeat the process.

'Competition and land degradation by feral goats' has been listed as a key threatening process by both the Federal and NSW Governments.

Goats will be controlled through exclusion (fencing). This should prove adequate to control goats within the site.

#### 5.5.1.5 Pigs

Feral pigs are known in the locality, more than 500 pigs were destroyed in the southern Blue Mountains area, which includes wilderness areas such as Kanangra-Boyd and Blue Mountains national parks, Yerranderie State Conservation Area and the proposed Murruin wilderness area (DECC Feral Pigs Factsheet 2006). Feral pigs cause severe environmental degradation by:

- Feeding selectively on plant communities;
- Creating drainage channels in swamps;
- Eroding soil and fouling watering points with their wallowing;
- Eating frogs, reptiles, birds and small mammals; and
- Spreading weeds and possibly disease.

'Predation, habitat degradation, competition and disease transmission by feral pigs' has been listed as a key threatening process by both the Federal and NSW Governments.

NPWS has control programs for all parks and reserves where feral pigs pose a significant problem. Many of these are in conjunction with local landholders and other government or non-government agencies such as rural lands protection boards (RLPBs).

Aerial shooting of feral pigs is most commonly used by NPWS because it is more efficient than shooting from the ground. However ground shooting is used where trees obscure vision from the air.

Pigs fitted with radio collars are sometimes used to guide shooters to the location of other feral pigs, a control method known as the 'Judas pig' technique. Trapping and 1080 baiting are also used in some areas.

Fencing to control access of the site by feral pigs is generally ineffective. Feral pigs are an intelligent, strong and determined animal and they will often severely damage fencing when crossing property boundaries.

Pigs will be controlled within the site through exclusion (fencing) and where necessary through a trapping and humane euthanasia program.

#### 5.5.1.6 Dogs

Wild dogs cause substantial losses of livestock for sheep graziers: up to 30 per cent in some areas. They prey on native mammals and birds and may also compete with native predators, such as quolls, for food and other resources.

In rare cases, aggressive wild dogs may threaten or attack people. Breeding between dingoes and feral dogs is one of the biggest threats to remaining native dingo populations. Wild dogs may also suppress other pests such as feral goats and rabbits.

Illegal pig hunting within conservation reserves often leads to the release or escape of hunting dogs that can become feral.

Ground-baiting using buried 1080 meat baits is the most effective control option and the most widely used. It allows baits to be placed where they are most likely to be found by wild dogs and reduces their uptake by native animals. Dog trappers and shooters will then often target bait-shy or rogue dogs.

Aerial baiting is used in some parks where the terrain is inaccessible or other methods have not reduced wild dog attacks on stock to an acceptable level.

Dog-proof exclusion fencing is used with great effect in some areas.

Initial control of dogs within the site will be through exclusion (fences) and discouragement (lack of resources such as food scraps or garbage). If dogs persist within the site then pro-active strategies such as trapping using baited cage traps and subsequent humane euthanasia will be applied. It must be noted that some domestic dogs owned by local residents may be captured. In cases where this is possible, the dogs will be taken to the nearest pound.

#### 5.5.1.7 Project Commitment

Management occurring as part of this FFMP will include:

- Foxes and Dogs: Working with local National Parks and Wildlife Service (NPWS) to jointly fund annual fox and dog control in the immediate locality of the project;
- Rabbits: Rabbits are not considered to be a major problem in the locality. Where NPWS indicates a desire, funding will go towards Rabbit control;
- Goats and Pigs: Working with local National Parks and Wildlife Service (NPWS) to jointly fund annual goat and pig control in the immediate locality of the project;
- The proponent will undertake flora and fauna monitoring as outlined in Section 6 and within the 100m buffer within the vicinity of the two surface monitoring points shown on Figure 10 in the Water Management Plan by GSS dated January 2011.

### 5.5.2 Weed Control methods

Major causes of weed spread in the region are:

- Disturbance such as clearing, soil erosion or fire in natural areas;
- Exotic or non-endemic plants escaping from gardens;
- Dumping of garden and construction waste such as soils, in bushland;
- Vehicle transport of seeds along roads, tracks and railway corridors;
- Use of weed contaminated soil, mulch or other horticulture products;

- Use of weed contaminated hay or other stock feed, and spread from faeces or fur of stock;
- Planting of exotic species into public reserves or open space areas;
- Spread of weed seed or propagules on clothing and boots;
- Nutrient-enriched runoff from sources such as stormwater, septic tanks, sewerage overflows, pet wastes, washing of cars and runoff containing fertilisers;
- Utility easements through sensitive areas, associated access roads and slashing, cause disturbance, open up native vegetation, and provide a foothold for weed invasion; and
- Poor vegetation management practices such as over-clearing, slashing and trampling by public land management authorities, developers, recreationalists and the community.

Minimising all of the above points as part of an integrated strategy will ameliorate the spread of weeds within the subject site and surrounds. Those weeds that bypass these strategies or naturally disperse into the site will be controlled by weed management procedures.

Weed removal shall include any species likely to significantly invade bushland, prevent natural regeneration, or impede native seedling growth. Priority shall be given to species listed as 'noxious plants' for the Upper Macquarie County Council (which includes Lithgow Local Government Area) in the Schedules of the NSW Noxious Weeds Act 1993. Lists of targeted Noxious and other weed species known within the locality have been included within Section 5.1.

Weeding techniques should be appropriate to the weed type, growth form, ecology and to the existing site conditions. Wherever possible, weed removal should be carried out prior to annual seed set.

The accepted strategy for weed removal is based on the Bradley Method and is summarised as follows:

- Work from good (low weed level) areas into the bad (high weed level) areas;
- Make minimal disturbance to the soil or adjacent native plants; and
- Do not over-clear, it results in potential soil erosion and provides space for more weeds to colonise.

Weeds are to be progressively removed in accordance with the following techniques recommended by the National Trust, NSW National Parks and Wildlife Service, the Australian Association of Bush Regenerators and as described in Bradley (2002).

#### 5.5.2.1 Woody weed removal techniques:

MECHANICAL REMOVAL (RADIATA PINE <10 CM BASAL AREA)

- Make a horizontal cut through the stem as close to the ground as possible using secateurs, loppers or a bush saw. The application of herbicide is not required to control this species (HNCMA undated).

CUT AND PAINT (WOODY WEEDS EXCLUDING RADIATA PINE <10 CM BASAL DIAMETER)

- Make a horizontal cut through the stem close to the ground using secateurs, loppers or a bush saw; and
- Immediately apply herbicide to the exposed flat stump surface.

Considerations:

- Cuts should be horizontal to prevent herbicide from running off the stump, sharp angle cuts are hazardous;
- Herbicide must be applied immediately before the plant cells close (within 30 seconds) and translocation of herbicide ceases;

- If plants re-sprout cut and paint the shoots after sufficient re-growth has occurred; and
- Stem scraping can be more effective on some woody weeds.

STEM INJECTION

- At the base of the tree drill holes at a 45 degree angle into the sapwood;
- Fill each hole with herbicide immediately; and
- Repeat the process at 5 cm intervals around the tree.

FRILLING OR CHIPPING

- At the base of the tree make a cut into the sapwood with a chisel or axe;
- Fill each cut with herbicide immediately; and
- Repeat the process at 5 cm intervals around the tree.

Considerations:

- Plants should be actively growing and in good health;
- Deciduous plants should be treated in spring and autumn when leaves are fully formed;
- For multi-stemmed plants, inject or chip below the lowest branch or treat each stem individually; and
- Herbicides must be injected immediately before plant cells close (within 30 seconds) and translocation of herbicide ceases.

#### 5.5.2.2 Small hand-pullable plant removal techniques:

HAND REMOVAL

- Remove any seeds or fruits and carefully place into a bag;
- Grasp stem at ground level, rock plant backwards and forwards to loosen roots and pull out; and
- Tap the roots to dislodge any soil, replace disturbed soil and pat down.

Considerations:

- Leave weeds so roots are not in contact with the soil e.g. hang in a tree, remove from site or leave on a rock.

#### 5.5.2.3 Vine and scrambler removal techniques:

HAND REMOVAL

- Take hold of one runner and pull towards yourself;
- Check points of resistance where fibrous roots grow from the nodes;
- Cut roots with a knife or dig out with a trowel and continue to follow the runner;
- The major root systems need to be removed manually or scrape/cut and painted with herbicide; and
- Any reproductive parts need to be bagged.

STEM SCRAPING

- Scrape 15 to 30 cm of the stem with a knife to reach the layer below the bark/outer layer; and
- Immediately apply herbicide along the length of the scrape.

Considerations:

- A maximum of half the stem diameter should be scraped. Do not ringbark;
- Larger stems should have two scrapes opposite each other; and
- Vines can be left hanging in trees after treatment provided they are unable to regrow from leaves or stems.

#### 5.5.2.4 Weeds with underground reproductive structures removal techniques:

HAND REMOVAL OF PLANTS WITH A TAPROOT

- Remove and bag seeds or fruits;
- Push a narrow trowel or knife into the ground beside the tap root, carefully loosen the soil and repeat this step around the taproot;
- Grasp the stem at ground level, rock plant backwards and forwards and gently pull removing the plant; and
- Tap the roots to dislodge soil, replace disturbed soil and pat down.

CROWNING

- Remove and bag stems with seed or fruit;
- Grasp the leaves or stems together so the base of the plant is visible;
- Insert the knife or lever at an angle close to the crown;
- Cut through all the roots around the crown; and
- Remove and bag the crown.

HERBICIDE TREATMENT – STEM SWIPING

- Remove any seed or fruit and bag; and
- Using an herbicide applicator, swipe the stems/leaves.

Considerations:

- Further digging may be required for plants with more than one tuber;
- Some bulbs may have small bulbils attached or present in the soil around them which need to be removed;
- It may be quicker and more effective to dig out the weed;
- Protect native plants and seedlings; and
- For bulb and corm species the most effective time to apply herbicide is after flowering and before fruit is set.

#### 5.5.2.5 Disposal of exotic vegetation

Exotic vegetation will be removed and stockpiled in a clear area away from adjoining bushland. This stockpile should be removed from the site at the earliest convenient time. As part of the regular maintenance of the restored area any re-growth of the exotic plant species will be removed and disposed of appropriately.

Disposal of weed material via burns piles is generally discouraged, however it may be permitted only after approval has been obtained from the relevant authorities. Any burning must be carried out as advised by the Environment Protection Authority and NSW Fire Brigade. In other circumstances where burning is not an

option, weed derived material will be collected, stockpiled and as soon as possible transported to an approved green waste collection facility where it will be destroyed.

#### 5.5.2.6 Use of Herbicides

Herbicides should not be applied prior to rain occurring. This reduces the effectiveness of the herbicide and poses the risk of the herbicide being transported by runoff into local creeklines and waterways.

An advantage of herbicide use is the low time taken to spray weeds as compared to physically removing them, particularly for large infestations of weeds.

The use of herbicides should be considered when:

- There are small areas of dense weeds with few or no native plants to protect;
- There are large areas of weeds; and
- The weeds are growing too rapidly for physical removal;

Herbicide application via stem injection, frilling, scraping or foliar spray must not be applied to plants bearing ripe or semi-ripe fruit. It is important to plan herbicide control of target species according to a weeding calendar that recognises the weed's life form and seasonality (i.e. flowering, fruiting and seed set).

The spraying of weeds must only be undertaken by experienced persons with Chemcert or equivalent qualifications. The success of each treatment must be evaluated by the operator after a set period of time and re-applied (if necessary) according to the labelled effectiveness for each herbicide. Care must be taken when applying herbicides near drainage lines to avoid excess use environmental contamination and loss of sensitive flora and fauna.

The herbicide of choice for bush regeneration work is glyphosate (Roundup). Roundup Biactive shall be used in wet areas (e.g. drainage lines, sediment basin).

Garlon (triclopyr) is recommended for control of Blackberry, and Brushoff (metsulfron) for the control of both Ground Asparagus and Bridal Creeper. Access or Brushoff are more effective in controlling Green Cestrum than Roundup.

Unless otherwise agreed, herbicide application shall be limited to the following techniques:

- Cut-stump and poison (cut and dab);
- Stem injection;
- Stem-scrape or frilling and poison;
- Basal bark painting; and
- Selective spot-spraying.

#### 5.5.2.7 Control techniques for known weed species

The method ‘Cut and paint can be used for large *Cotoneaster glaucophyllus* plants. This weed has a large woody root system, which will require the application of a glyphosate chemical (eg. Roundup herbicide) for sufficient eradication. Smaller individuals can be removed by hand and discarded appropriately. *Cotoneaster glaucophylla* is apomictic (can set seed without pollination) and seeds are regularly spread by birds so it is important to consider removing plants that are in flower to reduce the amount of regrowth and follow up measures.

*Hypochaeris radicata* is best controlled by total removal of the plant. A small digging tool will be sufficient to dig the plant out. Herbicides such as glyphosate can also be used if necessary to help control weed densities of this species. All plants should be removed from site appropriately.

#### 5.5.2.8 Project Commitment

Management occurring, as part of this FFMP will include:

- Monitoring of native areas adjoining the project area as part of the monitoring program;
- Where developing weed problems are identified within 200m of the project boundary (or the area affected as a result of the project) a weed control program using the above relevant methods will be implemented in conjunction with NPWS by a qualified bushland regenerator;
- It should be noted that Conservation Bonds will be paid to the State Government, so it is in the interest of the proponent to ensure this bond is not forfeited through lack of action on weed management;
- The proponent will undertake flora and fauna monitoring within the 100m buffer within the vicinity of the two surface monitoring points shown on Figure 10 in the Water Management Plan by GSS dated January 2011.

# 6.0 Flora and Fauna Monitoring Program

## 6.1 Detailed Baseline Data on Flora and Fauna present

### 6.1.1 Flora and Fauna present within the site

Gunninah Environmental Consultants have produced *Document C – Flora and Fauna Issues* as an Attachment to the EIS. Extracts from this document are as follows:

> *'Previous flora surveys on this particular site include the Environmental Impact Statement (EIS) completed by International Environmental Consultants Pty Ltd (2003) and work completed by P & J Smith Consultants (2003) involved a flora survey of the site. Studies adjacent to the proposal area include EIS's prepared for the Clarence Colliery by Corkery and Co Pty Ltd (1994) and International Environmental Consultants (2000). Regional flora studies include mapping work completed by Benson and Keith (1990), The natural vegetation of the Wallerawang 1: 100 000 map sheet, which describes and coarsely maps the different vegetation communities in this area.'*
>
> *'The assemblage of flora species which have been recorded on the subject site at Newnes to date is the culmination of a number of investigations, including those by IEC (2003), P & J Smith (2003), Biosphere (2004) and HWR (2004). In terms of threatened flora species, the results of other investigations undertaken in the immediate vicinity have also been considered (Corkery & Co 1993; IEC 2000).'*
>
> *'There are three different vegetation communities occurring on site. In order of abundance these are Blue Mountains Sandstone Plateau Forest occurring over the majority of the site, Newnes Plateau Shrub Swamp was found in one area of the southern drainage line and Newnes Plateau Woodland situated in a small area on the west of the proposal area.'*
>
> *'A total of 171 flora species, including introduced plants and weeds have been recorded on the subject site at Newnes. It is of particular note that not a single threatened flora species has been recorded by any of the investigators who have conducted surveys on the subject site at Newnes.' (Gunninah 2004).*

A supplementary submission addressing Flora and Fauna issues that were raised during the exhibition period was produced by HWR (2004). This work included additional survey and assessment work and validated the work undertaken by Gunninah.

Since these reports were written the Newnes Plateau Shrub Swamp (NPSS) vegetation community has been listed as an Endangered Ecological Community (EEC) within the NSW Threatened Species Conservation (TSC) Act (1995). The NPSS vegetation community is also considered to form part of the 'Temperate Highland Peat Swamps on Sandstone' vegetation community, which has been listed as an Endangered Ecological Community within the commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act (1999).

In addition, subsequent to the completion of the Flora and Fauna components of the EIS, the vegetation in areas within, north, south and west of the subject site have been mapped and described in '*The Vegetation of the Western Blue Mountains'* (DEC 2006). The vegetation communities mapped within or adjacent to the subject site by DEC (2006) are:

- Map Unit 26a – Newnes Plateau Gum Hollows variant: Brittle Gum-Mountain Gum, Scribbly Gum-Snow Gum shrubby open forest;
- Map Unit 29 – Sandstone Slopes Sydney Peppermint Shrubby Forest;
- Map Unit 30 – Exposed Blue Mountains Sydney Peppermint-Silver-top Ash Shrubby Woodland; and
- Map Unit 51 – Newnes Plateau Hanging Swamp (Forms a component of the Temperate Highland Peat

Swamps on Sandstone listed as an EEC under the EPBC Act)

**Table 6 Combined flora species recorded on the subject site (IEC 2003; P & J Smith 2003; HWR 2004)**

| Family/Class Name | Species Scientific Name | Species Common Name | A | B |
|---|---|---|---|---|
| **Class LYCOPSIDA** | **Clubmosses and Quillwarts** | | | |
| LYCOPODIACEAE | *Lycopodium deuterodensum* | Bushy Clubmoss | √ | √ |
| GLEICHENIACEAE | *Gleichenia dicarpa* | Pouched Coral-fern | √ | |
| DENNSTAEDTIACEAE | *Calochlaena dubia* | False Bracken | √ | |
| | *Pteridium esculentum* | Bracken | √ | √ |
| LINDSAEACEAE | *Lindsaea linearis* | Screw Fern | √ | √ |
| DICKSONIACEAE | *Calochlaena dubia* | - | | √ |
| SCHIZAEACEAE | *Schizaea bifida* s. str. | Forked-comb fern | | √ |
| BLECHNACEAE | *Blechnum cartilagineum* | Gristle Fern | √ | √ |
| | *Blechnum nudum* | Fishbone Water-fern | √ | √ |
| **Class MAGNOLIDAE** | **Flowering Plants** | | | |
| LAURACEAE | *Cassytha melantha* | Devils Twine | √ | |
| RANUNCULACEAE | *Clematis aristata* | Toothed Clematis | √ | |
| DILLENIACEAE | *Hibbertia cistifolia* | - | | √ |
| | *Hibbertia obtusifolia* s.str | Blunt-leaf Guinea-flower | √ | |
| RHAMNACEAE | *Pomaderris andromedifolia* | - | √ | √ |
| EUPHORBIACEAE | *Amperea xiphoclada* | Broom Spurge | √ | √ |
| | *Poranthera microphylla* | Small Poranthera | √ | |
| TREMANDRACEAE | *Tetratheca rubioides* | - | | √ |
| VIOLACEAE | *Hybanthus monopetalus* | Slender Violet-bush | √ | √ |
| | *Viola hederacea* | Ivy-leaf Violet | √ | √ |
| DROSERACEAE | *Drosera sphathulata* | Common Sundew | √ | |
| CASUARINACEAE | *Allocasuarina littoralis* | Black She-oak | √ | |
| CUNONIACEAE | *Callicoma serratifolia* | Black Wattle | √ | √ |
| MALACEAE | *Cotoneaster glaucophyllus** | Cotoneaster | √ | |
| PROTEACEAE | *Banksia conferta var.penicillata* | - | √ | |
| | *Banksia cunninghamia* | - | √ | |
| | *Banksia marginata* | Silver Banksia | √ | √ |
| | *Banksia oblongifolia* | Spoon-leaf Banksia | √ | √ |
| | *Banksia serrata* | Saw Banksia | √ | √ |
| | *Banksia spinulosa var. spinulosa* | Hairpin Banksia | √ | √ |
| | *Grevillea laurifolia* | Laurel Grevillea | √ | √ |
| | *Hakea laevipes ssp. laevipes* | - | √ | √ |
| | *Hakea pachyphylla* | - | √ | √ |
| | *Isopogon anethifolius* | Narrow-leaf Drumstick | | √ |
| | *Isopogon prostratus* | Prostrate Drumstick | | √ |
| | *Isopogon anemonifolius* | Broad-leaf Drumsticks | √ | √ |
| | *Lomatia silaifolia* | Crinkle Bush | √ | √ |

| Family/Class Name | Species Scientific Name | Species Common Name | A | B |
|---|---|---|---|---|
| | *Persoonia chamaepitys* | Prostrate Geebung | √ | √ |
| | *Persoonia laurina subsp. laurina* | Laurel-leaf Geebung | √ | √ |
| | *Persoonia levis* | Broad-leaf Geebung | √ | √ |
| | *Persoonia myrtilloides* | Myrtle Geebung | | √ |
| | *Petrophile canescens* | - | | √ |
| | *Petrophile pulchella* | Conesticks | √ | √ |
| | *Telopea speciosissima* | Waratah | √ | √ |
| MYRTACEAE | *Eucalyptus blaxlandii* | Blaxland's Stringybark | √ | √ |
| | *Eucalyptus laophila* | - | √ | √ |
| | *Eucalyptus mannifera* | Brittle Gum | √ | √ |
| | *Eucalyptus piperita* | Sydney Peppermint | √ | √ |
| | *Eucalyptus radiata ssp. radiata* | Narrow-leaved Peppermint | √ | √ |
| | *Eucalyptus sclerophylla* | Hard-leaved Scribbly Gum | √ | √ |
| | *Eucalyptus sieberi* | Silvertop Ash | √ | √ |
| | *Eucalyptus sparsifolia* | Narrow-leaved Stringybark | √ | √ |
| | *Baeckea linifolia* | Swamp Baeckea | √ | √ |
| | *Leptospemum macrocarpum* | - | | √ |
| | *Leptospermum myrtifolium* | Swamp Tea-tree | | √ |
| | *Leptospermum arachnoides* | Spider Teatree | √ | √ |
| | *Leptospermum continentale* | Prickly Tea-tree | √ | √ |
| | *Leptospermum grandifolium* | Wooly Tea-tree | √ | √ |
| | *Leptospermum juniperinum* | Prickly Teatree | √ | √ |
| | *Leptospermum polygalifolium* | Yellow Tea-tree | √ | √ |
| | *Leptospermum sphaerocarpum* | Round-fruited Tea-tree | √ | √ |
| | *Leptospermum trinervium* (narrow leaf form) | Flaky-bark Tea-tree | √ | √ |
| | *Leptospermum trinervium* (broad leaf form) | Flaky-bark Tea-tree | √ | √ |
| HALORAGACEAE | *Gonocarpus tetragynus* | Poverty Raspwort | √ | √ |
| | *Gonocarpus teucroides* | Raspwort | √ | √ |
| RUTACEAE | *Boronia microphylla* | Small-leaved Boronia | √ | √ |
| FABACEAE | *Bossiaea heterophylla* | Variable Bossiaea | √ | √ |
| | *Daviesia latifolia* | Broad-leaf Bitter Pea | √ | √ |
| | *Daviesia acicularis* | - | | √ |
| | *Daviesia squarrosa* | - | | √ |
| | *Daviesia ulicifolia* | Gorse Bitter-pea | √ | √ |
| | *Gompholobium latifolium* | Broad-leaf Wedge-pea | √ | √ |
| | *Hovea ? heterophylla* | - | √ | √ |
| | *Mirbelia platylobioides* | - | √ | √ |
| | *Phyllota squarrosa* | Dense Phyllota | √ | √ |
| | *Pultenaea scabra* | Rough Bush-pea | √ | √ |
| MIMOSOIDEAE | *Acacia myrtifolia* | Myrtle Wattle | | √ |
| | *Acacia falcata* | Sickle Wattle | √ | |

| Family/Class Name | Species Scientific Name | Species Common Name | A | B |
|---|---|---|---|---|
| | *Acacia implexa* | Hickory | √ | |
| | *Acacia longifolia* | Sydney Golden Wattle | √ | √ |
| | *Acacia obtusifolia* | - | √ | √ |
| | *Acacia terminalis* | Sunshine Wattle | √ | √ |
| | *Acacia ulicifolia* | Prickly Moses | √ | √ |
| SANTALACEAE | *Choretrum pauciflorum* | Dwarf Sourbush | √ | √ |
| | *Leptomeria acida* | Native Currant | √ | √ |
| | *Omphacomeria acerba* | Leafless Sour Bush | √ | √ |
| PITTOSPORACEAE | *Billardiera scandens* | Apple-berry | √ | √ |
| | *Rhytidosporum procumbens* | Marianthus | √ | √ |
| POLYGALACEAE | *Comesperma ericinum* | Matchheads | | √ |
| | *Comesperma volubile* | Love Creeper | | √ |
| ARALIACEAE | *Polyscias sambucifolia* | Elderberry Panax | √ | √ |
| APIACEAE | *Xanthosia stellata* | - | | √ |
| | *Hydrocotyle peduncularis* | Hairy Pennywort | √ | √ |
| | *Platysace lanceolata* | Native Parsnip | √ | √ |
| | *Platysace linearifolia* | Narrow-leaf Platysace | √ | √ |
| | *Xanthosia pilosa* | Hairy Xanthosia | √ | |
| ASTERACEAE | *Arrhenechthites mixta* | Purple Fireweed | √ | √ |
| | *Cassinia aculeata* | Dollybush | √ | √ |
| | *Helichrysum adenophorum var. wadelliae* | Waddel Everlasting | √ | √ |
| | *Helichrysum leucopsideum* | Satin Everlasting | | √ |
| | *Helichrysum rutidolepis* | Pale Everlasting | | √ |
| | *Helichrysum scorpioides* | - | √ | √ |
| | *Hypochoeris radicata** | Flatweed | √ | |
| CAMPANULACEAE | *Wahlenbergia sp.* | - | | √ |
| EPACRIDACEAE | *Epacridaceae sp.* | - | | √ |
| | *Brachyloma daphnoides* | Daphne Heath | √ | √ |
| | *Epacris microphylla* | Small-leaf Heath | √ | √ |
| | *Epacris pulchella* | Coral Heath | √ | √ |
| | *Leucopogon lanceolatus* | Lance-leaf Beard-heath | √ | √ |
| | *Monotoca scoparia* | Prickly Broom-heath | √ | √ |
| LAMIACEAE | *Prostanthera scutellarioides* | Coast Mint-bush | | √ |
| GOODENIACEAE | *Goodenia dimorpha var. dimorpha* | - | | √ |
| | *Dampieria stricta* | Blue Dampieria | √ | √ |
| | *Goodenia bellidifolia ssp bellidifolia* | Daisy-leaved Goodenia | √ | √ |
| LOGANIACEAE | *Mitrasacme polymorpha* | Mitre Weed | √ | √ |
| RUBIACEAE | *Galium binifolium* | Bedstraws | √ | |
| | *Galium propinquum* | Maori Bedstraw | √ | |
| | *Pomax umbellata* | Pomax | √ | √ |
| SCROPHULARIACEAE | *Veronica plebeia* | - | √ | |
| **Subclass LILIDAE** | **Monocotyledons** | | | |

| Family/Class Name | Species Scientific Name | Species Common Name | A | B |
|---|---|---|---|---|
| LOMANDRACEAE | *Lomandra cylindrica* | Needle Mat-rush | | √ |
| | *Lomandra glauca subsp. glauca* | Glaucous Mat-rush | √ | |
| | *Lomandra filiformis subsp. filiformis* | Wattle Mat-rush | √ | √ |
| | *Lomandra longifolia subsp. longifolia* | Spiny Mat-rush | √ | √ |
| | *Lomandra multiflora subsp. multiflora* | Many-flowered Mat-rush | √ | |
| XANTHORRHOEACEAE | *Xanthorrhoea resinifera* | Spear Grass-tree | | √ |
| | *Xanthorrhoea media* | Sydney Grass-tree | √ | |
| | *Xanthorrhoea resinosa* | Sydney Swamp Grass-tree | √ | √ |
| PHORMIACEAE | *Dianella caerulea var. caerulea* | Rough Flax Lily | √ | √ |
| | *Dianella prunina* | - | | √ |
| | *Dianella revoluta* | Mauve Flax Lily | √ | √ |
| IRIDACEAE | *Patersonia sericea* | Silky Purple-flag | √ | √ |
| | *Patersonia fragilis* | Glabrous Purple-flag | √ | √ |
| | *Patersonia glabrata* | Cauline-leaf Purple-flag | √ | √ |
| ORCHIDACEAE | *Acianthus sp.* | - | | √ |
| | *Caladenia dimorpha* | | | √ |
| | *Diuris sulphurea* | Tiger Orchid | | √ |
| | *Genoplesium sp* | - | | √ |
| | *Pterostylis tunstallii* | - | | √ |
| | *Pterostylis concinna* | Trim Greenhood | | √ |
| | *Orthoceras strictum* | Horned Orchid | √ | |
| HAEMODORACEAE | *Haemodorum planifolium* | Bloodroot | √ | √ |
| | *Haemodorum corymbosum* | Rush-leaf Bloodroot | | √ |
| XYRIDACEAE | *Xyris gracilis subsp. gracilis* | Slender Yellow-eye | √ | √ |
| JUNCACEAE | *Juncus planifolius* | - | | √ |
| | *Juncus continuus* | Sand Rush | √ | √ |
| CYPERACEAE | *Caustis flexuosa* | Curved Caustis | √ | √ |
| | *Gahnia filifolia* | - | √ | √ |
| | *Gahnia microstachya* | Slender Saw-sedge | √ | √ |
| | *Gahnia sieberiana* | Red-fruited Saw-sedge | √ | √ |
| | *Lepidosperma laterale* | Variable Sword-sedge | √ | √ |
| | *Lepidosperma limicola* | Razor Sword-sedge | √ | √ |
| | *Lepidiosperma tortuosum* | - | √ | √ |
| | *Schoenus brevifolius* | Zig-zag Bog-rush | | √ |
| | *Schoenus melanostachys* | Black Bog-rush | | √ |
| | *Schoenus villosus* | Hairy Bog-rush | √ | √ |
| RESTIONACEAE | *Empodisma minus* | Spreading Rope-rush | √ | √ |
| | *Lepyrodia muellerii* | - | √ | |
| | *Lepyrodia scariosa* | Chaffy Scale-rush | √ | √ |
| | *Restio australis* | - | √ | √ |
| POACEAE | *Aristida benethamii var. benthamii* | - | | √ |
| | *Aristida personata* | - | | √ |

| Family/Class Name | Species Scientific Name | Species Common Name | A | B |
|---|---|---|---|---|
| | *Austrostipa pubescens* | Tall Spear Grass | √ | √ |
| | *Austrostipa rudis* | - | √ | √ |
| | *Dichelachne inaequiglumis* | - | √ | √ |
| | *Entolasia stricta* | Wiry Panic | √ | √ |
| | *Joycea pallida* | Red-anthered Wallaby Grass | √ | √ |
| | *Microlaena stipoides var. stipoides* | Weeping Grass | √ | √ |
| | *Poa labillardieri* | Tussock Grass | √ | |
| | *Tetrarrhena turfosa* | - | √ | |
| | *Poa sieberiana* | - | √ | √ |

| Key |
|---|
| A Surveys undertaken by HWR (2004) |
| B Previous surveys by Smith & Smith (2003) and International Environmental Consultants (EIS) 2003 |

* exotic species

### 6.1.2 Habitat present in the adjoining Greater Blue Mountains WHA

The vegetation and habitat types of the site and those on the landscapes to the north, south and west have been mapped described in the *Vegetation of the Western Blue Mountains* (DEC 2006). However, the habitat to the east in the GBMWHA has not.

The vegetation on the site can be classified by the following communities (DEC 2006):

- Map Unit 26a – Newnes Plateau Gum Hollows variant: Brittle Gum-Mountain Gum, Scribbly Gum-Snow Gum shrubby open forest;
- Map Unit 29 – Sandstone Slopes Sydney Peppermint Shrubby Forest; and
- Map Unit 30 – Exposed Blue Mountains Sydney Peppermint-Silver-top Ash Shrubby Woodland.

The vegetation in the GBMWHA immediately adjacent to the quarry site is expected to be very similar to that of the site due to proximity and identical topography. A little further in the GBMWHA other vegetation communities will be present, including high value NPSS and Newnes Plateau Hanging Swamp (NPHS).

It is to be noted that the Conditions of Consent requires that monitoring locations be established in the GBMWHA. These have been established as outlined further below.

### 6.1.3 Habitat present along the Wollangambe River and tributaries

The Conditions of Consent also requires that monitoring sites are to be established along the Wollangambe River and its tributaries within the GBMWHA. These have been established as outlined further below.

## 6.2 Detailed Flora and Fauna Impact Assessment Criteria

The details of specific impact assessment criteria relating to flora and fauna, vegetation communities and habitat, are based on the selected monitoring sites for the vegetation surveys.

The monitoring of vegetation characteristic (i.e. floristic composition, habitat structure and condition) as well as hydrological regimes and other site characteristics were carried out within the NPSS. This and any monitoring of additional NSW and Australian Government listed Ecological Endangered Communities that may be identified in the compensatory sites will provide assessment data as well as inform the development

and refinement of assessment criteria. These will be compared with the available scientific evidence, and in particular the profiles provided in "The Vegetation of the Western Blue Mountains including the Capertee, Coxs, Jenolan & Gurnang Areas" Volume 2: Vegetation Community Profiles (DECCW 2006).

The regular systematic monitoring of these sites over the life of the project and in accordance with the protocols outlined in this FFMP will determine if these community types, and by inference to similar vegetation types nearby, have been impacted by the activities of the project.

Similarly, the monitoring of fauna species and habitat characteristic at these sites and elsewhere in the area - in accordance with the protocols herein - will determine if fauna species have been impacted by the activities of the project.

Monitoring of the composition and degree of existing weed infestation in accordance with the Pest and Weed Management Plan has provided a baseline for the assessment of any weed invasion of the subject sites and helped inform the selection of criteria for the assessment of flora and fauna communities.

## 6.3 Programming of Flora and Fauna and Habitat Health Monitoring

A variety of field survey techniques have been employed over the course of fieldwork for this program to record the flora and fauna species across the subject site and compensatory habitat sites and monitoring sites within the GBMWHA. Targeted searches for threatened flora and fauna species were also undertaken.

## 6.4 Monitoring Methodology

### 6.4.1 Vegetation Mapping

Flora surveys on site and vegetation mapping were carried out and included the following procedures:

- Review of the vegetation mapping (Benson and Keith 1990, DECCW 2006) for the study locality;
- Aerial Photograph Interpretation (API) to map the community(s) extent into definable map units;
- Confirmation of the community type(s) present (dominant species) via the undertaking of detailed field flora surveys and identification; and
- Mapping of the type and general extent of the community(s) present into definable map units where appropriate.

### 6.4.2 General Flora Survey

General flora surveys were carried out across the subject site to determine species diversity and abundance and vegetation structure (the flora quadrat proforma in Appendix 1 outlines the information that was recorded during surveys). This consisted of ten 20 m x 20 m quadrats and random meanders throughout each quadrat as described by Cropper (1993). A map showing the study site with the location of each quadrat is shown in Figure 6-1.

All species recorded were identified as far as practicable to species and subspecies (where relevant) level. When a plant could not be identified accurately in the field, a single sample was collected, together with notes on habitat, form, percent coverage and height. These samples were identified in the office (according to nomenclature in Harden [1992 – 2002]) or sent to the Royal Botanical Gardens for identification.

Fauna habitat assessments were conducted at each quadrat to determine the possible composition of faunal assemblages at each site if species were not observed during the survey.

An example of flora and fauna data sheets is supplied in Appendix 2.

Weed identification and monitoring (as required under Condition 29(c)) was undertaken in association with these works.

### 6.4.3 Monitoring site locations and project commitments

Flora and fauna monitoring was carried out within the 100m buffer and within the adjoining GBMWHA and alongside the Wollangambe River and tributaries, totalling ten monitoring plots in the survey area. The location of these survey locations is shown in Figure 6-1.

The program of monitoring within the GBMWHA and alongside the Wollangambe River and tributaries is similar to that for the subject site and compensatory sites.

Assessment of the potential for the identified vegetation communities to constitute EEC's as listed within the *TSC Act* and the *EPBC Act* was undertaken within each monitoring quadrat. Vegetation communities that are listed during the life of the project will be further assessed and additional surveys undertaken if this is found to be necessary. Floristic composition, geo-morphological characters and geographic distribution will be considered when determining whether a vegetation community comprises an EEC or not.

Weed and pest monitoring also occurred in these areas in accordance with Condition 29(c).

WARNING
No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from RPS Newcastle.

Clarence Rail Loop

The Site

Newnes Junction

Blue Mountains National Park

N

1
2
3
4
5
6
7
8
9
10

**LEGEND**

- Monitoring Point
- Site Boundary
- National Park

| | | | | | |
|---|---|---|---|---|---|
| TITLE: FIGURE 6-1 MONITORING POINT LOCATIONS | LOCATION: CLARENCE, NSW | DATUM: N/A<br>PROJECTION: MGA ZONE 56 (GDA 94) | DATE: 3/11/2011<br>PURPOSE: DUE DILIGENCE | LAYOUT REF:<br>VERSION (PLAN BY): A A3 (TL) | |

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Program of monitoring within the 100m buffer

Two monitoring sites using the methods outlined previously were located within the buffer were surveyed.

Program of monitoring within the adjoining Greater Blue Mountains WHA

Four monitoring sites using the methods outlined previously were located within 200m of the common project / GBMWHA boundary to ensure that the project does not impact upon the biodiversity of the GBMWHA.

Program of Monitoring along the Wollangambe River and tributaries

Two monitoring sites using the methods outlined previously were located along the main tributaries to the Wollangambe River, with an additional two monitoring sites along the Wollangambe River itself to ensure that the project does not impact upon the ecology of the Wollangambe River and its tributaries.

Program of monitoring within the Dargans Creek Reserve and Shrub Swamp habitats on the Newnes Plateau

It is expected that the start-up and annual funding directed to the HNCMA for these areas will also effectively fund annual monitoring activities showing an improvement in rehabilitated areas, though this is outside the scope of the site-specific Flora and Fauna Monitoring Program.

Program of monitoring within the minimum 25ha offset area

The land tenure and location of the minimum 25ha offset area has informed monitoring requirements. Land will be purchased and granted to NPWS, which would not require specific annual monitoring.

## 6.5 Survey

Of the ten monitoring quadrats that were set up four were surveyed on the first occasion 30/6/11-1/7/11 and the remaining six were surveyed from 27/7/11-28/7/11. A total number of 106 flora species were identified within these quadrats. All flora species recorded were native, indicating a high quality ecosystem due to its natural state without the presence of competing invasive species. Such information provides good baseline data to initiate monitoring and ensure that any impacts recorded in the future are managed accordingly.

Significant Flora Survey

A list of potentially occurring significant flora species from the study locality has been compiled during the literature review (see **Table 3**). Significant flora species include threatened flora species listed under the *TSC Act* and *EPBC Act*, Rare or Threatened Australian Plants (ROTAP) listed flora species (Briggs and Leigh 1996), as well as any other flora species deemed to be of local importance. **Section 3-1** identified significant flora species that occurred within the subject site. Should additional species be listed during the life of the project these will be added to the list and targeted surveys will be conducted to ascertain their presence or not.

Habitat types

During the fauna surveys the type and condition of potential habitats for fauna species was recorded. Habitat features investigated during targeted and general habitat assessments included:

- Topographic features (such as slope, aspect & landscape position);
- Dominant vegetation community composition, structure and condition at all strata levels (i.e. from ground to canopy cover);

- Ground cover type and percentage cover;
- Form, quality and location of water sources;
- Location, type and size of tree hollows;
- The presence, number and condition of unique habitat features (such as caves, crevices, loose tree bark, rocks on rock and mistletoe); and

The level of disturbance.

During the habitat assessment opportunistic observations of fauna or faunal activity were recorded, including visual and auditory recognition of fauna species and identification of evidence of faunal activity (e.g. nests, diggings, scratch marks, droppings).

Landscape Context

The potential habitat links within and to and from the subject site were investigated via aerial photograph interpretation.

Fauna Surveys

Fauna surveys were concentrated on bird diversity at each of the 10 survey points. Bird diversity is considered to be the best bio-indicator from a habitat health perspective.

Pest monitoring (as required under Condition 29(c)) will be undertaken in association with these works.

## 6.6 Flora and Fauna Survey Limitations

### 6.6.1 Flora

Data collection on site was subject to a number of limitations that are likely to have affected the results of flora surveys during the survey period. Seasonal changes have a major influence on the presence and/or the flowering habits of plants. Not all flora species occurring throughout the year are likely to be detected during a survey undertaken once during the year particularly in colder winter months. For example cryptic orchids flower within certain seasons and cannot be detected at other times of the year. Also, the vegetation structure data identified was estimated by eye and therefore, due to human differences there can be discrepancies between data that has been collected by different people.

Similarly the Braun-Blanquet scale, which is used to estimate vegetation cover, is also estimated by eye, and differences can occur when two different ecologists are collecting the data. This may have occurred during the collection of data between different monitoring periods.

Daily weather can also impact on survey results particularly if extreme weather such as storms or snow has recently occurred.

### 6.6.2 Fauna

Data collection of fauna occurrence within the site was subject to a number of limitations that are likely to have affected the results of fauna surveys during the survey period, including:

- Weather – Although most fauna species remain active and detectable under a range of different weather patterns, overcast or very warm conditions and windy episodes over the survey period were likely to have affected either the ability to detect fauna, or influenced fauna activity, and therefore added some element of inconsistency to the collection of data at different sites;
- Season – All fauna life-cycles are tied closely to seasonal variations with regard to breeding-cycles and response to foraging resources. The different ecological requirements of a wide and varied suite of fauna that might potentially use the site, place limitations on the potential for all species to be surveyed at any one time during the year. Furthermore, the availability of some resources, such as *Eucalyptus* blossom, is differently distributed over cycles that span several years (up to decades) and this may strongly affect the distribution of more mobile fauna from year to year; and
- Survey Effort – Due to the mobility, large home ranges and varied movements of some species (such as Microchiropteran bats and Forest Owls), it is difficult to determine the presence of those species, which might use a particular habitat, without sustained survey effort at each site. Therefore, current survey results may not be a strong indication of the presence / absence of those species within the site. However, in the absence of direct observation of these species habitat assessment is considered to be a reliable indicator of the potential for these species to occur within a site.

## 6.7 Recorded Baseline Data

### 6.7.1 Flora

A total of 106 species were recorded (Appendix 1). All species recorded were native species. The sites are currently not subjected to impacts by weeds species.

Table 6-2 lists the vegetation communities sampled, total number of plants, and percentage of natives and exotic species within each flora monitoring plot.

**Table 7 Flora Diversity within Plots**

| Flora Monitoring Plot | Total No. Spp | No. Native spp. | % Natives | No of exotic spp. | % Exotics |
|---|---|---|---|---|---|
| 1 | 28 | 28 | 100 | 0 | 0 |
| 2 | 23 | 23 | 100 | 0 | 0 |
| 3 | 28 | 28 | 100 | 0 | 0 |
| 4 | 23 | 23 | 100 | 0 | 0 |
| 5 | 35 | 35 | 100 | 0 | 0 |
| 6 | 34 | 34 | 100 | 0 | 0 |
| 7 | 29 | 29 | 100 | 0 | 0 |
| 8 | 25 | 25 | 100 | 0 | 0 |
| 9 | 27 | 27 | 100 | 0 | 0 |
| 10 | 27 | 27 | 100 | 0 | 0 |

The vegetation condition of all sites was considered to be of high quality for various reasons. The absence of weed species, unauthorised tracks and illegal dumping has aided in the perpetuation of a natural ecosystem with little competition and degradation. Minimal die-back was recorded within the quadrats during surveys, indicating low stress environments. All vegetation layers were generally diverse and healthy at each quadrat.

Further detailed analysis of the baseline data is not required at this stage. This will be done as part of the annual monitoring requirements and will include more detailed information on flora diversity and structure comparison for all sites against their 2011 baseline data.

### 6.7.2 6.5.2 Fauna

Habitat

Habitat across the site was a mixture of swamp and woodlands. The lower flats were largely characterised by dense, shrubby vegetation, with moist soils often associated with creeklines.

The more elevated areas of the site consisted of various open woodlands, which exhibited an assemblage of young and old canopy trees. There were few hollow bearing trees or stags recorded within all quadrats.

The relatively low incidence of hollows within the site's woodland habitats places limitations upon the site's potential to support a diverse suite of native fauna. Threatened species guilds, such as arboreal mammals, hollow-dwelling Microchiropteran bats and hollow-nesting birds, are dependent upon tree hollows for shelter and nesting sites. Furthermore, other fauna guilds, such as forest owls, are dependent upon healthy populations of arboreal mammals for prey. Therefore, the absence of hollows affects guilds of fauna other than those that might directly use hollows within the habitat.

At most monitoring sites the shrub layer was considered moderately diverse. These understorey shrubs provide significant shelter and foraging opportunities for small bird species, including threatened woodland species occurring within the site.

Bird survey plots

Twenty-minute bird surveys within designated bird plots detected a low diversity of common native bird species (n=20). Previous studies have recorded one threatened species, the Brown Treecreeper, within and surrounding the subject site. Ideally fauna monitoring would occur in spring to obtain the highest diversity of species occurring on site. The results of individual Bird Survey Plots are displayed in Table 8.

**Table 8 Results of Fixed Bird Survey Plots**

| **Bird species** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Bird Plot Number** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | **Bird species count** | 7 | 9 | 8 | 4 | 5 | 10 | 3 | 2 | 4 | 9 |
| *Phylidonyris novaehollandiae* | New Holland Honey-eater | 1 | | | | 1 | 1 | | | | 4 |
| *Eopsaltria australis* | Eastern Yellow Robin | 2 | | 1 | 1 | | | | 1 | | |
| *Menura novaehollandiae* | Superb Lyrebird | 1 | 1 | 2 | 1 | | 1 | | | | 1 |
| *Lichenostomus chrysops* | Yellow-faced Honey-eater | 4 | 2 | | | 2 | 1 | | | | 1 |
| *Colluricincla harmonica* | Grey Shrike-thrush | 2 | | | | | | | | | 1 |
| *Sericornis frontalis* | White-browed Scrub-wren | 1 | | | | | | | | | 1 |
| *Platycercus elegans* | Crimson Rosella | 1 | | | | | | | | 2 | |

| Bird species | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Cacomantis flabelliformis* | Fan-tailed Cuckoo | | 1 | | | | | | | | |
| *Callocephalum fimbriatum* | Gang-gang Cockatoo | | 2 | | | | | | | | |
| *Acanthorhynchus tenuirostris* | Eastern Spinebill | | 8 | 10+ | | 3 | | | | 4 | 2 |
| *Cormobates leucophaeus* | White-throated treecreeper | | 1 | 1 | | 1 | 1 | 1 | 1 | | 1 |
| *Alisterus scapularis* | Australian King Parrot | | | 3 | | | | | | | |
| *Falcunculus frontatus* | Crested Shrike-tit | | | 3 | | | | | | | |
| *Anthochaera carunculata* | Red Wattlebird | | 1 | 1 | 2 | 1 | | 1 | | | 1 |
| *Corvus coronoides* | Australian Raven | | 2 | 1 | 1 | | 1 | 2 | | | |
| *Acanthiza pusilla* | Brown Thornbill | | 6 | | | | 4 | | | | |
| *Malurus cyaneus* | Superb Fairy Wren | | | | | | 3 | | | | 2 |
| *Psophodes olivaceus* | Eastern Whipbird | | | | | | 1 | | | | |
| *Acanthiza lineata* | Striated Thornbill | | | | | | | | | 6 | |
| *Lichenostomus leucotis* | White-eared Honeyeater | | | | | | | | | 2 | |

These results will be compared in future years monitoring to ascertain whether any impact to bird and related habitat diversity is noted. This will allow for any impacts to be addressed if recorded.

Opportunistic Fauna Data

During the monitoring surveys visual and auditory opportunistic identification was used. *Crinia signifera* (Common Eastern Froglet), *Vombatus ursinus* (common wombat) scat and burrows and *Felis catus* (domestic cat) were recorded during survey methods. *C. signifera* was heard calling at multiple sites, scats and burrows of wombats were recorded at multiple sites and a single *F. catus* was observed on an access track exiting the subject site.

## 6.8 Flora and Fauna impact assessment criteria - Non Compliance with Conditions of Consent Protocols

The monitoring and management procedures described in this FFMP, the Compensatory Habitat Management Plan and the Fauna and Flora monitoring program together with regular reviews/audits of the program will provide ongoing assessments of progress and opportunities for SCM to address any non compliance that might be identified.

The monitoring of vegetation characteristic (i.e. floristic composition, habitat structure and condition) will be carried out within the NPSS. This and any monitoring of additional NSW and Australian Government listed Ecological Endangered Communities that may be identified in the compensatory sites will provide assessment data. These will be compared with the available scientific evidence, and in particular the profiles provided in “The Vegetation of the Western Blue Mountains including the Capertee, Coxs, Jenolan & Gurnang Areas” Volume 2: Vegetation Community Profiles (DECCW 2006).

The regular systematic monitoring of these sites over the life of the project and in accordance with the protocols outlined in this FFMP will determine if these community types, and by inference to similar vegetation types nearby, have been impacted by the activities of the project.

Similarly, the monitoring of fauna species and habitat characteristic at these sites and elsewhere in the area - in accordance with the protocols herein - will determine if fauna species have been impacted by the activities of the *project*.

### 6.8.1 Consent Conditions relevant to the Fauna and Fauna Management Plan

The development consent conditions require that the FFMP, and in particular the Flora and Fauna impact assessment criteria described herein and to be further developed, are reviewed and reports submitted with respect to compliance (or otherwise) with the Conditions of Consent in accordance with the *EP&A Act*.

Conditions relevant to this FFMP and the Compensatory Habitat Management Plan – that inform the selection of impact assessment criteria, the ongoing revision of the plan in light of the monitoring, evaluation, external auditing and reporting - are given below.

***NOTE: The Schedule numbers and paragraph numbers listed below are those of the Development Consent.***

#### 6.8.1.1 Time Critical Conditions

**Schedule 3 – Specific Environmental Conditions**

**Conservation Bond**

37. Within 5 years of lodging the conservation bond ... and every 5 years thereafter ... the Applicant shall review, and if necessary revise, ... :

(b) any changes to the Compensatory Habitat Management Plan; and

(c) the performance of:

- the conservation of the Greater Blue Mountains WHA against the impact assessment criteria in the Flora and Fauna Management Plan ...; and
- the compensatory revegetation against the assessment and completion criteria of the Compensatory Habitat Management Plan.

**Schedule 5 – Environmental Management, Monitoring, Auditing and Reporting**

**Environmental Monitoring Program**

Within 3 months of the completion of each Independent Environmental Audit (see below), the Applicant shall review, and if necessary update, the Environmental Monitoring Program to the satisfaction of the Director-General.

**Annual Reporting**

5. Each year, following the date of [the] consent, the Applicant shall prepare and submit an AEMR [Annual Environmental Management Report] to the Director-General and the relevant agencies. This report must:

(a) identify the standards and performance measures that apply to the development;

(d) include a summary of the monitoring results for the development during the past year;

(e) include an analysis of these monitoring results against the relevant:

- impact assessment criteria;
- monitoring results from previous years; and
- predictions in the EIS and Supplementary Report;

(f) identify any trends in the monitoring results over the life of the development;

(g) identify any non-compliance during the previous year; and

(h) describe what actions were, or are being taken to ensure compliance.

**Independent Environmental Audit**

6. Within 1 year of the date of commencement of extraction, and every 2 years thereafter ... the Applicant shall commission ... an Independent Environmental Audit of the development. This audit must:

(a) be conducted by a team comprising suitably qualified, experienced, and independent specialists, including but not limited to a specialist hydrogeologist, hydrologist and ecologist, and whose appointments have been endorsed by the Director-General;

(b) be consistent with ISO 19011:2002 - Guidelines for Quality and/or Environmental Systems Auditing, or updated versions of this guideline;

(c) assess the environmental performance of the development, and its effects on the surrounding environment including surrounding protected areas;

(d) assess whether the development is complying with the relevant standards, performance measures, and statutory requirements;

(e) review the adequacy of the Applicant's Environmental Management Strategy and environmental management plans/protocols; and, if necessary,

(f) include visual inspections of the site and the adjacent environment including the Greater Blue Mountains WHA and the Wollangambe River and its tributaries, by relevant audit team members; and

(g) recommend measures or actions to improve the environmental performance of the development, and/or the environmental management and monitoring systems.

7. Within 3 months of commissioning the Independent Environmental Audit, the Applicant shall submit a copy of the audit report to the Director-General, with a response to the recommendations contained in the audit report.

8. Within 6 months of each Independent Environmental Audit, the Applicant shall review and if necessary revise each of the environmental management and monitoring plans/protocols/programs in schedule 3 and 5, to the satisfaction of the Director-General.

**Access to Information**

11. Within 1 month of the approval of any management plan/strategy or monitoring program required under this consent (or any subsequent revision of these management plans/strategies or monitoring programs), the completion of the independent audits required under this consent, or the completion of the AEMR, the Applicant shall:

(a) provide a copy of the relevant document/s to the Council, relevant agencies and the CCC;

(i) ensure that a copy of the relevant documents is made publicly available at the site; and

(j) put a copy of the relevant document/s on the Applicant's website;

- to the satisfaction of the Director-General.

#### 6.8.1.2 Prior to Development

**Schedule 3 – Specific Environmental Conditions**

**Flora and Fauna**

**Flora and Fauna Management Plan [This document]**

26. Prior to carrying out any development, the Applicant shall prepare and subsequently implement a Flora and Fauna Management Plan for the development, to the satisfaction of the Director-General, the DEC and the DEH. This plan must ... include:

(a) a Vegetation Clearing Protocol;

(b) a Compensatory Habitat Management Plan;

(c) a Pest and Weed Management Plan; and

(d) a Flora and Fauna Monitoring Program.

27. The Vegetation Clearing Protocol shall:

(a) delineate the areas of vegetation to be cleared; and

(b) describe the procedures that would be implemented for:

- pre-clearance surveys;
- progressive clearing;
- fauna management;
- conserving and reusing topsoil;
- collecting seed from the site;
- salvaging and reusing material from the site;
- managing waste vegetation; and
- controlling weeds.

28. The Compensatory Habitat Management Plan shall be prepared in consultation with the HNCMA, Council and applicable landowners, and shall:

(a) describe the compensatory vegetation proposal, including the requirements of condition 25 above;

(b) justify why the proposed areas are suitable for the compensatory vegetation proposal, including how the areas will integrate with existing habitat areas on and near the site, including the Greater Blue Mountains WHA;

(c) establish baseline data for the existing habitat in the proposed areas;

(d) describe how the compensatory vegetation proposal would be implemented;

(e) set assessment and completion criteria for the compensatory vegetation proposal;

(f) describe how the performance of the compensatory vegetation proposal would be monitored over time; and

(g) describe how conservation of the compensatory vegetation proposal would be secured over the long term.

30. The Flora and Fauna Monitoring Program shall include:

(a) detailed baseline data on the flora and fauna on the site and adjacent the site, including habitat present in the Greater Blue Mountains WHA and along the Wollangambe River and its tributaries;

(b) detailed flora and fauna impact assessment criteria;

(c) a program to monitor flora and fauna and habitat health on and adjacent the site, including within the Greater Blue Mountains WHA and along the Wollangambe River and its tributaries; and

(d) a protocol for the investigation, notification and mitigation of identified non-compliances with the flora and fauna impact assessment criteria. (This section.)

**Flora and Fauna**

**Compensatory Habitat**

25. The Applicant shall:

(a) implement the offset measures identified in the Supplementary Report (Document F – Newnes Plateau Conservation, Restoration and Enhancement Project), including:

- assistance in rehabilitation and conservation of Newnes Plateau Shrub Swampland, located north of Lithgow;
- assistance in rehabilitation and conservation of the Dargan's Creek Crown Lands, located to the south of the site;
- establishment and maintenance of a community nursery; and

(b) establish, conserve and maintain an additional area of at least 25 hectares of eucalypt vegetation habitat within proximity to the Greater Blue Mountains World Heritage Area, to the satisfaction of the Director-General.

### 6.8.2 Investigation

Compliance will need to be investigated by the quarry Environmental Officer and project ecologists.

Compliance will be required to be demonstrated in the Annual Environmental Monitoring Report.

### 6.8.3 Notification

Notification of non-compliances will be required in between submissions of Annual Environmental Monitoring Reports. Where any situations can be dealt with and it can be demonstrated that a permanent impact has not occurred, this can be outlined in the Annual Environmental Monitoring Report.

Where substantial temporary and / or significant non-compliance occurs this will need to be notified to the Department of Planning, the consent authority and measured enacted to remedy any such situation.

### 6.8.4 Mitigation

This is dependent on the relevant condition and the specific incident, however in general full mitigation will be required to remedy any situation such that the environment is returned to a pre-incident state.

# 7.0 Fulfilment of Objectives

The environmental objectives of the proposal are to firstly minimise the environmental impact caused by the proposal and secondly to ameliorate, reconstitute or replace that which has been affected. The overall detailed objectives for this project are shown in Table 2-2.

Each objective is raised individually below with an explanation of the methods of avoidance, amelioration or compensation for each objective and how it will satisfy requirements set by various government departments.

## 7.1 Objective 1

Objective 1 (see Section 2.3.1) outlines the need to ensure that "*environmental impacts are avoided using all cost effective measures available with offsets used only to address remaining impacts*".

Chapter 4 of the EIS details the project justification and alternatives.

In determining the design of this development Sydney Construction Materials (SCM) has engaged in significant investigation and planning to ensure that all cost-effective measures of reducing or eliminating environmental impacts were explored. For example:

- SCM will utilise state-of-the-art surface mining technology, eliminating potential exceedances of the NSW EPA Industrial Noise Policy, and minimising dust generation,
- All processing will occur off-site, eliminating the need for on-site settling ponds and eliminating the potential for spillage,
- Mining will occur in a staged manner, with progressive rehabilitation, lessening the total area disturbed at any one time, this will be enhanced due to the absence of on-site settling ponds and processing plant.
- Any water to be discharged will first be treated, eliminating any downstream water quality impacts.

The remaining impact that is unavoidable is the removal of vegetation over the extraction area. Therefore SCM has committed to the offset programs described elsewhere.

## 7.2 Objective 2

This objective (see Section 2.3.1) outlines the need for "*regulatory requirements to be met, and offsets to be consistent with government policy*."

Existing discussion and concept papers have been reviewed and in combination with existing industry practice have provided a benchmark upon which the offsets have been developed.

## 7.3 Objective 3

Objective 3 (see Section 2.3.1) outlines the need for green offsets to provide "*net environmental improvement, i.e. 'like for like' or better, in terms of quantity, quality and other factors*"

### 7.3.1 Quantity

The project will require the clearing of a total of 25 hectares, however the clearing will take place in a staged manner with rehabilitation closely following, therefore the total impact at any one time is considerably less.

The total area proposed for clearing is approximately 25 hectares while the total area of land identified for restoration under the NPSS and Dargan's Creek Crown Lands projects totals in excess of 869 hectares. The types of proposed works do not require long lead times and will demonstrate positive results in a short time.

In addition, land is to be purchased by SCM and granted to OEH for inclusion into Wollemi National Park, as agreed with DoP and OEH.

### 7.3.2 Quality

The offset areas provide larger areas of similar vegetation types and habitat potential. If managed these areas will provide larger areas of equal or better habitat than that currently present within the development area. A suite of threatened flora and fauna species have varying likelihoods (moderate, marginal and minimal) of occurring within the site based on the habitats present. No threatened species, populations or ecological communities were recorded within the proposed development site by numerous surveys undertaken by several ecological researchers.

The management and enhancement of the offset areas will provide similar or better potential for the abovementioned threatened species (as well as non-threatened species), populations and ecological communities within a much larger area within the locality with a view to preserving this habitat by including it in Crown Lands Reserve.

Water quality has been of high importance within the project. The drainage line which crosses the proposed extraction area will be re-routed to the south and then back into its original course. This will ensure the same flow rates and quality downstream. In addition any water within the extraction area will be treated before discharge into the drainage line. This will ensure the best quality water for the drainage line, the vegetation and habitats downstream and particularly within the Greater Blue Mountains World Heritage Area and in the Blue Mountains National Park.

With respect to the NPSS EEC there is no vegetation within the development site that corresponds to NPSS. However there is some swampy vegetation in the south-eastern part of the site that will be retained (HWR 2004).

The enhancement an continued management of the Dargans Creek Reserve will also have beneficial effects downstream where there are several other reserves including Hyde Park that are known to contain threatened species such as *Asterolasia buxifolia* and *Grevillea rosmarinifolia* subsp. *rosmarinifolia*.

No flora or fauna of conservation significance were detected on the proposed development site. The proposed offset sites contain in excess of 10 flora species that are listed within the TSC Act (1995) the EPBC Act (1999) or as a ROTAP species. In addition there are plant communities within the offset areas such as NPSS that will benefit from rehabilitation works carried out under this plan. The NPSS vegetation provides habitat for the threatened Newnes Plateau Swamp Skink. Investigations have identified that some areas within the proposed offsets are of much higher environmental value that the proposed development site.

The proposed Wollemi National Park additional land is considered likely to be in good condition and of high quality, given its isolation.

## 7.4 Objective 4

Objective 4 (see Section 2.3.1) outlines the need for green offsets to ensure that there are *"no permanent environmental costs due to time lag in establishing the offsets."*

The restoration of the offset areas will provide immediate benefits. The remediation of the offset areas, made possible by the removal of weeds and illegal or duplicated tracks, will provide further habitat in the medium to

long term. Given that the proposed extraction will be associated with equally progressive rehabilitation, the offsets will secure habitat well in excess of that removed throughout the life of the mine.

In addition to the other offset measures, additional land is to be granted to Wollemi National Park, providing immediate offsets for the project.

## 7.5 Objective 5

Objective 5 (see Section 2.3.1) outlines the need for green offsets *"to last the term of the impact".* The Newnes Plateau Conservation, Restoration and Enhancement Project produced for SCM proposes to provide offset areas in perpetuity. SCM will continue to fund this project throughout the life of the project and subsequent to that to investigate the feasibility of reverting the lands back to Crown Land Reserve status.

The community plant nursery established for this project will provide plant stock for the rehabilitation works within the development site, to do so requires the nursery to operate at least until the end of the mine life, shutdown and rehabilitation. This nursery could also provide plant stock for rehabilitation works in the offset and other degraded areas in the locality.

The Wollemi addition will be permanent and add to conservation outcomes in the region.

## 7.6 Objective 6

Objective 6 (see Section 2.3.1) outlines the need for "*impacts and benefits to be readily identifiable and quantifiable*."

The key impact addressed by this offset strategy is the loss of approximately 25 hectares of native vegetation. The quantity and quality of this vegetation has been readily obtained and the offsets will similarly be quantifiable with respect to size and quality.

## 7.7 Objective 7

Objective 7 (see Section 2.3.1) outlines the need for "*offsets to be located appropriately, offsetting the impact in the same area*".

This requirement is for the offsets to be located in the same locality as the impact. As all offset projects occur within a few kilometers of the proposed impact, the proposed offsets satisfy this objective. While the Wollemi National Park addition occurs further away it provides an excellent regional outcome for native habitat, still in the region.

## 7.8 Objective 8

Objective 8 (see Section 2.3.1) outlines the need for "*offset areas to be supplementary beyond existing requirements, i.e. they must be in addition to existing offset areas*".

SCM recognises that mine rehabilitation is required by the Mining Act (1992) and as such any rehabilitation within the extraction area is not covered by this objective.

As the proposed development is new (i.e. not an application for an extension) there are currently no related offsets for this proposal in the region. Consequently any offsets established for this development will be new, designed solely for the purpose of satisfying this developments requirements.

The Wollemi lands are in addition to existing offset areas.

## 7.9 Objective 9

Objective 9 (see Section 2.3.1) outlines the need to *"minimise risks and threats:*

- *Enforceable and legally secure*
- *threats from future development and land use conflicts*
- *adequate resources for management and monitoring, including best practice, adaptive management, open and accountable administration such as advisory panel and public annual report."*

It is proposed to provide protection for each offset area through re-classification for environmental purposes. Threats from future development and land use have been considered in the selection of offset areas. Based on current knowledge there are no economical sand resources located beneath any of the proposed land restoration areas.

The enhancement of habitat within the offset areas is consistent with surrounding land uses, being primarily coal mining, sand quarrying, residential, forestry and environmental conservation.

SCM will invest up front establishment funds as well as ongoing management funds to ensure adequate resources for management and monitoring is available. It is anticipated that the Hawkesbury-Nepean Catchment Management Authority (HNCMA) will be the scheme manager, holding and disbursing the funds and using its standard reporting process to report to SCM, Government departments and other stakeholders in a public annual report.

The additional Wollemi National Park land is isolated and unlikely to be subject to risk or threats.

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# Appendix 1

## Vegetation Monitoring Plot Results

| Family/Class Name | Species Scientific Name | Species Common Name | Plot Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Class LYCOPSIDA | Clubmosses and Quillwarts | | | | | | | | | | | |
| GLEICHENIACEAE | *Gleichenia dicarpa* | Pouched Coral-fern | | | x | | x | | | | | |
| | *Pteridium esculentum* | Bracken | x | x | x | | | x | | x | x | x |
| LINDSAEACEAE | *Lindsaea linearis* | Screw Fern | | | | | | | | | | |
| SCHIZAEACEAE | *Schizaea bifida* s. str. | Forked-comb fern | x | | | | | | | | | |
| BLECHNACEAE | *Blechnum cartilagineum* | Gristle Fern | | | | | x | x | | | | |
| | *Blechnum nudum* | Fishbone Water-fern | x | | | | | | | | | |
| OSMUNDACEAE | *Todea barbara* | King Fern | | | x | | | | | | | |
| Class MAGNOLIDAE | Flowering Plants | | | | | | | | | | | |
| RANUNCULACEAE | *Clematis aristata* | Toothed Clematis | | | | | | x | | | | |
| RHAMNACEAE | *Pomaderris andromedifolia* | - | x | | x | x | | | | | | |
| EUPHORBIACEAE | *Amperea xiphoclada* | Broom Spurge | | x | | | x | x | x | | x | x |
| VIOLACEAE | *Viola hederacea* | Ivy-leaf Violet | x | x | | | | | | | | |
| | *Viola sieberiana* | | x | x | x | | x | | | | | |
| CASUARINACEAE | *Allocasuarina littoralis* | Black She-oak | | x | | | | | | | | |
| CUNONIACEAE | *Callicoma serratifolia* | Black Wattle | | x | x | | | | | | | |
| | *Bauera rubioides* | River Rose | | | | | | x | x | | | |
| MALACEAE | *Cotoneaster glaucophyllus* | Cotoneaster | | | | | | | | | | |
| PROTEACEAE | *Banksia marginata* | Silver Banksia | | | | | x | | | | | |
| | *Banksia serrata* | Saw Banksia | | x | | | | | x | x | | |
| | *Banksia spinulosa var. spinulosa* | Hairpin Banksia | x | x | | x | x | x | x | x | x | x |
| | *Grevillea laurifolia* | Laurel Grevillea | | | | x | | | x | | | x |
| | *Hakea dactyloides* | | | | | | x | | x | | | |
| | *Hakea laevipes ssp. laevipes* | - | | | | x | | | | | | |
| | *Hakea sericea* | | | | | | x | | | | | |
| | *Isopogon prostratus* | Prostrate Drumstick | | | x | | | | | | | |
| | *Isopogon anemonifolius* | Broad-leaf Drumsticks | x | x | | x | | | x | x | | |
| | *Lomatia silaifolia* | Crinkle Bush | | | | x | x | x | x | x | | x |
| | *Persoonia lanceolata* | Lance Leaf Geebung | | | x | | | x | x | | x | x |
| | *Persoonia laurina subsp. laurina* | Laurel-leaf Geebung | x | | | | | | | | | |
| | *Persoonia levis* | Broad-leaf Geebung | | x | x | x | | x | x | x | | x |
| | *Persoonia myrtilloides* | Myrtle Geebung | | | | | | | | | | |
| | *Petrophile canescens* | Conesticks | | | | x | | | x | | x | x |
| | *Petrophile pulchella* | Conesticks | | | | | | | | | | |
| | *Petrophile sessilis* | Conesticks | | | | | x | x | | | | x |
| | *Telopea speciosissima* | Waratah | | x | x | x | | x | x | x | x | x |
| MYRTACEAE | *Eucalyptus blaxlandii* | Blaxland's Stringybark | | | x | | | x | | | x | |
| | *Eucalyptus laophila* | - | | | | | | | | | | |
| | *Eucalyptus mannifera* | Brittle Gum | x | | | | | | | | | |
| | *Eucalyptus piperita* | Sydney Peppermint | x | x | | | | x | | x | | |
| | *Eucalyptus radiata ssp. radiata* | Narrow-leaved Peppermint | | | | | | x | x | | | |

| Family/Class Name | Species Scientific Name | Species Common | Plot Number | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Eucalyptus sclerophylla* | Hard-leaved Scribbly Gum | | | | x | | | | | |
| | *Eucalyptus sieberi* | Silvertop Ash | | x | | x | | | x | | x | x |
| | *Eucalyptus sparsifolia* | Narrow-leaved Stringybark | | | | | | | x | | | |
| | *Baeckea linifolia* | Swamp Baeckea | x | | | | | | | | | |
| | *Leptospermum myrtifolium* | Swamp Tea-tree | | | | | | | | | x | |
| | *Leptospermum arachnoides* | Spider Teatree | x | | | | | | | | | |
| | *Leptospermum emarginatum* | Twin-flower Tea-tree | x | | | | | | | | | |
| | *Leptospermum grandifolium* | Wooly Tea-tree | x | | | | | | | | | |
| | *Leptospermum polygalifolium* | Yellow Tea-tree | x | | | | x | | | | | |
| | *Leptospermum sphaerocarpum* | Round-fruited Tea-tree | | | | x | | | x | x | | |
| | *Leptospermum trinervium* (narrow leaf form) | Flaky-bark Tea-tree | | | x | | | | | | | |
| RUTACEAE | *Boronia anemonifolia* | | | | | | | | | x | | |
| | *Boronia microphylla* | Small-leaved Boronia | | | x | | x | x | x | | x | x |
| FABACEAE | *Bossiaea heterophylla* | Variable Bossiaea | | | | | | | | | | |
| | *Daviesia latifolia* | Broad-leaf Bitter Pea | | | | | x | | | | x | x |
| | *Gompholobium latifolium* | Broad-leaf Wedge-pea | | | | | x | x | | | | |
| | *Pultenaea scabra* | Rough Bush-pea | | | x | | | | x | | | |
| | *Platylobium formosum* | | | | | x | | | | | | |
| | *Dillwynia floribunda* | | | | | x | | | | | | |
| MIMOSOIDEAE | *Acacia longifolia* | Sydney Golden Wattle | x | x | x | x | x | x | | x | | |
| | *Acacia obtusifolia* | - | | | | | | | | | | |
| | *Acacia terminalis* | Sunshine Wattle | x | x | x | x | x | | | x | x | x |
| | *Acacia ulicifolia* | Prickly Moses | | | | x | x | | x | | | |
| SANTALACEAE | *Leptomeria acida* | Native Currant | | | x | | | | x | x | | |
| PITTOSPORACEAE | *Billardiera scandens* | Apple-berry | x | | | | x | x | | | | x |
| ARALIACEAE | *Polyscias sambucifolia* | Elderberry Panax | | | | | | x | | | | |
| | *Astrotricha latifolia* | | | | | | x | | | | | |
| | *Astrotricha longifolia* | | | | | | | x | | | | |
| APIACEAE | *Platysace lanceolata* | Native Parsnip | | | x | | | | | | | |
| | *Platysace linearifolia* | Narrow-leaf Platysace | | | | | x | | x | x | x | |
| | *Xanthosia pilosa* | Hairy Xanthosia | | | | | | x | | x | | |
| ASTERACEAE | *Arrhenechthites mixtus* | Purple Fireweed | | | x | | | | | | x | |
| | *Ozothamnus ferrugineus* | Tree Everlasting | | x | x | | | | | x | | |
| EPACRIDACEAE | *Epacris microphylla* | Small-leaf Heath | x | | x | | | | | | | |
| | *Epacris pulchella* | Coral Heath | x | x | x | | x | x | | x | x | x |
| | *Epacris purpurascens var onosmiflora* | Port Jackson Heath | | | | | x | | | | | |
| | *Leucopogon lanceolatus* | Lance-leaf Beard-heath | | | x | | | | | | x | |
| | *Monotoca scoparia* | Prickly Broom-heath | | | | | | x | x | | x | x |
| RUBIACEAE | *Pomax umbellata* | Pomax | | x | x | x | | x | | x | | |
| SCROPHULARIACEAE | *Veronica plebeia* | - | | | | | | | | | x | |

| Family/Class Name | Species Scientific Name | Species Common | Plot Number | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ERICACEAE | *Dracophyllum secundum* | | | | x | | | | | | |
| | *Lissanthe strigosa* | Peach Heath | | | x | | | | x | | x |
| STYLIDIACEAE | *Stylidium graminifolium* | Grass Trigger-plant | | | x | | x | x | x | | |
| PODOCARPACEAE | *Podocarpus spinulosis* | Spiny-leaf Podocarp | | | | | x | | | | |
| LOBELIACEAE | *Lobelia anceps* | | | | | | | | x | | x |
| Subclass LILIDAE | Monocotyledons | | | | | | | | | | |
| LOMANDRACEAE | *Lomandra glauca subsp. glauca* | Glaucous Mat-rush | | x | x | | | x | x | x | x | x |
| | *Lomandra longifolia subsp. longifolia* | Spiny Mat-rush | x | x | x | | x | x | | x | x | x |
| XANTHORRHOEACEAE | *Xanthorrhoea media* | Sydney Grass-tree | | | | | | | x | | |
| PHORMIACEAE | *Dianella caerulea var. caerulea* | Rough Flax Lily | | | | | | | | x | |
| | *Dianella prunina* | - | | | | | x | x | | | |
| IRIDACEAE | *Patersonia sericea* | Silky Purple-flag | | | | | x | | | x | x |
| | *Patersonia fragilis* | Glabrous Purple-flag | | | | | | | | | |
| | *Patersonia glabrata* | Cauline-leaf Purple-flag | | | | x | x | x | x | x | x |
| XYRIDACEAE | *Xyris gracilis subsp. gracilis* | Slender Yellow-eye | x | | | | | | | | |
| CYPERACEAE | *Caustis flexuosa* | Curved Caustis | | | | x | x | | x | x | | |
| | *Gahnia sieberiana* | Red-fruited Saw-sedge | x | x | | | x | x | | | | |
| | *Lepidosperma laterale* | Variable Sword-sedge | | x | | | | | | | | |
| RESTIONACEAE | *Empodisma minus* | Spreading Rope-rush | x | | | | | | | | |
| | *Lepyrodia scariosa* | Chaffy Scale-rush | | | | | | | | | x |
| POACEAE | *Austrostipa bigeniculata* | | | | | | x | | | | |
| | *Entolasia stricta* | Wiry Panic | | | | | x | | | | |
| | *Microlaena stipoides var. stipoides* | Weeping Grass | | | | | x | | | x | x |
| | *Poa labillardieri* | Tussock Grass | | | | | | | | x | x |
| | *Poa sieberiana* | - | | | | | x | | | x | |

# Appendix 2

## Government Department Confirmation Letters

Catchment Management Authority
Hawkesbury-Nepean

NSW GOVERNMENT

Tony Proust,
Senior Environmental Planner,
RPS,
PO Box 428,
Hamilton NSW 2303.

12 December 2011

Contact: Bill Dixon
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E: bill.dixon@cma.nsw.gov.au

**Subject: Newnes Plateau Conservation, Restoration and Enhancement Project**

Dear Mr Proust

The HNCMA is prepared to act as the Scheme Manager to deliver the Off-site Offsets as listed in the Conditions of Consent as set out in DA 329-7-2003 for the proposed Sand and Kaolin Mine on the Newnes Plateau.

I recognise that the Scheme Manager will oversee offset measures identified in the Supplementary Report (Newnes Plateau Conservation, Restoration and Enhancement Project), including:

- assistance in rehabilitation and conservation of Newnes Plateau Shrub Swamp, located north of Lithgow;
- assistance in rehabilitation and conservation of the Dargans Creek Crown Lands, located to the south of the site; and
- establishment and maintenance of a community nursery.

The HNCMA accepts this role on the understanding that the Sydney Construction Materials, the mine operator will provide the following funding to enable the offsets:

- $50,000 in the first year of operation of the mine; and
- $30,000 p.a. thereafter, indexed for CPI for the life of the mine.

I look forward to further advice on the timelines for the development and the next steps in how the HNCMA takes up this role.

Yours sincerely,

B J Bugden

Bernie Bugden
General Manager
Hawkesbury-Nepean CMA.

NSW GOVERNMENT | Office of Environment & Heritage

Our reference:
DOC11/53524;
LIC11/63-02

RECEIVED
25 NOV 2011
BY:

Mr Tony Proust
Senior Environmental Planner
RPS
PO Box 428
HAMILTON NSW 2303

22 November 2011

Dear Mr Proust

**Re: DA 329-7-2003, Newnes Kaolin and Sand Mine**

I refer to the above development application and your proposal to purchase and transfer Lot 1, DP753824, Parish Wirriba, County Hunter, Lithgow LGA in order to meet requirements for Compensatory Habitat.

Please note that the regulatory responsibilities of the Office of Environment and Heritage (OEH) are now carried out by the Environment Protection Authority (EPA).

Lot 1 or Mount Wirriba covers 24.28 hectares (ha) of undisturbed eucalypt vegetation habitat similar to vegetation occurring in the vicinity of the Newnes development proposal. The land is an isolated inholding surrounded by Wollemi National Park, the Greater Blue Mountains World Heritage Area (GBMWHA) and the legally gazetted Wollemi Wilderness Area.

OEH wishes to confirm that this block of land would be acceptable to meet DA 329-7-2003 requirements for Compensatory Habitat under Condition 25. OEH also wishes to confirm that at a later date negotiations about establishment costs associated with the transfer can take place, should the block of land be transferred to the Wollemi National Park, subject to the approval of the Minister for the Environment.

Given the proposal to add the block to Wollemi National Park and integrate its management into the reserve and the GBWHA, the requirement for preparation of a Compensatory Habitat Management Plan under condition 28 could be considered to be covered by the Plan of Management for Wollemi NP.

OEH looks forward to progressing the transfer. If you have any further enquires, please contact David Crust at the Parks and Wildlife Group's Mudgee Office on 0263 70 9000.

Yours sincerely

**RICHARD WHYTE**
**Manager Bathurst**
**Environment Protection Authority**

PO Box 1388 Bathurst NSW 2795
Level 2, 203 – 209 Russell Street Bathurst NSW 2795
Tel: (02) 63 327 600 Fax: (02) 63 327 630
ABN 30 841 387 271
www.environment.nsw.gov.au

# Appendix 3

## Example Monitoring Data Sheets

# Diurnal Avifauna Record Sheet

Job Name:_____ Project Number: _____

Date: _____ Time Start: _____ Time Finish: _____

Rain: 0 1 2 3 4 Cloud: 0 1/8 ¼ 3/8 ½ 5/8 ¾ 7/8 1 Wind: 0 1/8 ¼ 3/8 ½ 5/8 ¾ 7/8 1

Wind Direction: N NE E SE S SW W NW

Approx. Temp: _____ Site/Transect Name: _____

GPS Track Name: _____ GPS Datum: GDA94 other:

| | Species | O/H | No. | Remarks |
|---|---|---|---|---|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |
| 4. | | | | |
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| 24. | | | | |
| 25. | | | | |
| 26. | | | | |
| 27. | | | | |

O = Observed, H = Heard

No. = Number of threatened or migratory species.

RPS

# Fauna Habitat Assessment Record Sheet (page 1 of 2)

| | | | | | |
|---|---|---|---|---|---|
| Site | | Job Name | | Job Number | |
| GPS plot ID | | Date | | Recorder | |
| Eastings | | Northings | | Location format | UTM |
| Photo numbers (4) | N E S W | | | GPS datum | WGS84 |
| Quadrat type | 10 metre radius | 10 by 10 metre quadrat | 20 by 20 metre quadrat | area assessment | |
| Topographic position | gully/drainage line | lower slope | mid-slope | upper slope | ridge | cliff line | no clear topographic position |
| Slope | | 0-5 6-10 11-20 21-30 30+ | Aspect | Nil N NE E SE S SW W NW | |
| Fire | nil slight minor moderate severe extreme | No. cut stumps | Nil | none rare few moderate common abundant | |
| Grazing | nil slight minor moderate severe extreme | Grazing by | sheep cattle goats kangaroos rabbits wombats horses | | |
| Erosion | nil slight minor moderate severe extreme | Erosion type | N/A sheet rill/gully pedestal | | |
| Dumping | nil slight minor moderate severe extreme | Water within 100m | nil creek river farm dam drains spring puddles | | |
| Weeds | nil slight minor moderate severe extreme | Dominant species | n/a | | |

| | Count | Relative abundance | Condition (types present) |
|---|---|---|---|
| Logs <100mm | Nil | none scarce few moderate common abundant | solid + bark solid no bark hollow rotten |
| Logs 100-300 | Nil | none scarce few moderate common abundant | solid + bark solid no bark hollow rotten |
| Logs >300mm | Nil | none scarce few moderate common abundant | solid + bark solid no bark hollow rotten |
| Natural Stumps | Nil | none scarce few moderate common abundant | solid + bark solid no bark hollow rotten |
| Stags | Nil | none scarce few moderate common abundant | solid + bark solid no bark hollow rotten |

| | | | |
|---|---|---|---|
| Soil | 0 1-5 6-25 26-50 51-75 76-95 96-100 | Rock (50-500mm) | 0 1-5 6-25 26-50 51-75 76-95 96-100 |
| Lichen | 0 1-5 6-25 26-50 51-75 76-95 96-100 | Boulder/solid rock | 0 1-5 6-25 26-50 51-75 76-95 96-100 |
| Litter | 0 1-5 6-25 26-50 51-75 76-95 96-100 | Rock on rock | none scarce few moderate common abundant |
| Herbs/forbs | 0 1-5 6-25 26-50 51-75 76-95 96-100 | Overhangs/caves | none scarce few moderate common abundant |
| Grasses | 0 1-5 6-25 26-50 51-75 76-95 96-100 | Grassland condition | native predominately native mixed predominately introduced introduced |
| Grassland height | | Grassland Species Diversity | poor low moderate high very high |
| Dieback | none scarce few moderate common abundant | Mistletoe | none scarce few moderate common abundant |
| Scratches on smooth tree trunks | large deep large shallow medium deep medium shallow small shallow many some few | | |
| Litter – tree base | None scarce few moderate common abundant | Loose tree bark | none scarce few moderate common abundant |
| Terrestrial termite mounds | None scarce few moderate common abundant | Arboreal termite mounds | None scarce few moderate common abundant |

| DBH range | Age class | Percentage cover | Count | Height range | Hollows? |
|---|---|---|---|---|---|
| N/A | Shrub layer | 0 1-5 6-25 26-50 51-75 76-95 96-100 | Sp. | | ---------- |
| < 100mm | Sapling | 0 1-5 6-25 26-50 51-75 76-95 96-100 | Ind. | | ---------- |
| 100 - 200 mm | Regenerating | 0 1-5 6-25 26-50 51-75 76-95 96-100 | Ind. | | Y N |
| 200 - 400 mm | Middle aged | 0 1-5 6-25 26-50 51-75 76-95 96-100 | Ind. | | Y N |
| 400 – 600 mm | Mature | 0 1-5 6-25 26-50 51-75 76-95 96-100 | Ind. | | Y N |
| 600+ | Old Growth | 0 1-5 6-25 26-50 51-75 76-95 96-100 | Ind. | | Y N |

| | | | |
|---|---|---|---|
| Shrub species | | | |
| Shrub layer species diversity | poor low moderate high very high | Shrub layer structural diversity | poor low moderate high very high |
| Canopy species | | | |
| Canopy layer species diversity | poor low moderate high very high | Canopy layer structural diversity | poor low moderate high very high |
| Patch health | pristine very good good average poor degraded completely degraded (almost without native) | | |
| Structure | closed forest (>70%) open forest (30-70%) woodland (10-30%) open woodland (<10%) shrubland grassland forbland wetland | | |
| Patch Size | <1ha 1-5ha 5-20ha 20-50ha 50-250ha >250ha | Patch Shape | square/circular semi-irregular very irregular linear |
| Linear Type | none watercourse road rail windbreak fence stock route | Width if linear | <35m 35-75m 75-150m 150-300m >300m |
| Connectivity | isolated semi-isolated not isolated continuous | | |
| Geology | alluvial clay sand coarse sedimentary fine sedimentary ignesous (coarse) volcanic (fine) limestone | | |
| Soil Colour | whitish yellow orange brown red black grey pale dark mottled | texture | clay silt loam sand gravel saline mud |

PTO

| Hollow size class | Number | Relative abundance |
|---|---|---|
| Tiny <25mm | | none scarce few moderate common abundant |
| Small 25-50mm | | none scarce few moderate common abundant |
| Medium 50-100mm | | none scarce few moderate common abundant |
| Large 100-300mm | | none scarce few moderate common abundant |
| Extra large 300+ | | none scarce few moderate common abundant |
| No. habitat trees | nil | Hollow Status: mostly dead mostly alive mixture |

| Canopy description | grassland woodland forest regeneration open closed tall short rainforest dry wet scattered trees disturbed |
|---|---|
| Understorey description | open scattered moderate dense tall short prickly vines weedy shrubless open ground cover |

| Tree species | Count or % | Tree species | Count or % | Tree species | Count or % |
|---|---|---|---|---|---|
| *Eucalyptus tereticornis* | 0 | *Eucalyptus signata* | 0 | *Allocasuarina dimunuta* | 0 |
| *Eucalyptus microcorys* | 0 | *Eucalyptus albens* | 0 | *Allocasuarina gymnanthera* | 0 |
| *Eucalyptus punctata* | 0 | *Eucalyptus populnea* | 0 | *Allocasuarina littoralis* | 0 |
| *Eucalyptus viminalis* | 0 | *Eucalyptus robusta* | 0 | *Allocasuarina luehmannii* | 0 |
| *Eucalyptus haemastoma* | 0 | *Casuarina glauca* | 0 | *Allocasuarina verticillata* | 0 |
| *Eucalyptus camaldulensis* | 0 | *Casuarina cunninghamiana* | 0 | *Casuarina* spp. | 0 |
| | | | | *Allocasuarina* spp. | 0 |

**Optional** (If a measure of hollow density is required and there are too many trees to sample them all)

| Tree Hollow Density (when required) – ten 20 × 20 metre quadrats 50 metres apart | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Quadrat number | Tiny <25mm | Small 26-50 mm | Medium 51-100 mm | Large 101-200 mm | Very large 200-400 mm | Massive >400 mm | Number of trees with hollows | Total number. of trees | Number of SEPP 44 trees |
| 1 | | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |

**Optional** (If a koala scat assessment is required in this habitat type)

| Koala Scat Searches (when required) – Minimum of ten trees – One metre radius around trunk | | | | | | | |
|---|---|---|---|---|---|---|---|
| Tree Id | Tree species | No. of Scats | Species | Tree Id | Tree species | No. of Scats | Species |
| | | 0 | | | | 0 | |
| | | 0 | | | | 0 | |
| | | 0 | | | | 0 | |
| | | 0 | | | | 0 | |
| | | 0 | | | | 0 | |
| | | 0 | | | | 0 | |
| | | 0 | | | | 0 | |
| | | 0 | | | | 0 | |
| | | 0 | | | | 0 | |
| | | 0 | | | | 0 | |

Notes:

# Flora Quadrat

**Job:** _____

**Location:** _____

**Date:** _____ **Quadrat No:** _____

**Details**

| ***Size of Quadrat:*** | ***Vegetation Community:*** | ***Co-ordinates (MGA /GDA)*** |
|---|---|---|
| 20m x 20m / 10m x 40 m | | **Easting:** <br> **Northing:** |

**Physical Attributes**

| ***Topographic Position:*** | ***Elevation:*** | ***Slope:*** |
|---|---|---|
| ***Aspect:*** | ***Soil Type: (eg. clay, sand, loam)*** | ***Other attributes of influence:*** |
| ***Photo Numbers:*** | | |

***Structural Components***

| ***Structural Layers*** | ***Height*** | ***Foliage Cover*** **(10% units)** | ***Dominant Species*** |
|---|---|---|---|
| Tree / Canopy Layer | | | |
| Emergents | | | |
| Sub-canopy Layer | | | |
| Tall Shrub / Small Tree Layer | | | |
| Shrub Layer | | | |
| Ground Cover | | | |
| Other | | | |

**SEPP 14 Tree Species Assessment**

| ***Tree Species*** | ***%*** | ***Tree Species*** | ***%*** | ***Tree Species*** | ***%*** |
|---|---|---|---|---|---|
| *Eucalyptus tereticornis* | | *Eucalyptus signata* | | *Allocasuarina dimunuta* | |
| *Eucalyptus microcorys* | | *Eucalyptus albens* | | *Allocasuarina gymnanthera* | |
| *Eucalyptus punctata* | | *Eucalyptus populnea* | | *Allocasuarina littoralis* | |
| *Eucalyptus viminalis* | | *Eucalyptus robusta* | | *Allocasuarina luehmannii* | |
| *Eucalyptus haemastoma* | | *Casuarina glauca* | | *Allocasuarina verticillata* | |
| *Eucalyptus camaldulensis* | | *Casuarina cunninghamiana* | | *Casuarina* spp. | |
| **% = percentage of canopy cover** | | | | *Allocasuarina* spp. | |

***Comments***

_____

_____

_____

Quadrat No: _____

| Scientific Name | Common Name | Cover Abundance<br>**1** = <5% few individuals<br>**2** = <5% many individuals<br>**3** = 5-25% cover<br>**4** = 25-50% cover<br>**5** = 50-75% cover<br>**6** = 75-100% cover |
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