Annual Environmental Management Report

2012

(SMALL MINE VERSION)

Enhance Place Mine

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1 INTRODUCTION AND GENERAL OBJECTIES

1.1 BACKGROUND DEVELOPMENT

Enhance Place Pty Ltd (Enhance Place) was established in 1997 to recover remnant coal from areas previously open cut mined in the1950's. A principle objective of Enhance Place was to provide the means to improve the appearance and general amenity of the land through the rehabilitation of land previously impacted by mining.

Enhance Place operated the Enhance Place Open Cut Coal Mine (Enhance Place Mine) from 1997 until its closure in June 2005 following the extraction of all economically feasible coal reserves. The Enhance Place Mine is located in the Western Coalfields of NSW at Blackmans Flat, 15km north of Lithgow on the southern side of the Castlereagh Highway. The site is approximately 3km south-west of Mount Piper Power Station and adjacent to the Springvale Coal Handling Facility.

The Enhance Place Mine extracted coal over the abandoned Eastern Main Underground Mine workings (Eastern Main Mine). The Eastern Main Mine operated as a Bord and Pillar mine until 1975. Mining activities were undertaken by six employees, being augmented for short periods by secondment of maintenance, operating or rehabilitation personnel from other areas of the contractor's operations as required.

Open cut operations ceased in June 2005 when economically feasible coal reserves were exhausted. The area of surface disturbance was estimated at 30 Hectares (ha) at the cessation of mining. Since then surface water control, rehabilitation of land-form with seeding and fertilisation, feral animal and weed control programmes have been instituted. Final rehabilitation is complete along with the fencing of the various public and private land portions.

1.2 MINE PRODUCTION, PRODUCT AND MARKET

All the crushed and screened product coal, - 50 mm, was sold direct to the nearby Wallerawang and Mount Piper Power Stations, owned by Delta Electricity. Details of production history are detailed in **Table 1**.

Table 1
Production History

Year	Production Total (Tonnes)
1998	73,632
1999	86,007
2000	77,804
2001	77,579
2002	77,109
2003	101,851
2004	89,000
2005	27,228
Total	**609,940**

The mine ceased production at the end of June 2005 when all coal reserves had been extracted.

2 TITLE DETAILS

Name of Mine	Enhance Place Mine		
Mining Titles/Leases	ML 1422	**Expiry Date**	03/12/2018
Mining Titles/Leases	ML 1458	**Expiry Date**	29/11/2020
Mining Titles/Leases	ML 1520	**Expiry Date**	29/08/2023
Name of Leaseholder	Enhance Place Pty Ltd		
Name of Mine Operator	As above		
Postal Address	Enhance Place Pty Ltd		
	PO Box 202		
	Wallerawang, N.S.W, 2845		
Telephone	(02) 6355 7893		
Fax	(02) 6355 7894		
Email	tatami@bigpond.net.au		

2.1 LAND OWNERSHIP AND LAND USE BOUNDARIES

Land ownership of the Enhance Place Mine consists of private freehold and crown land. The current status of land ownership, tenure and pre-mining land use at the Enhance Place Mine is summarised in **Table 2**.

Table 2
Land Ownership

Land Owner/Occupier	Tenure (freehold leasehold)	Pre-mining land use
Mrs M. E. Brown	Freehold	Grazing
Mr & Mrs J. Cherry	Freehold	Grazing
Mrs J. Cope	Freehold	Grazing
D & J Hunt	Freehold	Grazing
Glen Davis Recreation Trust (Crown)	-	Grazing
Wallerawang Collieries	Freehold	Grazing

2.2 CONSENTS AND LICENCES

Local Council Area: Lithgow City Council Development Consent 36/99

Development Consent: granted [√] required but not granted [ ] not required [ ]

Do licences granted by other agencies apply to the mine activities? Yes [√] No [ ]

EPA [√] - EPL No.6312 surrendered 28/09/2005 after cessation of mining
NPWS [N/A]
Dam Safety [N/A]
Other [N/A]

2.3 MOP AND AEMR PERIOD

MOP Commencement Date	11 October 2002	**Completion Date**	May 2013
AEMR Start Date	1 January 2012	**End Date**	31 December 2012

2.4 SIGNATURES

Manager of Mine Engineering

Signature

Name Graham Goodwin

Date 16-5-13

3 MINING OPERATIONS DURING THE REPORTING PERIOD

There were no mining activities undertaken during the reporting period as mining ceased on 29 June 2005.

Table 3
Production and Waste Summary

	Production and Waste (cubic metres)		
	Start of Reporting Period	**At end of Reporting Period**	**End of next reporting(estimated)**
Topsoil stripped	nil	nil	nil
Topsoil used/spread	nil	nil	nil
Waste Rock	nil	nil	nil
Ore	nil	nil	nil
Processing Waste	nil	nil	nil
Product	nil	nil	nil

4 REHABILIATION DURING THE REPORTING PERIOD

A summary of the disturbed and rehabilitated areas at the Enhance Place Mine is summarised in **Table 4**.

Table 4
Rehabilitation Summary

		Cumulative Area Affected (hectares)		
		To Date	**Last Report**	**Next Report (estimated)**
A: MINE LEASE AREA				
A1	**Mine Lease(s) area**	35	35	35
B: DISTURBED AREAS				
B1	**Infrastructure Area**	nil	nil	nil
B2	**Active Mining Area**	nil	nil	nil
B3	**Waste Emplacements**	nil	nil	nil
B4	**Tailings Emplacements**	n/a	n/a	n/a
B5	**Shaped Waste Emplacement**	nil	nil	nil
ALL DISTURBED AREAS		**nil**	**nil**	**nil**
C: REHABILITATION PROGRESS				
C1	**Total Rehabilitated Area**	26	26	26
D: REHABILITATION ON SLOPES				
D1	**10 to 18 Degrees**	6	6	6
D2	**Greater than 18 Degrees**	0.5	0.5	0.5
E: SURFACE OF REHABILITATED LAND				
E1	**Pasture and Grasses**	20	20	20
E2	**Native Forest / Eucalypt**	6	6	6
E3	**Plantations and Crops**	nil	nil	nil
E4	**Other**	nil	nil	nil

Details of pasture and grass species used for rehabilitation, the seeding rates and the fertiliser are summarised in **Table 5**.

Table 5
Species and Seeding Rate

Cool Season		
Species	**Rate (kg/ha)**	**Fertiliser**
Cereal Rye Grass	20	Starter 15 or Grower 11 (or equivalent) 400kg/ha
Perennial Rye Grass	10	
Highlands Bent	10	
Phalaris (Sirosa)	5	
Seaton Park Sub-clover	6	
Red Clover	6	
Currie Coxsfoot	6	
Warm Season		
Japanese Millet	20	Starter 15 Or Grower 11 (or equivalent) 400kg/ha
NZ Rye	10	
Rhodes Grass	10	
White Clover (Haifa)	4	
Note: Legumes were inoculated with their appropriate rhizobia immediately prior to sowing		

Ongoing rehabilitation maintenance works were conducted during the reporting period which involved erosion control, grazing, slashing and weed spraying (see **Table 6**). As mining had stopped in June 2005 and all rehabilitation activities have been undertaken, no further rehabilitation works were required during the reporting period.

Table 6
Maintenance Activities on Rehabilitated Land

	Area Treated (ha)		
Nature of Treatment	**Report period**	**Next period**	**Comment/control strategies/ treatment detail**
Additional erosion control works (drains re-contouring, rock protection)	1	1	Maintenance works on contour drains and sediment dam.
Re-covering (detail - further topsoil, subsoil sealing etc)	0	0	None
Soil treatment (detail - fertiliser, lime, gypsum etc)	0	0	None
Treatment/Management (detail - grazing, cropping, slashing etc)	35	35	Slashing of the taller vegetation (grasses) over the area. Grazing commenced from current land owner.
Re-seeding/Replanting (detail - species density, season etc)	0	0	Further monitoring of seeded areas. Re-seeding in areas has not been required.
Adversely Affected by Weeds (detail - type and treatment)	5	5	Slashing and spot spraying of Blackberry and St John's Wort as it presented in small area.
Feral animal control (detail - additional fencing, trapping, baiting etc)	0	0	Kangaroos prevalent. Numbers do not reach uncontrolled levels.

4.1 REHABILATION MONITORING

A Rehabilitation Assessment was carried out during the reporting period by Geoff Cunningham Natural Resource Consultants Pty Ltd (GCNRC) at Enhance Place Mine as part of the annual flora monitoring surveys **Appendix B**. The monitoring program provides the company and relevant government agencies with details of the extent and composition of the ground cover that establishes on the rehabilitated land. In addition, the monitoring program provides information on the presence of undesirable flora species on the rehabilitated lands and provides advice on management of these lands to maintain and improve vegetative cover.

Monitoring quadrats at the Enhance Place Mine were established on the rehabilitated lands at a density of one quadrat per 10 ha of rehabilitated land. Each quadrat is one ha in size and assessed for:

- Foliage cover;
- Species composition of ground cover; and
- Tree and shrub counts.

4.2 REHABILIATION AREA SURVEY RESULTS

The results from the flora monitoring found that the site is progressing towards target levels and has almost reached a sustainable level. On completion of the monitoring at the Enhance Place Mine for 2012, GCNRC commented:

"*Given the improvements in plant cover, and particularly perennial grass cover, it is my opinion that monitoring should cease and the management of the rehabilitated Enhance Place Mine lands be handed over to the current owners of the land to use as they wish".*

The report also noted that the diversity of flora species was considerably less than the initial inspection conducted in 1998 (pre mining) with most of the cover provided by a few perennial grasses and two clover species that have established from the sown pasture mix. The ground cover percentage across the four quadrates was found to increase over the past 12 months with a common trend of Annual cover decreasing and Perennial cover increasing. It is noted that this trend may be associated with the grazing of the site by domestic livestock, introduced by the new owners of the land. A complete copy of the monitoring results is available in **Appendix B** and details species abundance and variety.

The survey recorded the following noxious weeds within the monitoring quadrats:

- African Lovgrass (*Eragrostis curvula*);
- Blackberry (*Rubus sp. agg*.); and
- St John's Wort (*Hypericum perforatum*).

During the reporting period Enhance Place embraced the principles of integrated weed management to control the three Class 4 Noxious Weeds identified. Ongoing weed eradiation will continue on the site until management of the rehabilitated lands are handed over to the current landowners.

4.3 FURTHER DEVELOPMENT OF FINAL REHABILATION PLAN

This has not altered since the previous reporting period.

4.4 METEOROLOGICAL DATA

An automatic weather station was set up on site for the Pine Dale Open Cut Mine project in 2006. The data is downloaded by Metford Labs (RCA) from Newcastle, NSW.

Rainfall figures prior to 2006 were taken from a rain gauge located at the Enhance Place Mine site. As the two mine sites are in close proximity it is assumed that the rainfall figures would be similar. The average rainfall is 766mm at Lidsdale (Maddox Lane), approximately 2km from the Enhance Place Mine (Source: Bureau of Meteorology, based on the rainfall period 1959 – 2012). During the reporting period, the Enhance Place Mine received 776.4mm of rain, which is 10mm above the average. The Annual Rainfall for the period 2002 – 2012 can be seen if **Figure 1**, whilst the monthly rainfall for 2012 can be seen in **Figure 2**.

Figure 1
Annual Rainfall 2002 - 2012

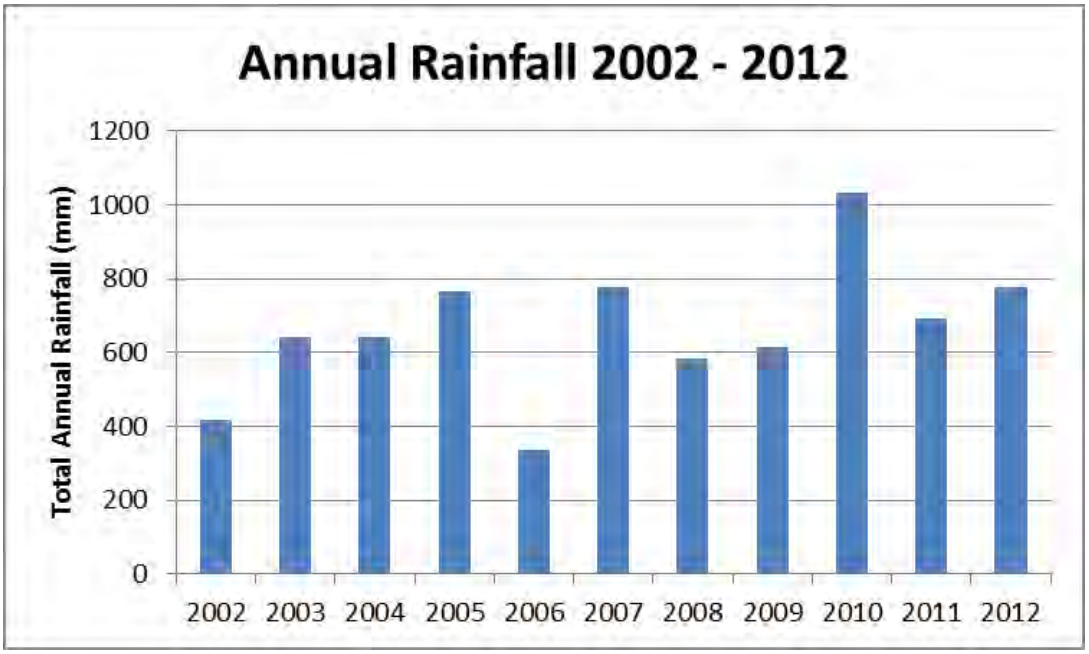
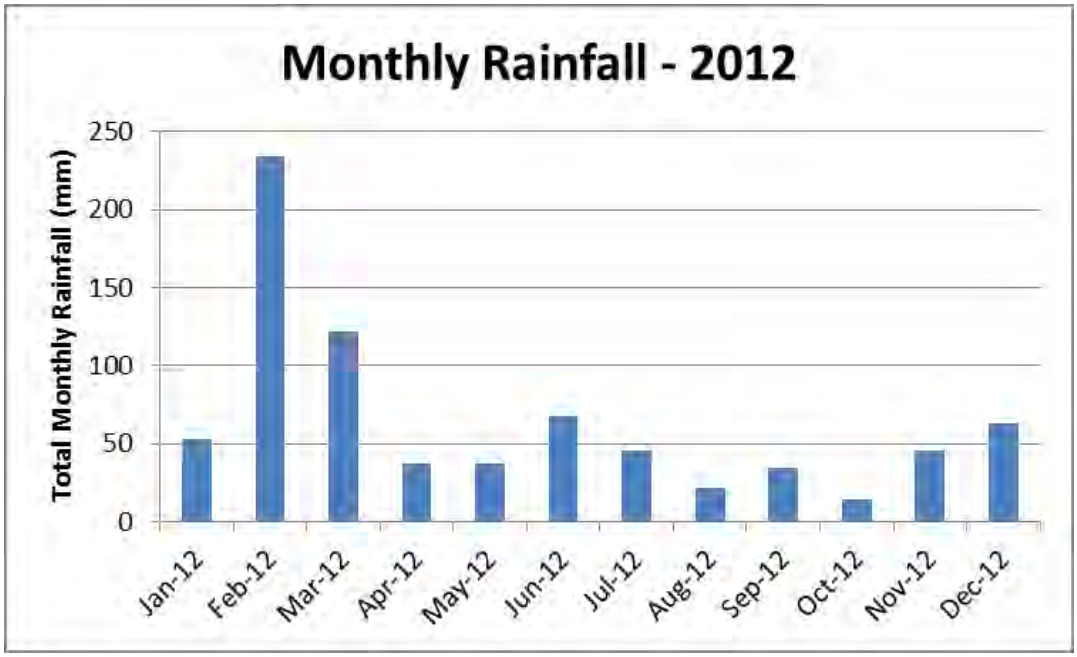


Figure 2
Monthly Rainfall 2012



5 ENVIRONMENTAL PERFORMANCE

EPL 6312 was surrendered on 19 October 2005 following the cessation of mining. As such no environmental monitoring at Point 2 (depositional dust) and Point 3 (water discharge) were conducted during the reporting period.

The proposed final land use and ownership of the Glen Davis Recreation Trust area at the Enhance Place Mine is progressing in consultation with LCC.

During the reporting period, negotiations for handing over of the maintenance of the Enhance Place Mine continued and are currently in consultation with the relevant stakeholders. Until the land is handed back to the owners, ongoing monitoring and maintenance of the rehabilitated area will continue.

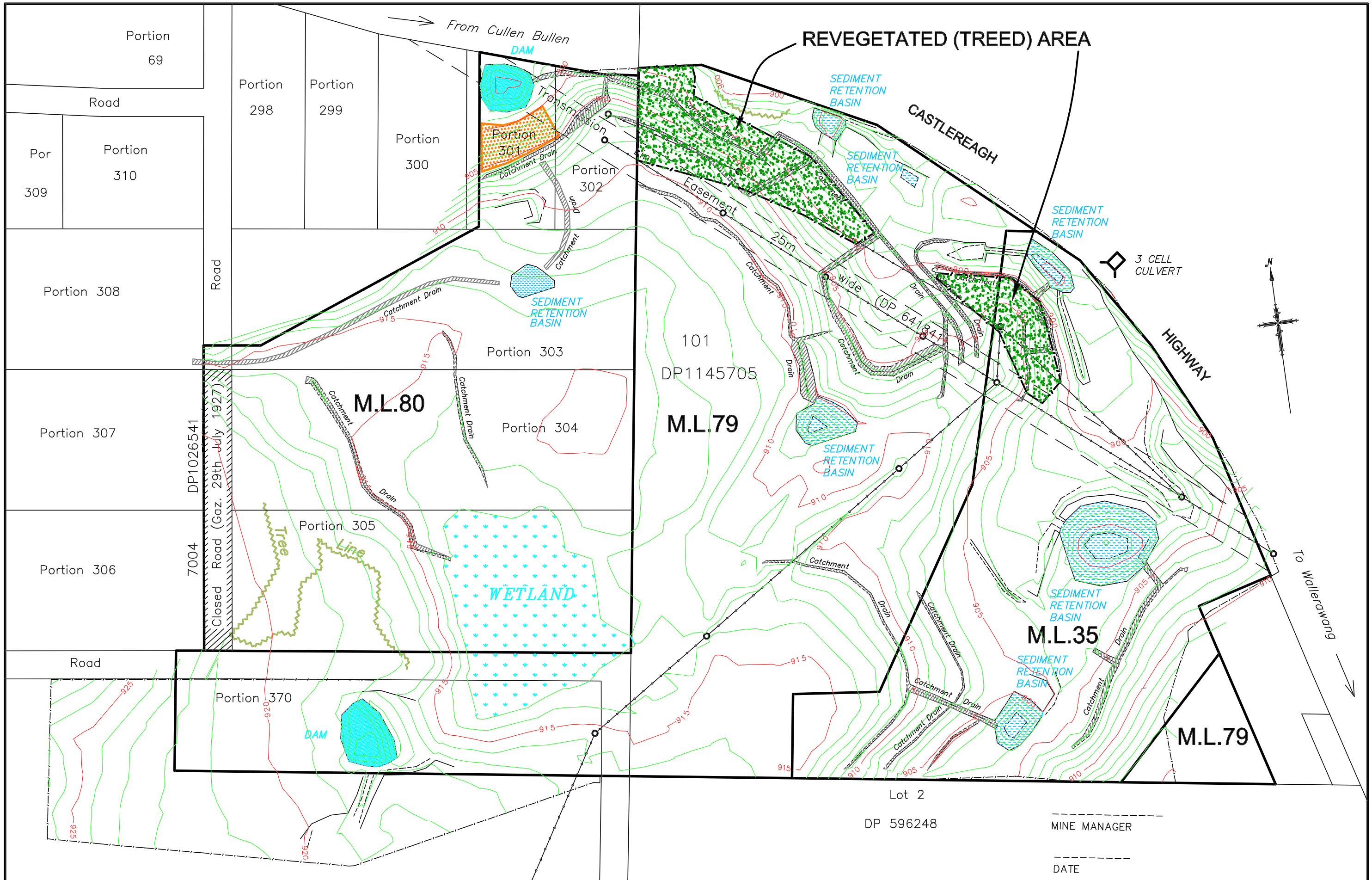
6 COMMUNITY AND LIAISON

6.1 ENVIRONMENTAL COMPLAINTS

There were no environmental complaints recorded during the reporting period from the general public or near neighbours. Discussions with key landholders were ongoing during the reporting period to ensure dialog was maintained regarding land management matters.

Appendix A

Enhance Place Mine Plan



NOTES:

CRAVEN, ELLISTON & HAYES (LITHGOW) PTY.LTD.
CONSULTING LAND, ENGINEERING AND MINING SURVEYORS
ACN 056 544 551
"ASTROLABE" RUTHERFORD LANE, LITHGOW, 2790 PH: (02) 6351 2281, FAX: (02) 6352 1339
EMAIL : survey@ceh.com.au

DATE	31–12–12
AMENDED	
SURVEYOR	T.H./T.E
DRAWN	K.L.F.
CHECKED	

ENHANCE PLACE MINE
AEMR PLAN
END DECEMBER 2012

SCALE - 1 : 2500 (A3 SHEET)

DWG No

ENH-AEMR12

Appendix B

Annual Flora Monitoring

FLORA MONITORING REPORT

ENHANCE PLACE COAL MINE –

November, 2012

Prepared for

Enhance Place Pty Limited
Level 33, 385 Bourke Street,
MELBOURNE VIC 3000

By

Geoff Cunningham Natural Resource Consultants Pty Ltd,
9 The Crest
KILLARA NSW 2071 [ACN 058 178 493]

Telephone: 02 9416 1995
Fax: 02 9416 6626
Email: geoffcun @ bigpond.net.au

November, 2012

FLORA MONITORING REPORT

ENHANCE PLACE COAL MINE –

November, 2012

1 BACKGROUND

The Conditions of Consent for the Enhance Place Coal Mine document does not contain any specific and detailed conditions relatin to vegetation cover monitoring on rehabilitated mined land.

As a consequence, Enhance Place Pty Limited established a regular monitoring program on these rehabilitated areas that mirrors monitoring programs used at similar mine sites in New South Wales.

The monitoring program provides the Company and relevant government agencies with details of the extent and composition of the ground cover that establishes on the rehabilitated land.

In addition, the monitoring program will provide information on the presence of undesirable species on the rehabilitated lands and provide advice on management of these lands to maintain and improve vegetative cover.

The procedures adopted for this monitoring program are detailed in Section 4 of this report

2 VEGETATION COMMUNITIES PRIOR TO MINING

NOTE: * denotes an introduced species.

The vegetation communities occurring on the Enhance Place Mine site were field surveyed by Geoff Cunningham Natural Resource Consultants Pty Ltd [GCNRC] for the Environmental Impact Statements prepared and exhibited prior to approval being received for commencement of mining.

Two flora studies were prepared for the Enhance Place Coal Mine - that covering the original extent of the proposed mine and a second covering an extension of the original area. [GCNRC, 1998; GCNRC, 2001]

The vegetation communites identified at Enhance Place are described in the sections below.

2.1 Vegetation Communities of the Original Enhance Place Mine Area [GCNRC, 1998]

GCNRC identified the following communities within the original project site boundary.

2.1.1 Community 1 - Open Pasture Land

This vegetation type is generally devoid of trees but in some areas there are patches of eucalypt regeneration and a variable cover of very low to prostrate shrubs and some patches of taller ones. Shrubs recorded in these more open areas include *Cassinia arcuata* [Chinese Shrub], *Leptospermum polygalifolium* [Yellow Tea-tree], *Acacia dealbata* [Silver Wattle] and *Hibbertia obtusifolia* [Hoary Guinea Flower]. Scattered Blackberry [*Rubus* spp.]* plants were also noted.

Ground layer species predominate and include a variety of annual and perennial grasses many of which were grazed too low to be identified. Included among the recognisable species were *Themeda australis* [Kangaroo Grass] and *Aristida jerichoensis* var. *jerichoensis* [Number 9 Wiregrass], *Hypochaeris glabra** [Flatweed], *Plantago lanceolata** [Ribwort], *Leucochrysum albicans* ssp. *albicans* var. *albicans* and *Aristida ramosa* var. *ramosa* [Purple Wiregrass].

This community is predominant within the area of existing and proposed mining activity.

2.1.2 Remnant Tree Cover Adjacent to the State Forest

Trees are spaced between 2 and 15 metres apart with the cover comprising mainly *Eucalyptus mannifera* subsp. *mannifera* [Brittle Gum] and *Eucalyptus dives* [Broadleaf Peppermint] [on the ridges] with some Apple Box [*Eucalyptus bridgesiana*] and *Eucalyptus pauciflora* [Snow Gum] in the lower areas. Regeneration of Apple Box was noted in places, mainly on the edges of the stand and associated with more isolated patches of trees.

Shrub species are present at 1 to 5 metre spacings and include *Cassinia arcuata* [Chinese Shrub], *Cassinia laevis* [Cough Bush], *Acacia dealbata* [Silver Wattle], *Leptospermum polygalifolium* [Yellow Tea-tree], *Brachyloma daphnoides* [Daphne Heath], *Astroloma humifusum* [Cranberry Heath], *Hibbertia obtusifolia* [Hoary Guinea Flower], *Lissanthe strigosa* [Peach Heath], *Acacia* sp. [Wattle], *Leptospermum myrtifolium* [Swamp Tea-tree] [in lower situations] and an occasional *Exocarpos cupressiformis* [Native Cherry].

Pasture species were very much grazed back but *Themeda australis* [Kangaroo Grass], *Aristida ramosa* var. *ramosa* [Purple Wiregrass], *Lomandra* sp. [Matrush] and *Poa* sp.[Tussock Grass] were recognisable along with *Plantago lanceolata** [Ribwort] and *Hypochaeris glabra** [Flatweed]. Some *Rubus* spp.]* [Blackberries] were also noted.

2.1.3 Scattered Remnant Vegetation:

The clumps and lines of remnant native vegetation scattered over the study area mirror the other remnant stands in and adjacent to the Ben Bullen State Forest with the main species being *Eucalyptus bridgesiana* [Apple Box], *Eucalyptus mannifera* subsp. *mannifera* [Brittle Gum] and *Eucalyptus dives* [Broad-leaf Peppermint]. Some

isolated trees and clumps of *Eucalyptus pauciflora* [Snow Gum] and *Eucalyptus rossii* [Scribbly Gum] occur. Regenerating Apple Box seedlings and saplings were common in some areas.

A shrub cover of scattered *Acacia dealbata* [Silver Wattle], *Leptospermum polygalifolium* [Yellow Tea-tree], *Cassinia laevis* [Cough Bush] and the low growing *Lissanthe strigosa* [Peach Heath] is evident plus *Dillwynia philicoides, Mirbelia platyloboides, Gompholobium huegelii* [Pale Wedge-pea], *Acacia gunnii* [Ploughshare Wattle], *Pultenaea hispidula, Leptospermum juniperinum* [Prickly Tea-tree], *Brachyloma daphnoides* [Daphne Heath], *Astroloma humifusum* [Peach Heath], *Hibbertia obtusifolia* [Hoary Guinea Flower], *Cassinia arcuata* [Chinese Shrub] and *Rosa rubiginosa** [Briar Rose].

Ground cover is again dominated by *Poa* sp. [Tussock Grass[and *Themeda australis* [Kangaroo Grass] with *Danthonia eriantha* [Wallaby Grass], *Aristida ramosa* var. *ramosa* [Purple Wiregrass] and *Elymus scaber* [Common Wheatgrass].

2.1.3 Main Creekline North of the House:

The creek line which commences in Ben Bullen State Forest and which runs east-north-east through the property carries a variable cover of trees and shrubs. The main tree species in the area near the "hayshed" on the property is *Eucalyptus mannifera* subsp. *mannifera* [Brittle Gum]. This occurs as an open stand with a relatively dense cover of shrubs beneath. Other trees which occur at times along the creek are *Eucalyptus bridgesiana* [Apple Box], *Eucalyptus pauciflora* [Snow Gum] and *Eucalyptus dives* [Broad-leaf Peppermint]. Near the boundary with the next door property, occasional trees of *Eucalyptus aggregata* [Black Gum] were noted.

Some sections the depression are basically devoid of shrubs but others support a relatively dense cover dominated by *Leptospermum polygalifolium* [Yellow Tea-tree], *Leptospermum myrtifolium* [Swamp Tea-tree], *Lissanthe strigosa* [Peach Heath] and *Bursaria spinosa* var.*lasiophylla* [Native Blackthorn] with some shrubs of and *Rosa rubiginosa** [Briar Rose] and *Rubus* spp.* [Blackberry]. *Hymenanthera dentata* [Tree Violet] also occurs along the creek bank.

Ground layer species on this property were similar to those encountered elsewhere in the study area with shrubs being generally less prominent.

2.2 Vegetation Communities of the Enhance Place Mine Extension Area [GCNRC, 2001]

The study area comprised two sections,

- the main eastern section that supports a woodland community except for where clearing in the past has left a small area almost devoid of trees and shrubs

[*associated with this area is a small dam, a number of derelict fences and associated farm facilities in varying stages of disrepair*] , and

- a second much smaller area on the western side that is basically cleared for grazing.

2.2.1 The Woodland Community

Trees are spaced from 5-20m apart. The main species is *Eucalyptus mannifera* subsp. *mannifera* [Brittle Gum] but *Eucalyptus dives* [Broad-leaf Peppermint] is common in scattered clumps throughout. *Eucalyptus rossii* [Scribbly Gum] occurs on some of the more shallow soil areas.

Regeneration of all eucalypts is prevalent. There are a few plants of introduced *Pinus* sp.* [Pine] evident as well.

Shrubs are generally spaced from 1 to 2 m apart. The shrub layer is variable in its composition in different parts of the area. Many species occur in colonies while others are scattered over the whole site.

The main shrub species present are *Cassinia arcuata* [Chinese Shrub], *Acacia gunnii* [Ploughshare Wattle], *Acacia dealbata* [Silver Wattle], *Mirbelia platyloboides*, *Daviesia leptophylla* [Slender Bitter-pea], *Dillwynia philicoides*, *Brachyloma daphnoides* [Daphne Heath], *Lissanthe strigosa* [Native Cranberry], *Astroloma humifusum* [Cranberry Heath], *Hibbertia obtusifolia* [Hoary Guinea Flower], *Leucopogon virgatus*, *Bossiaea prostrata*, *Cryptandra amara* var. *amara* [Bitter Cryptandra], *Rosa rubiginosa** [Briar Rose] and *Rubus* spp.* [Blackberry].

Ground cover varies from 70% to 100% with a good cover of living and dead plant material. Ground layer species present include mainly *Poa* sp.[Tussock Grass] and *Themeda australis* [Kangaroo Grass] with *Plantago lanceolata** [Ribwort], *Aristida ramosa* var. *ramosa* [Purple Wiregrass], *Hypochaeris radicata** [Flatweed[, *Hypochaeris glabra** [Smooth Catsear], *Oxalis corniculata* [Wood Sorrel], Sedge [not identifiable], *Hypericum perforatum** [St Johns Wort], *Cirsium vulgae** [Black Thistle], *Ajuga australis* [Australian Bugle], *Lomandra filiformis* ssp. *flavior* [Matrush], *Glycine* sp. [Glycine], *Hydrocotyle* sp. [Pennyroyal], *Bracteantha bracteata* [Golden Everlastings], *Geranium* sp. [Native Geranium], *Echinopogon caespitosus* [Tufted Hedge-hog Grass], *Craspedia canens*, *Acaena* sp.[Bidgee-Widgee], *Leucochrysum albicans* ssp. *albicans* var. *albicans* [Hoary Sunray], *Cheilanthes* sp. [Rock Fern], *Lomandra longifolia* [Spiny-headed Matrush], *Solenogyne bellioides*, *Goodenia* sp. [Goodenia], *Chrysocephalum apiculatum* [Yellow Buttons], *Cymbonotus preissianus* and *Veronica calycina* [Speedwell].

A small colony of a few plants of the orchid *Diuris behrii* [Golden Cowslips] was noted near the old car and rubbish repository on the eastern side of the study area.

2.2.2 The Cleared Area

This area includes a dam as well as an area used for storage of disused mine equipment etc. The area has been cleared and grazed for many years.

A few scattered *Eucalyptus mannifera* subsp. *mannifera*] [Brittle Gum] trees occur near the fence that encloses the woodland area. Shrubs are mainly *Rosa rubiginosa** [Briar Rose] although other shrubs as described by GCRNC [1998] occur close by.

Ground layer species predominate and include a variety of annual and perennial grasses and herbs, many of which were grazed too low to be identified. Included among the recognisable species were *Themeda australis* [Kangaroo Grass] and *Aristida jerichoensis* var. *jerichoensis* [Number 9 Wiregrass], *Hypochaeris glabra* [Smooth Catsear]*, *Plantago lanceolata** [Ribwort] and *Aristida ramosa* var. *ramosa* [Purple Wiregrass].

3 SCOPE OF THE REHABILITATION WORKS

3.1 General

Mining at the Enhance Place Coal Mine ceased in 2005.

Initial rehabilitation works were undertaken in 2007 and then additional work was carried out in December 2008 when approximately 5 hectares of the site were reseeded.

The seed used in the rehabilitation of the site comprised:

- 40% Fescue
- 25% Cocksfoot
- 20% Subterranean Clover
- 6% Perennial Ryegrass
- 4% Phalaris
- 5% White Clover

This mixture is known locally as 'Cox's River Mix'.

In addition to reseeding, the rehabilitated land was fertilized with a mixture of lime to rectify soil acidity and fowl manurte toprovide nutrients for the establishing pasture.

4 FLORA MONITORING OF THE REHABILITATED LANDSCAPE

4.1 Details of the Monitoring Procedure

Monitoring quadrats at the Enhance Place site were established on the rehabilitated lands at the density of one quadrat per 10 hectares of rehabilitated land.

Quadrats are one hectare in size [a 100m X 100m square] and preferably laid out with sides in an east – west and north – south orientation wherever possible. Where it is not possible to utilize this format, rectangular or trapezoid shaped quadrats are used.

Monitoring of each quadrat involves the following procedures.

[i] A minimum of one permanent photopoint will be established per quadrat.

[ii] Photographs will be taken in set directions from one or more designated corners of the quadrat at the commencement of monitoring and thereafter at annual intervals for five years and then biennially until the monitoring program ceases.

[iii] Each quadrat will initially be monitored at the time of establishment and thereafter at approximately annual intervals for five years and then biennially until the monitoring program ceases.

[iv] Measurements to be made will include:

- foliage cover measurements along two 100 metre step-point transects;
- an assessment of the species composition of the ground flora in the quadrat using the modified Braun-Blanquet [Poore, 1955] scale; and
- tree and shrub counts in the quadrat to quantify deaths and regeneration [where these are relevant].

4.2 Details of Monitoring at the Enhance Place Site

Monitoring at the former Enhance Place Coal Mine site is confined to the rehabilitated areas. The area that was mined was predominantly open cleared country that had been subjected to mining and agricultural land use for many years. The areas of woodland and shrubland were small in comparison and no control plots were established before mining commenced.

Similarly the area that has been rehabilitated and which has had tree trunks and branches replaced on it is very small and too small to establish a one hectare monitoring quadrat.

At the initial monitoring inspection four monitoring quadrats were established on the former Enhance Place Coal Mine site.

No control quadrats were utilized at the former Enhance Place Coal Mine site as the whole area has been mined and rehabilitated.

4.3 Procedure for Consultation Following Monitoring

The monitoring ecologist will consult with Enhance Place Pty Limited within four weeks of the end of each flora monitoring program to advise of any need for replantings, additional plantings, maintenance works etc required to ensure the success of the vegetation establishment programs. The recommended works will be undertaken in the timeframe recommended by the ecologist.

5 VEGETATION MONITORING QUADRAT LOCATIONS AND TREE / SHRUB COVER

Flora monitoring at this inspection involved an assessment of ground cover alone and no counts of trees or shrubs were made.

It was noted that a number of groves of native trees and shrubs had been planted at the Enhance Place site. No attempt was made to count these at this inspection.

During the monitoring program for the rehabilitated Enhance Place lands no attempt was made to count tree and shrub regeneration as most of the rehabilitated area developed a good pasture cover which was suitable for use by domestic livestock.

Very few trees and shrubs established on three of the quadrats on what was previously largely farmland while the fourth is located on the Glen Davis Trust Land that was probably more shrubby ofr a start. Shrubs have regenerated on this land to a moderate extent.

5.1 Enhance Place Coal Mine Site

5.1.1 Quadrat 1 Location

The corner peg locations are shown in **Table 1**.

Table 1

Quadrat 1 Corner Peg Locations [AMG coordinates]

CORNER PEG	EASTING	NORTHING
Northwest	226994E	6303710N
Southwest	226994E	6303610N
Southeast	227094E	6303610N
Northeast	227094E	6303710N

5.1.2 Quadrat 2 Location

The corner peg locations are shown in **Table 2**.

Table 2

Quadrat 2 Corner Peg Locations [AMG coordinates]

CORNER PEG	EASTING	NORTHING
Northwest	227159E	6303772N
Southwest	227159E	6303672N
Southeast	227259E	6303672N
Northeast	227259E	6303772N

5.1.3 Quadrat 3 Location

The corner peg locations are shown in **Table 3**.

Table 3

Quadrat 3 Corner Peg Locations [AMG coordinates]

CORNER PEG	EASTING	NORTHING
Northwest	226868E	6303874N
Southwest	226855E	6303777N
Southeast	226965E	6303768N
Northeast	226978E	6303858N

5.1.4 Quadrat 4 Location

The corner peg locations are shown in **Table 4.**

Table 4

Quadrat 4 Corner Peg Locations [AMG coordinates]

CORNER PEG	EASTING	NORTHING
Northwest	226997E	6303960N
Southwest	226983E	6303860N
Southeast	227083E	6303860N
Northeast	227097E	6303960N

6 STEP POINT TRANSECT MEASUREMENTS – November, 2012

NOTE * denotes introduced species

The following **Tables 5, 6, 7** and **8** summarise the percentage groundcover provided by individual species within the four established monitoring quadrats.

6.1 General Comments

It should be noted that at the initial inspection of all four quadrats there was a wide variety of flora species present and recorded. At the present inspection the variey was considerably less and most of the cover was provided by a few perennial grasses and the two clover species [White Clover and Subterranean Clover] that have established from the sown pasture mix.

At the present, there is an issue with the identification of the different species of perennial grasses - Cocksfoot, Fescue, Phalaris and some of the native and other introduced grass species..

This is because of the heavy grazing by the landowners' horses and the resident kangaroo population. To overcome this problem the perennial grasses have been bulked together as Perennial Grass cover.

The exception within the perennial grasses is *Eragrostis curvula** [African Lovegrass] which is a noxious weed and a species that kangaroos and domestic stock seem to avoid as much of the previous season's growth was rank and intact making identification relatively easy.

NOTE: The letters **A** and **P** in the Life Form columns of these Tables indicates an Annual or Perennial species respectively.

6.2 Monitoring Quadrat 1 – Enhance Place

6.2.1 Transect Data

Table 5 - Transect Data

SPECIES	% COVER TRANSECT 1	% COVER TRANSECT 2	MEAN % COVER	Life Form
Annual Grass	6.0%	1.0%	3.5%	A
Annual Herb	2.0%	0%	1.0%	A
*Chenopodium album** [Fat Hen]	0%	1.0%	0.5%	A
*Eragrostis curvula** [African Lovegrass]	12.0%	0%	6.0%	P
*Holcus lanatus** [Yorkshire Fog]	4.0%	0%	2.0%	P
Geranium retrorsum [Common Cranesbill]	0%	1.0%	0.5%	A
*Hypochaeris glabra** [Smooth Catsear]	1.0%	0%	0.5%	A
*Hypericum perforatum** [St Johns Wort]	3.0%	1.0%	2.0%	P
*Modiola caroliniana** [Red-flowered Mallow]	0%	6.0%	3.0%	A
Perennial Grass	33.0%	62.0%	47.5%	P
Plantago varia {ribwort]	2.0%	5.0%	3.5%	A
*Trifolium species** [Clover]	4.0%	0%	2.0%	A
*Trifolium repens** [White Clover]	22.0%	22.0%	22.0%	P
LITTER	**11.0%**	**1.0%**	**6.0%**	
BARE	**0%**	**0%**	**0%**	
TOTAL COVER	**100.0%**	**100.0%**	**100%**	
TOTAL LIVING COVER	**89.0%**	**99.0%**	**94.0%**	
PERENNIAL LIVING COVER+	**74.0%**	**85.0%**	**79.5%**	
ANNUAL LIVING COVER+	**15.0%**	**14.0%**	**14.5%**	

6.2.2 Other Species Observed Within the Quadrat

*Bromus mollis** [Soft Brome]
Cassinia arcuata [Chinese Shrub]
*Cirsium vulgare** [Spear Thistle]
*Dactylis glomerata** [Cocksfoot]
*Eruca sativa** [Purple-vein Rocket]
*Hypochaeris radicata** [Flatweed]
Lolium sp.* [Ryegrass]
*Phalaris aquatica** [Phalaris]
Rumex sp.* [Dock]

6.3 Monitoring Quadrat 2 – Enhance Place

6.3.1 Transect Data

Table 6 - Transect Data

SPECIES	% COVER TRANSECT 1	% COVER TRANSECT 2	MEAN % COVER	Life Form
Annual Grass	2.0%	1.0%	1.5%	A
Annual Herb	1.0%	0%	0.5%	A
*Cirsium vulgare** [Spear Thistle]	2.0%	1.0%	1.5%	A
*Conyza bonariense** [Flaxleaf Fleabane]	0%	1.0%	0.5%	A
*Eragrostis curvula** [African Lovegrass]	1.0%	6.0%	3.5%	P
Geranium retrorsum [Common Cranesbill]	1.0%	1.0%	1.0%	A
*Hypericum perforatum** [St. John's Wort]	0%	1.0%	0.5%	P
*Modiola caroliniana** [Red-flowered Mallow]	1.0%	1.0%	1.0%	A
Perennial Grass	38.0%	38.0%	38.0%	P
*Plantago lanceolata** [Ribwort]	10.0%	5.0%	7.5%	A
*Rubus sp.** [Blackberry]	0%	1.0%	0.5%	P
*Trifolium repens** [White Clover]	37.0%	31.0%	64.0%	P
LITTER	**3.0%**	**10.0%**	**6.5%**	
BARE	**2.0%**	**3.0%**	**2.5%**	
TOTAL COVER	**98.0%**	**97.0%**	**97.5%**	
TOTAL LIVING COVER	**95.0%**	**87.0%**	**91.0%**	
PERENNIAL LIVING COVER	**76.0%**	**77.0%**	**76.5%**	
ANNUAL LIVING COVER	**19.0%**	**10.0%**	**14.5%**	

6.3.2 Other Species Observed Within the Quadrat

*Echium vulgare** [Vipers Bugloss]
Rumex sp. [Dock]
Senecio quadridentatus [Cotton Fireweed]

6.4 Monitoring Quadrat 3 – Enhance Place

6.4.1 Transect Data

Table 7 - Transect Data

SPECIES	% COVER TRANSECT 1	% COVER TRANSECT 2	MEAN % COVER	Life Form
Acaena sp.	0%	1.0%	0.5%	P
Annual Grass	1.0%	5.0%	3.0%	A
Annual Herb	0%	5.0%	2.5%	A
Cassinia arcuata [Chinese Shrub]	1.0%	0%	0.5%	A
*Cirsium vulgare** [Spear Thistle]	1.0%	0%	0.5%	A
Epacridaceae shrub	1.0%	0%	0.5%	
*Eragrostis curvula** [African Lovegrass]	26.0%	39.0%	32.5%	P

*Eruca sativa** [Purple-vein Rocket]	1.0%	1.0%	1.0%	A
Geranium retrorsum [Common Cranesbill]	0%	1.0%	0.5%	A
Gnaphalium luteo-album [Jersey Cudweed]	1.0%	0%	0.5%	P
*Hypericum perforatum** [St Johns Wort]	1.0%	5.0%	3.0%	P
*Hypochaeris radicata** [Flatweed]	6.0%	5.0%	5.5%	A
Perennial Grass	14.0%	16.0%	15.0%	P
*Plantago lanceolata** [Ribwort]	4.0%	3.0%	3.5%	A
*Trifolium repens** [White Clover]	32.0%	13.0%	22.5%	P
*Vulpia sp.** [Silver Grass]	0%	1.0%	0.5%	A
LITTER	**3.0%**	**2.0%**	**2.5%**	
BARE	**8.0%**	**3.0%**	**5.5%**	
TOTAL COVER	**92.0%**	**97.0%**	**94.5%**	
TOTAL LIVING COVER	**89.0%**	**95.0%**	**92.0%**	
PERENNIAL LIVING COVER	**76.0%**	**74.0%**	**75.0%**	
ANNUAL LIVING COVER	**13.0%**	**21.0%**	**17.0%**	

6.4.2 Other Species Observed Within the Quadrat

Acacia dealbata [Silver Wattle]
Acacia rubida [Red-leaved Wattle]
Cassinia arcuata [Chinese Shrub]
*Cirsium vulgare** [Black Thistle]
Hibbertia obtusifolia [Hoary Guinea-flower]
Leucochrysum albicans ssp. *albicans* var. *albicans* [Hoary Sunray],
Rubus fruticosus sp. agg.* [Blackberry]
Senecio quadridentatus [Cotton Fireweed]
Epacridaceae shrub
Juncus sp. [Rush]
Centaurium sp. [Centaury]
*Phalaris aquatica** [Phalaris]
Austrodanthonia sp. [Wallaby Grass]
Gonocarpus sp. [Raspwort]
Fabaceae shrub

6.5 Monitoring Quadrat 4 – Enhance Place

6.5.1 Transect Data

Table 8 - Transect Data

SPECIES	% COVER TRANSECT 1	% COVER TRANSECT 2	MEAN % COVER	Life Form
Annual Herbs	3.0%	0%	1.5%	P
*Cirsium vulgare** [Black Thistle]	1.0%	0%	0.5%	A
Cyperus sp. [Sedge]	1.0%	0%	0.5%	P
*Eragrostis curvula** [African Lovegrass]	13.0%	18.0%	15.5%	P
*Eruca sativa** [Purple-vein Rocket]	1.0%	0%	0.5%	A
*Hypochaeris radicata** [Flatweed]	3.0%	0%	1.5%	A
*Hypericum perforatum** [St Johns	1.0%	0%	0.5%	P

Wort]				
Perennial Grass	38.0%	15.0%	26.5%	P
Perennial Herb	1.0%	2.0%	1.5%	P
*Plantago lanceolata** [Ribwort]	8.0%	10.0%	9.0%	A
*Trifolium repens** [White Clover]	14.0%	50.0%	32.0%	P
LITTER	**10.0%**	**3.0%**	**6.5%**	
BARE	**6.0%**	**2.0%**	**4.0%**	
TOTAL COVER	**94.0%**	**98.0%**	**96.0%**	
TOTAL LIVING COVER	**84.0%**	**95.0%**	**89.5%**	
PERENNIAL LIVING COVER	**68.0%**	**85.0%**	**76.5%**	
ANNUAL LIVING COVER	**16.0%**	**10.0%**	**13.0%**	

6.5.2 Other Species Observed Within the Quadrat

Cassinia arcuata [Chinese Shrub]
Juncus sp. [Rush]
*Reseda luteola** [Wild Mignonette]
*Rosa rubiginosa** [Briar Rose]
Rubus fruticosus sp. agg.* [Blackberry]
Senecio quadridentatus [Cotton Fireweed]
*Trifolium campestre** [Hop Clover]

7 SPECIES ABUNDANCE DATA – NOVEMBER, 2012

The monitoring program adopted for the Enhance Place Coal Mine dictates that the species recorded on each of the permanent quadrats will be given a modified Braun -Blanquet [Poore, 1995] cover abundance scale rating at each monitoring event. This scale is summarised in **Table 9**.

The species recorded on the different quadrats in the step-pointing transects are not the only species present. There are other species that were present in low numbers [i.e. < 0.5% cover] that were recorded as being present on the different quadrats.

These species were recorded during the step-point transects as plants not actually 'hit' but nevertheless present.

Tables 10, 11, 12 and **13** provide this data based on the step-point transects and these additional observations on each of the Permanent Quadrats.

Table 9

Modified Braun-Blanquet Cover Abundance Scale [Poore, 1955]

Aerial Vegetative Cover	Cover Class
95 -100°/a	6
75 - 95°/a	5
50 – 75%	4
25 – 50%	3
5 – 25%	2
1-5%	1

< 1%	+
Rare	r

7.1 Species Abundance in Monitoring Quadrat 1

Table 10

Species Lists and modified Braun-Blanquet Scores for Monitoring Quadrat 1

SPECIES	modified BRAUN-BLANQUET SCORE
Annual Grass	1
Annual Herb	1
*Bromus mollis** [Soft Brome]	r
Cassinia arcuata [Chinese Shrub]	r
*Chenopodium album** [Fat Hen]	+
*Cirsium vulgare** [Spear Thistle]	r
*Dactylis glomerata** [Cocksfoot]	r
*Eragrostis curvula** [African Lovegrass]	2
*Eruca sativa** [Purple-vein Rocket]	r
Geranium retrorsum [Common Cranesbill]	+
*Holcus lanatus** [Yorkshire Fog]	1
*Hypericum perforatum** [St Johns Wort]	1
*Hypochaeris glabra** [Smooth Catsear]	+
*Hypochaeris radicata** [Flatweed]	r
Lolium sp.* [Ryegrass]	r
*Modiola caroliniana** [Red-flowered Mallow]	1
Perennial Grass	3
*Phalaris aquatica** [Phalaris]	r
Plantago varia {ribwort]	1
Rumex sp.* [Dock]	r
*Trifolium repens** [White Clover]	2
*Trifolium species** [Clover]	1

7.2 Species Abundance in Monitoring Quadrat 2

Table 11

Species Lists and modified Braun-Blanquet Scores for Monitoring Quadrat 2

SPECIES	modified BRAUN-BLANQUET SCORE
Annual Grass	1
Annual Herb	+
*Cirsium vulgare** [Spear Thistle]	1
*Conyza bonariense** [Flaxleaf Fleabane]	+
*Echium vulgare** [Vipers Bugloss]	r
*Eragrostis curvula** [African Lovegrass]	1
Geranium retrorsum [Common Cranesbill]	1
*Hypericum perforatum** [St. John's Wort]	+

*Modiola caroliniana** [Red-flowered Mallow]	1
Perennial Grass	3
*Plantago lanceolata** [Ribwort]	2
*Rubus sp.** [Blackberry]	+
Rumex sp. [Dock]	r
Senecio quadridentatus [Cotton Fireweed]	r
*Trifolium repens** [White Clover]	4

7.3 Species Abundance in Monitoring Quadrat 3

Table 12

Species Lists and modified Braun-Blanquet Scores for Monitoring Quadrat 3

SPECIES	modified BRAUN-BLANQUET SCORE
Acacia dealbata [Silver Wattle]	r
Acacia rubida [Red-leaved Wattle]	r
Acaena sp.	+
Annual Grass	1
Annual Herb	1
Austrodanthonia sp. [Wallaby Grass]	r
Cassinia arcuata [Chinese Shrub]	+
Cassinia arcuata [Chinese Shrub]	r
Centaurium sp. [Centaury]	r
*Cirsium vulgare** [Spear Thistle]	+
Epacridaceae shrub	r
*Eragrostis curvula** [African Lovegrass]	3
*Eruca sativa** [Purple-vein Rocket]	1
Fabaceae shrub	r
Geranium retrorsum [Common Cranesbill]	+
Gnaphalium luteo-album [Jersey Cudweed]	+
Gonocarpus sp. [Raspwort]	r
Hibbertia obtusifolia [Hoary Guinea-flower]	r
*Hypericum perforatum** [St Johns Wort]	1

Table 12 [cont]

Species Lists and modified Braun-Blanquet Scores for Monitoring Quadrat 3

SPECIES	modified BRAUN-BLANQUET SCORE
*Hypochaeris radicata** [Flatweed]	2
Juncus sp. [Rush]	r
Leucochrysum albicans ssp. *albicans* var. *albicans* [Hoary Sunray],	r
Perennial Grass	2
*Phalaris aquatica** [Phalaris]	r
*Plantago lanceolata** [Ribwort]	1
Rubus fruticosus sp. agg.* [Blackberry]	r
Senecio quadridentatus [Cotton Fireweed]	r
*Trifolium repens** [White Clover]	2

*Vulpia sp.** [Silver Grass]	+

7.4 Species Abundance in Monitoring Quadrat 4

Table 13

Species Lists and modified Braun-Blanquet Scores for Monitoring Quadrat 4

SPECIES	modified BRAUN-BLANQUET SCORE
Annual Herbs	1
Cassinia arcuata [Chinese Shrub]	r
*Cirsium vulgare** [Black Thistle]	+
Cyperus sp. [Sedge]	+
*Eragrostis curvula** [African Lovegrass]	2
*Eruca sativa** [Purple-vein Rocket]	+
*Hypericum perforatum** [St Johns Wort]	1
*Hypochaeris radicata** [Flatweed]	1
Juncus sp. [Rush]	r
Perennial Grass	3
Perennial Herb	1
*Plantago lanceolata** [Ribwort]	2
*Reseda luteola** [Wild Mignonette]	r
*Rosa rubiginosa** [Briar Rose]	r
Rubus fruticosus sp. agg.* [Blackberry]	r
Senecio quadridentatus [Cotton Fireweed]	r
*Trifolium campestre** [Hop Clover]	r
*Trifolium repens** [White Clover]	3

8 PHOTOPOINTS

Photographs were taken from the northwest corner of all five monitoring quadrats looking towards the southeast corner peg in September, 2011.

These photographs will provide a visual record of change over the monitoring period.

The 2012 photographs are contained in **Appendix 1.**

9 COMMENTS ON THE VEGETATION COVER ON THE QUADRATS in September, 2011

This section of the Monitoring Report provides details of the rainfall received at the site since rehabilitation bgan and offers comment on the levels of cover recorded n each plot in relation to total living cover, perennial living cover and annual living cover.

In subsequent reports this section would be used to comment on measured changes in these parameters since the last observation and to provide guidance to Enhance Place Pty Ltd in relation to the management of the vegetative cover on the rehabilitation areas.

9.1 Rainfall since Commencement in December, 2005

Table 14

Rainfall [mm] Recorded at Pine Dale Open Cut Coal Mine –2006 to November 2012

YEAR / MONTH	2006	2007	2008	2009	2010	2011	2012
January	89.8	34.4	72.2	46.4 [7]	140.4	62.8	53.2
February	18.8	133.6 [3]	100.4	133.2	107.2	51.0	234.2
March	10.2	45.8	3.8 [4]	66.0	57.8	71.4	122.0
April	14.2	32.4	6.4 [5]	52.8	37.2	21.4	37.2
May	6.0	61.0	8.0 [6]	39.8	56.4	48.4	37.2
June	24.0 [1]	163.6	52.6	36.0	32.2	26.0	67.2
July	42.2 [2]	15.4	28.8	29.6 [8]	90.6	17.8	45.4
August	6.4	34.4	52.4	34.4 [9]	71.4	55.8	21.8
September	33.4	3.8	56.0	34.0 [10]	58.6	59.2	34.6
October	2.6	43.0	66.2	41.2	71.4	39.6	14.4
November	34.2	138.2	50.4	28.6	119.8	149.6	7.2[11]
December	39.0	72.2	121.4	76.0	190.4	91.0	-

Notes:

1 no data from 23rd June to end of month
2 no data from 1st July to 6th July
3 no data from 2nd February to 6th February
4 no data after 7th March at 22.15 hrs
5 no data from 16th to 23rd April and after 14.30 hrs on 30th April
6 no data fom 1st May to to 5.30 hrs on 3rd May and from 28th May at 12.15 hrs to end of month
7 total incorrect
8 no data from 22nd July to end of month
9 battery failure; Bathurst data
10 no data for 1st September to 2nd September 9.45 hrs
11 to 14th November, 2012

9.2 Changes in Vegetation Cover

The measurements reported here for **Quadrats 1 to 5 are the initial measurements** and provide a base from which to gauge the direction and magnitude of changes in ground cover in ensuing years.

Obviously, as these are the initial measurements it is not possible to comment on any changes that have occurred in the period since the previous monitoring.

Assessments of change will be possible after the quadrats are monitored at successive intervals in the future.

9.2.1 Monitoring Quadrat 1

From the data in **Table 17** it is evident that total living cover is high and comprised of a pleasing increase in perennial ground cover species. Annual ground cover species and litter cover have decreased, as has the bare area.

Table 15

Cover Classification	Percentage Cover at Each Observation		% change in absolute terms
	September, 2011	November, 2012	
Total Living Cover	90.0%	94.0%	+ 4.0%
Annual Living Cover	22.75%	14.5%	- 8.25%
Perennial Living Cover	67.25%	79.5%	+ 12.25%
Litter Cover	7.0%	6.0%	- 1.0%
Bare Surface	3.0%	0%	- 3.0%

9.2.2 Monitoring Quadrat 2

From the data in **Table 18** it is evident that total living cover has decreased slightly but the percentage of perennial cover has increased significantly at the expense of annuals. The bare area and area covered by litter have increased by relatively small increments. This may be a factor associated with the grazing of the site by domestic livestock introduced by the new owners of the land or a consequence of the relatively dry conditions recently.

Table 16

Cover Classification	Percentage Cover at Each Observation		% change in absolute terms
	September, 2011	November, 2012	
Total Living Cover	94.5%	91.0%	- 3.5%
Annual Living Cover	27.75%	14.5%	- 13.25%
Perennial Living Cover	66.75%	76.5%	+ 9.25%
Litter Cover	3.5%	6.5%	+ 3.0%
Bare Surface	2.0%	2.5%	+ 0.5%

9.2.3 Monitoring Quadrat 3

From the data in **Table 19** it is evident that total living cover has increased over the past year.Annual cover decreased slightly and perennial cover increased to a larger degree. Litter cover was halved and the amount of bare surface area decreased minimally.

Table 17

Cover Classification	Percentage Cover at Each Observation		% change in absolute terms
	September, 2011	November, 2012	
Total Living Cover	87.5%	92.0%	+ 4.5%
Annual Living Cover	21.75%	17.0%	- 4.5%
Perennial Living Cover	65.75%	75.0%	+ 9.25%
Litter Cover	6.0%	2.5%	- 3.5%
Bare Surface	6.5%	5.5%	- 0.5%

9.2.4 Monitoring Quadrat 4

From the data in **Table 20** it is evident that total living cover decreased during the year with annual cover decreasing and perennial cover and litter cover both increasing. The amount of bare area remained stable.

The bare area is relatively low.

Table 18

Cover Classification	Percentage Cover at Each Observation		% change in absolute terms
	September, 2011	November, 2012	
Total Living Cover	88.5%	89.5%	+ 1.0%
Annual Living Cover	22.75%	13.0%	- 9.75%
Perennial Living Cover	65.75%	76.5%	+ 10.75%
Litter Cover	5.0%	6.5%	+ 1.5%
Bare Surface	6.5%	4.0%	- 2.5%

9.3 Noxious Weed Control

9.3.1 General

The Noxious Weed Declarations for the Lithgow Local Government Area [Industry and Investment NSW website] have been examined and the following noxious weeds have been recorded on the monitoring quadrats.

African Lovegrass* [*Eragrostis curvula*], Blackberry* [*Rubus* sp. agg.], St John's Wort* [*Hypericum perforatum*] are all present at the Enhance Place site
and are classified as **Class 4** noxious weeds.

Class 4 noxious weeds are plants whose growth and spread nust be controlled according to measures specified in a management plan published by the local control authority – in this case the Upper Macquarie County Council.

The Upper Macquarie County Council Weed Management Plan Number 4 [as amended on 5th December, 2008] deals with the management and control of Class 4 weeds within the Council area.

The Plan requires landholders to institute, as soon as practicable after becoming aware of the presence of a **Class 4** noxious weed, to institute an effective program of work for controlling the growth and spread of the weed according to the principles of Integrated Weed Management.

The Plan defines Integrated Weed Management as ***'the planning and implementation of a program of work for controlling the growth and spread of a weed using such available methods of control that may be appropriate in the circumstances, including, but not necessarily limited to:***

- ***Measures to prevent invasion, or reinvasion, by the weed***
- ***Physical or mechanical measures***
- ***Biological agents***

- *Herbicide methods*
- *Cultural methods, and land management practices.'*

It has been appropriate that Enhance Place Pty Ltd has embraced the principles of Integrated Weed Management to control the three Class 4 Noxious Weeds identified on the lands that it controls – including the rehabilitated Enhance Place Mine lands – during the past years.

In the following sections, appropriate approaches to Class 4 noxious weed control for individual species are discussed. These approaches use the principles of Integrated Wedd Management.

9.3.2 Control of Blackberry and St John's Wort

The infestations of Blackberry and St John's Wort on the rehabilitated lands have been controlled largely by regular spot spraying campaigns using a chemical or chemicals approved for control of these species.

9.3.3 Control of African Lovegrass

African Lovegrass control in a pasture such as that established on the rehabilitated lands at Enhance Place Coal Mine requires a different approach to that recommended for control of Blackberry and St John's Wort.

The African Lovegrass plants are more prevalent and are contributing to soil erosion prevention on the rehabilitated landscape. There are too many plants to effectively spot spray and if a total spray approach that selectively targeted grass plants was used then a large amount of sown useful pasture grasses would be killed.

Obviously, any control [Integrated Weed Management] measures must recogise the need to retain a good cover on the area while the required management technique is being applied.

Parsons and Cuthberton [1992] in their book ***Noxious Weeds of Australia*** [Inkata Press, Melbourne] note that this species is most common on disturbed soil on wastelands, roadsides, railway tracks etc on acid sands and light sandy loams.

They indicate that the best way to control African Lovegrass on arable areas is to cultivate and establish a strong perennial pasture.

For non-arable areas, such as the rehabilitated lands at Enhance Place Coal Mine, they suggest that it may be best to utilize the species as a pasture plant by grazing it when it is nutritious [ie before flowering].

Grazing, at least in the early years of rehabilitation of rehabilitated mined land is also an inappropriate land use.

As a consequence, it is my opinion that the most appropriate way to control African Lovegrass at the Enhance Place site is to use increased competition from desirable species by establishing a strong cover of improved pasture species.

This cover should be maintained by regular fertilization with a suitable inorganic fertilizer plus, perhaps, regular dressings of mature [rather than fresh] fowl manure.

Applications of lime may also assist by raising the soil pH on the rehabilitated land if it is low. This will remove some of the habitat suitability that African Lovegrass prefers and may assist the other improved pasture species to grown more competitively.

It would als be useful to apply an appropriate rate of a fertilizer containing nitrogen, phosphorus and potassium at intervals in the future to maintain a vigorous pasture growth. Application by broadcasting would be the appropriate method of applying the fertilizer.

Given my conclusion in **Section 10**, this work can now be continued by the current landowners.

10 ACTIONS REQUIRED

10.1 Cessation of Monitoring

Given the improvements in plant cover, and particularly perennial grass cover, it is my opinion that monitoring should now cease and the management of the rehabilitated Enhance Place Coal Mine lands should be handed over to the current owners of the land to use as they wish.

The owners are currently grazing horses on the bulk of the land [excluding that vested in the Glen Davis Trust]. A relatively large population of kangaroos has also been evident on the site at the recent monitoring events – including 2012.

It is my opinion that the rehabilitation has reached such a stage that the Rehabilitation Security Deposit for the site can now be released by NSW Trade and Investment Dvision of Resources and Energy.

All land and pasture management actions and noxious weed and feral animal control work should now become the responsibility of the current owners of the land.

11 REFERENCES

GCNRC [1998] - Report on Flora Study – Enhance Place Colliery, Blackmans Flat via Wallerawang. Geoff Cunningham Natural Resource Consultants Pty Ltd, Killara.

GCNRC [2001] – Flora Study of an Extension to Enhance Place Colliery, Blackmans Flat via Wallerawang. Geoff Cunningham Natural Resource Consultants Pty Ltd, Killara.

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Parsons, W.T. and Cuthbertson, E.G. [1992] – Noxious Weeds of Australia. Inkata Press, Melbourne

Poore, M.E.D. [1955] – The Use of Phytosociological Methods in Ecological Investigations. J. Ecol. 43: 226-269

[ELECTRONICALLY SIGNED]

Geoff Cunningham B.Sc.Agr [Hons]; FAIAST
Managing Director and Principal Ecologist
Geoff Cunningham Natural Resource Consultants Pty Ltd.
26th November, 2012

APPENDIX 1

Quadrat 1 – from the southwest corner loongnortheast

Quadrat 2 – from the southwest corner looking northeast

Quadrat 3 – from the southwest corner looking northeast

Quadrat 4 – from the southwest corner looking northeast

226400E 226600E 226800E 227000E 227200E 227400E 227600E

6304400N 6304200N 6304000N 6303800N 6303600N

Portion 69

Road

Portion 309

Portion 310

Portion 298

Portion 299

Portion 300

Road

From Cullen Bullen

DAM

Transmission Line Easement 25m wide (DP 1141841)

Portion 301

Portion 302

Drain

Catchment Drain

Catchment

SEDIMENT RETENTION BASIN

CASTLEREAGH HIGHWAY

3 CELL CULVERT

Portion 308

Quadrant 4

Portion 303

Portion 307

Portion 304

Quadrant 3

Portion 306

Tree Line

Portion 305

WETLAND

Closed Road

Road

Portion 370

DAM

Quadrant 2

Quadrant 1

To Wallerawang

Lot 2
DP 596248
Ivanhoe Coal Pty Limited (ABN 79 064237 154)
C/o Centennial Coal Limited
Level 18, BT Tower,
1 Market Street
Sydney. NSW 2000

EP	Enhance Place Pty Limited
	Enhance Place
Enhance Place Quadrant Locations	
Date :23-Jan-2013	Scale: 1:1:3300 Fig : Enhance

226400E 226600E 226800E 227000E 227200E 227400E 227600E

6304400N 6304200N 6304000N 6303800N 6303600N

Portion 69

Road

Por 309

Portion 310

Portion 298

Portion 299

Portion 300

Road

From Cullen Bullen

DAM

Transmission Line Easement 25m wide (DP 941841)

Portion 301

Portion 302

Catchment Drain

Drain

Catchment

SEDIMENT RETENTION BASIN

CASTLEREAGH HIGHWAY

3 CELL CULVERT

Quadrant 4

Quadrant 3

Quadrant 2

Quadrant 1

Portion 303

Portion 304

Portion 305

Portion 306

Portion 307

Portion 308

Portion 370

Closed Road

Tree Line

Glenn Davis Rec Area

WETLAND

BASIN

To Wallerawang

Lot 2
DP 596248
Ivanhoe Coal Pty Limited (ABN 79 064237 154)
C/o Centennial Coal Limited
Level 18, BT Tower,
1 Market Street
Sydney. NSW 2000

Enhance Place Pty Limited

Enhance Place

Enhance Place Quadrant Locations and Glenn Davis Trust Recreation Area

Date :23-Jan-2013 | Scale: 1:1:3300 | Fig : Enhance