Enhance Place Pty Limited
ABN: 31 077 105 867

Annual Environmental Management Report

2014

(SMALL MINE VERSION)

Enhance Place Mine

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1 INTRODUCTION

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 the 1950'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-east of Mount Piper Power Station.

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.

When open cut operations ceased in June 2005 and since then, surface water control, rehabilitation of land-form with seeding and fertilisation, feral animal and weed control programmes have been implemented with final rehabilitation nearing completion.

During the 2014 reporting period, ongoing management of the site was undertaken in the form of targeted weed management.

1.2 MINE PRODUCTION, PRODUCT AND MARKET

The mine ceased production at the end of June 2005 when all coal reserves had been extracted. There was no coal production or active mining operations undertaken at Enhance Place during the 2014 reporting period. 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**

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	Enhance Place Pty Ltd		
Postal Address	Enhance Place Pty Ltd		
	PO Box 202		
	Wallerawang, N.S.W, 2845		
Telephone	(02) 6355 7893		
Fax	(02) 6355 7894		
Email	Graham.goodwin@energyaustralia.com.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** and shown on **Figure 3**.

Table 2
Land Ownership

Land Owner/Occupier	Lot/DP	Tenure (freehold leasehold)	Pre-mining land use
Mr & Mrs J. Cherry	301/751636	Freehold	Grazing
Mrs J. Cope	302/751636 303/751636	*Perpetual Lease*	Grazing
D & J Hunt	370/751651	Freehold	Grazing
State of NSW - Glen Davis Recreation Area (R. 59960)	304/751636 305/751636	Crown Land	Grazing
State of NSW	7004/1026541	Crown Land	Bush/grazing
M & L Morris	101/1145705	Freehold	Grazing

Figure 1
Land Ownership Plan

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	May 2013	**Completion Date**	January 2017*
AEMR Start Date	1 January 2014	**End Date**	31 December 2014

* During the reporting period a new Care and Maintenance MOP was under development, subsequently approved by *Trade and Investment Resources and Energy* in February 2015.

2.4 SIGNATURES

Manager of Mine Engineering

Signature

Name Graham Goodwin

Date 25.2.2015

3 ACTIONS FROM 2013 AEMR

Action items from Trade and Investment Resources and Energy review of the Enhance Place 2013 AEMR and site inspection are as follows:

Item no.	***Issue/ observation***	***Action***	***Due date***	**Addressed in 2014 AEMR**
2	*Results of monitoring against the rehabilitation completion criteria*	*DRE requests that monitoring is undertaken against the rehabilitation completion criteria and results are reported in the rehabilitation section of future AEMR's.*	*Next AEMR*	Section 5.1 and Appendix B
3	*Enhance place treed area rehabilitation success*	*Pine Dale Mines needs to actively manage this area to ensure it maintains a trajectory towards a sustainable final land use.*	*Ongoing*	Table 6 and Section 5.1

4 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

5 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**	30.6	30.6	30.6
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**	24.2	24.2	24.2
D: REHABILITATION ON SLOPES				
D1	**10 to 18 Degrees**	1.2	1.2	1.2
D2	**Greater than 18 Degrees**	0.5	0.5	0.5
E: SURFACE OF REHABILITATED LAND				
E1	**Pasture and Grasses**	21	21	21
E2	**Native Forest / Eucalypt**	1.2	1.2	1.2
E3	**Plantations and Crops**	nil	nil	nil
E4	**Other**	2	2	2

Ongoing rehabilitation maintenance works were conducted during the reporting period which involved grazing and weed spraying (see

Table 5). As mining had ceased in June 2005 and all rehabilitation activities have been undertaken, no further rehabilitation works were undertaken during the reporting period.

Approximately 21 ha of the study area has been rehabilitated to pasture. Pasture was sown with *Cox's River Mix*, comprising:

- 40% Fescue;
- 25% Cocksfoot;
- 20% Subterranean clover;
- 6% Perennial rye grass;
- 5% White clover; and,
- 4% Phalaris.

An additional 1.2 ha has been planted with trees and shrubs.

Table 5
Maintenance Activities on Rehabilitated Land

Nature of Treatment	Area Treated (ha)		Comment/control strategies/ treatment detail
	Report period	Next period	
Additional erosion control works (drains re-contouring, rock protection)	0	1.2	Erosion evident within treed rehabilitation area. Propose to undertake erosion control works within treed rehabilitation area.
Re-covering (detail - further topsoil, subsoil sealing etc)	0	0	None
Soil treatment (detail - fertiliser, lime, gypsum etc)	0	6	Propose to apply fertilizer and mulch around proposed additional tube stock within treed rehabilitation area.
Treatment/Management (detail - grazing, cropping, slashing etc)	30.6	30.6	Horse grazing by current land owner, approximately 10 animals. Proposed to consult with landowner to implement grazing management practices to enhance pasture growth.
Re-seeding/Replanting (detail - species density, season etc)	0	1.2	Propose to further monitor seeded areas and plant native species tube stock within treed rehabilitation area.
Adversely Affected by Weeds (detail - type and treatment)	17	17	Spraying of African Lovegrass and spot spraying of Blackberry to be continued in next reporting period.
Feral animal control (detail - additional fencing, trapping, baiting etc)	0	0	No additional feral animal control was undertaken.

5.1 REHABILATION MONITORING

During the reporting period, rehabilitation monitoring was undertaken against the rehabilitation completion criteria in the now approved Care and Maintenance MOP (February 2015). The Rehabilitation Monitoring Report is included at Appendix B.

During the monitoring survey, no significant or active erosion was identified within the pasture study area. Sheet erosion was evident throughout the 1.2ha of treed rehabilitation areas and were associated with the slope and exposed soils within these areas. Overall there has been a significant decrease in the presence of African love grass following targeted spraying during the reporting period.

As recommended within the Rehabilitation Monitoring Report, it is proposed to continue weed management and monitoring. Planting of additional native species tubestock, supplemented with fertiliser and mulch is proposed within the treed area. Engagement with the landowner of the pasture area will be undertaken for consideration to implement grazing practices to optimise pasture growth.

Monitoring the final landform and stability of the site will continue while Enhance Place hold relevant mining authorities over the area.

5.2 FURTHER DEVELOPMENT OF FINAL REHABILATION PLAN

This has not altered since the previous reporting period.

5.3 METEOROLOGICAL DATA

An automatic weather station was installed at the Pine Dale Open Cut Mine project site in 2006 (located in nearby Blackmans Flat). The data is downloaded by RCA Laboratories-Environmental (previously Metford Laboratories) from Newcastle, NSW.

The average rainfall is 858.5mm at Lithgow (Birdwood St), approximately 15km from the Enhance Place Mine (Source: Bureau of Meteorology, based on the rainfall period 1889 – 2006). During the reporting period, the Pine Dale Open Cut Mine meteorological monitoring station received 704.8mm of rain, which is below the Lithgow area's long term annual average. The Annual Rainfall for the period 2006 – 2014 recorded at the Pine Dale Mine meteorological monitoring station can be seen if **Figure 2**, whilst the monthly rainfall for 2014 can be seen in

Figure 3.

Figure 2
Blackmans Flat Annual Rainfall 2006- 2014

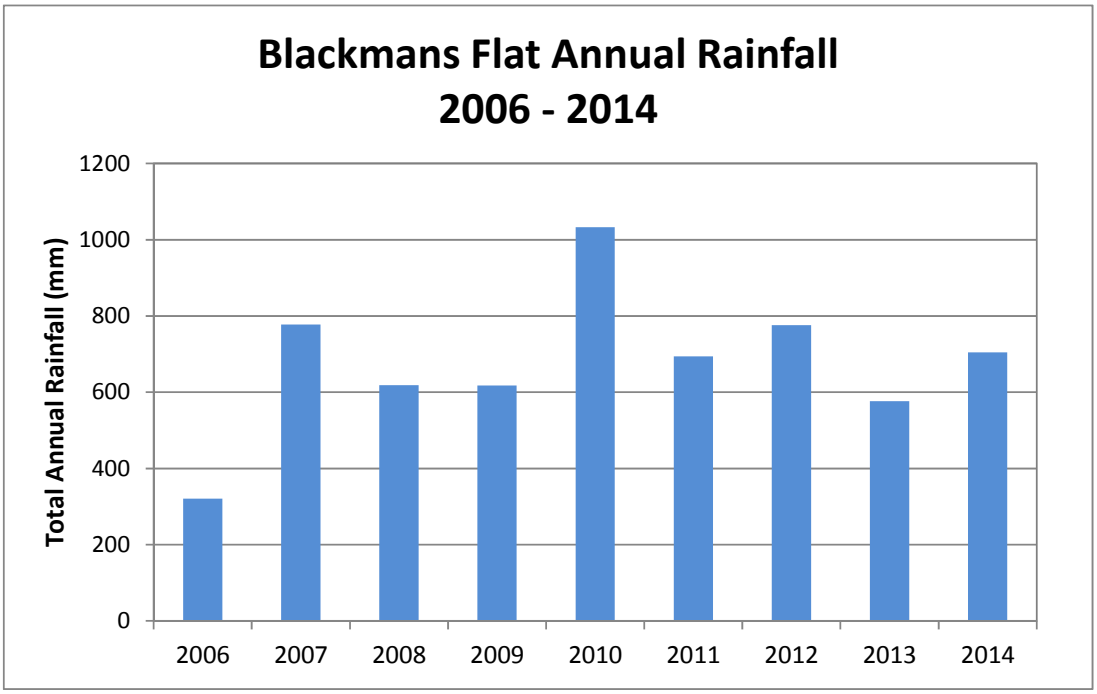
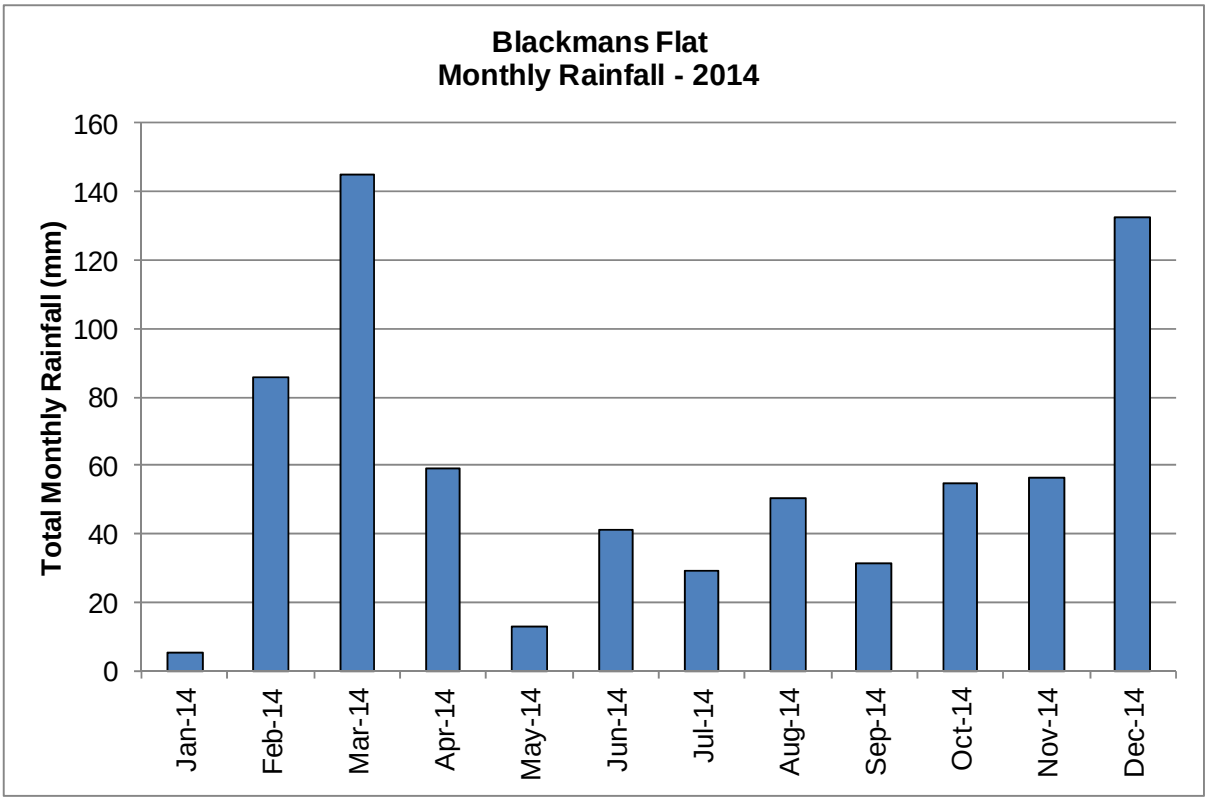


Figure 3
Blackmans Flat Monthly Rainfall 2014



6 ENVIRONMENTAL PERFORMANCE

The final landform and water management structures have been completed at Enhance Place. These areas and structures are inspected on a monthly basis by the Manager of Mining Engineering.

It should be noted that the majority of land within the leases of Enhance Place Mine is privately owned and landowner permission is required to access the site. The land is predominately used for grazing horses year round.

There were no environmental incidents reported during the 2014 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 Lithgow City Council and other relevant stakeholders.

Enhance Place will move to relinquish Mining Leases over the site following a satisfactory rehabilitation outcome and the resolution of the Glen Davis Trust land. Enhance Place will consult with relevant regulators and stakeholders to ensure final land use and landform objectives are achieved. Until the relevant leases are relinquished Enhance Place will continue ongoing monitoring and maintenance of the rehabilitated area as required.

7 COMMUNITY AND LIAISON

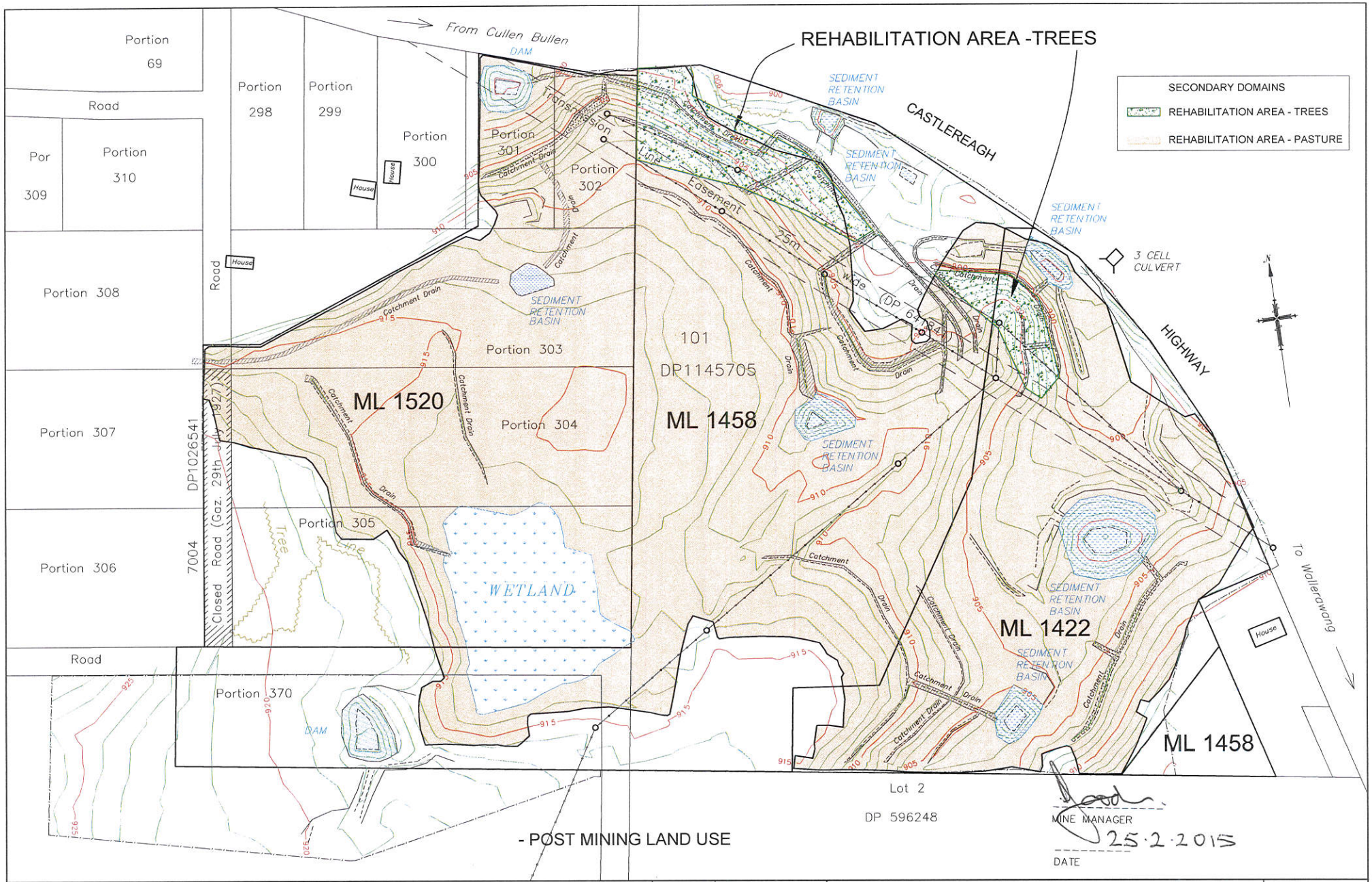
7.1 ENVIRONMENTAL COMPLAINTS

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	18–12–13
AMENDED	
SURVEYOR	T.H./T.E
DRAWN	K.L.F./D.M.
CHECKED	

ENHANCE PLACE MINE
- FINAL REHABILITATION/ POST MINING LAND USE

SCALE - 1 : 1250 (A1 SHEET)

DWG No
ENH-REH
PLAN 4

Appendix B

Rehabilitation Monitoring Report

Enhance Place Pty Limited
ABN: 31 077 105 867

Enhance Place Mine

Rehabilitation Monitoring Report

Prepared by

Enhance Place Pty Ltd

Castlereagh Highway

Blackmans Flat NSW 2790

January 2015

Revision History

Version	Date	Author	Authorised by
Draft	November 2014	Ben Eastwood	Graham Goodwin
Final	January 2015	Tom Hurdley	Graham Goodwin

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1. INTRODUCTION

Enhance Place Pty Ltd (Enhance Place) is a wholly owned subsidiary of EnergyAustralia and holds Mining Leases for the Enhance Place Mining area. Enhance Place Mine is located in the Western Coalfields of NSW at Blackmans Flat, 15km north west of Lithgow on the southern side of Castlereagh Highway, approximately 3km south east of Mount Piper Power Station. Enhance Place Mine has ceased mining operations in 2005 and the site has been rehabilitated predominantly with pasture.

Enhance Place Mine is managed in accordance with Mining Lease (ML) 1520, ML 1458 and ML 1422. The Care and Maintenance Mining Operations Plan dated January 2015 (MOP) has been prepared in accordance with *ESG3: Mining Operations Plan (MOP) Guidelines* (2013) and describes the following rehabilitation objectives:

- *Create a low maintenance, geotechnically stable and safe landform;*
- *Stabilise all earthworks, drainage lines and disturbed areas associated with both past and future activities in order to minimise erosion and the associated generation of sediment-laden water;*
- *Reduce the visual impact from both local or distant vantage points by means of final rehabilitation of areas of disturbance;*
- *Blend the created landform with the surrounding land fabric; and*
- *As appropriate, revegetate with native tree and shrub species and/or pasture species comparable with those on surrounding lands or which occurred in each area prior to agriculture of mining-related disturbance.'*

This report aims to identify progress, successes and failures of rehabilitation with regard to agreed performance indicators and completion criteria. Recommendations are made in areas that could be improved.

2. PERFORMANCE INDICATORS

Rehabilitation performance criteria has been developed for Enhance Place and included in the MOP for the site. The performance indicators include aspects that could be potentially impacted by the current state of the land. A completion criterion for each performance indicator has been developed based on site specific parameters. This report provides a high level review of the rehabilitated areas against the identified completion criteria as currently described in the MOP. The Performance Indicators, Completion Criteria and current status are described in more detail in **Section 5** and **Table 4**.

3. SURVEY METHODOLOGY

3.1 Mapping

Aerial images of Enhance Place Mine have been used to describe the physical location and extent of each study area in a landscape context.

3.2 Quadrats and transects

Monitoring quadrats 1-4 were established in previous surveys undertaken of the site by Cunningham (2012). Transect locations 5-8 were established by First Field Environmental (2014). Survey transects have been established within rehabilitated treed areas and pasture areas to monitor African lovegrass and the effectiveness of any controls. Survey transects have been positioned along observable contours and extend to a length of 50m, covering a width of 10m. Each transect is identified in the field by a surveyors peg. Coordinates of quadrats and transects are included in Appendix A. The locations of monitoring quadrates and transects are shown on **Plan 1**.

3.3 Landform assessment

Landform assessment includes the identification of erosion; drainage impediments; slope; and presence of cracking soils.

Erosion and sedimentation - Evidence of erosion and sedimentation were observed along and in the vicinity of each transect and assessed in accordance with the Australian Soil and Land Survey Field Handbook (CSIRO, 2009).

Drainage impediments - Drainage structures along and within the general vicinity of each transect were identified in the field and assessed for visible impediments and evidence of erosion and sedimentation.

Slope - Slope angle was estimated in the field by calculating angle over distance along each survey transect. Slope angle class and type was defined in accordance with the Australian Soil and Land Survey Field Handbook (CSIRO, 2009).

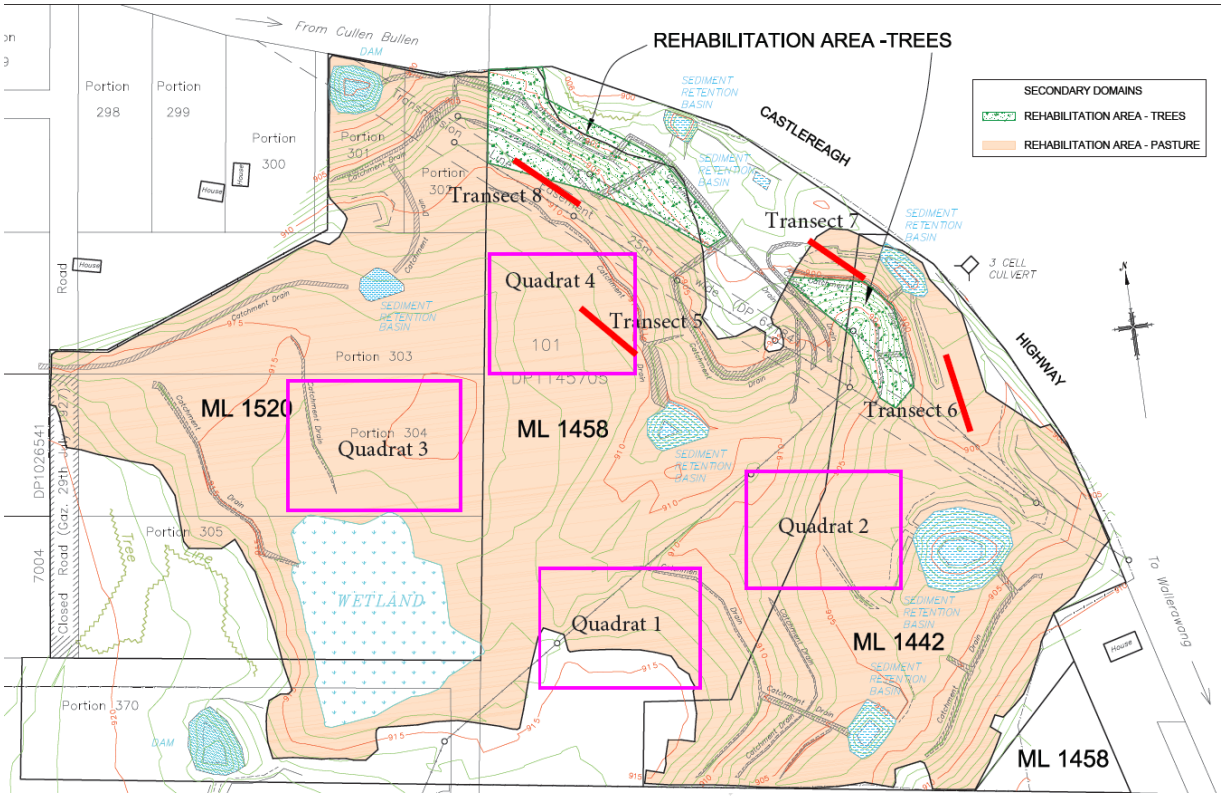
Cracking soils - Soil surfaces along and within the vicinity of each transect were observed for surface cracking.

3.4 Vegetation assessment

Vegetation assessment was conducted within quadrats and along transects within pasture and treed rehabilitation areas.

Vegetation surveys involved walking the 50 m length of each transect while recording species, vegetation structure, percentage ground cover and species richness. A random meander was employed for vegetation survey within quadrats.

Plan 1 Enhance Place Mine



3.5 Photo point monitoring

Photos were taken from the northwest corner of each existing monitoring quadrat. Additional photos were taken along transects within treed rehabilitation areas. Comparison of images from current and previous monitoring surveys shows visual changes to vegetation coverage and structure over time.

3.6 Exotic weed species

Noxious weeds listed for the study area are described by the *Upper Macquarie County Council* (NSW DPI, 2013). Targeted searches for these weeds was conducted along and in the vicinity of each transect. Identification of target weeds was assisted through the use of field guides and botanical keys.

4. RESULTS

Field surveys were conducted on 20 November 2014 by Ben Eastwood (Pine Dale Mine Environmental Manager) and Chris Schofield (Field Assistant). The surveys focused on collecting data to inform the progress of rehabilitation across the study area and provide recommendations if required.

4.1 Weather conditions

Surveys were preceded by a relatively dry winter and spring period. At the time of the survey there had been very little rainfall and it was generally very dry. Average monthly rainfall for the region was variable, with January 2014 records representing the lowest rainfall for that month in nine consecutive years, while April 2014 figures represented the highest records in nine consecutive years. **Table 1** presents regional rainfall data for the period since 2012.

Table 1 Rainfall (in mm) recorded at Lidsdale (Maddox Lane) 2010-2014

	2010	2011	2012	2013	2014
January	76.6	63	48.2	87.4	9.2
February	107.0	68.2	173.8	149.0	85.0
March	60.8	78.0	187.0	43.2	155.0
April	37.6	23.8	31.6	26.8	63.0
May	54.0	42.4	40.6	23.6	14.0
June	39.8	41.2	70.6	87.0	43.2
July	87.4	18.2	48.8	19.6	33.6
August	84.4	54.8	23.2	22.4	56.4
September	64.0	65.4	40.4	44.0	35.2
October	75.8	36.8	16.6	20.8	51.6
November	101.6	158.0	39.0	68.6	36.8
December	217.0	86.0	61.2	38.4	160.4
Annual	1006.0	735.8	781.0	630.8	743.4

4.2 Landform

4.2.1 Erosion and sedimentation

The presence and extent of active surface erosion along transects is recorded in **Appendix A**.

Pasture rehabilitation areas - No significant or active erosion was identified within the pasture study area during the survey. Some sedimentation was evident within areas of exposed soil but was limited to localised displacement of fine-grained particles.

Treed rehabilitation areas - Rill (<300mm depth) and sheet erosion were evident throughout the 1.2ha of treed rehabilitation areas and were associated with increased slope and exposed soils in these locations.

4.2.2 Surface Water Drainage

The survey was conducted following a period of low rainfall and very dry conditions, there was no evidence of surface water pooling during the survey. Previous land-forming and the establishment of drainage structures throughout the study area appear to be appropriate and in good condition (see **Plate 1**).

Plate 1: Water Drop Structures

Water drop structure above SD5 in good condition and stable

Water drop structure in treed area adjacent transect 8 in good condition and stable

Surface water flows to several sediment dams before flowing to the abandoned underground workings located to the north east of the site. Some rill erosion and bare ground was evident at Sediment Dame (SD) 5, and SD4 see **Plate 2** and **Plate 3**.

Plate 2: Sediment Dam 5 (SD5)

SD5 some rill erosion and bare ground evident during very dry conditions

Plate 3: Sediment Dam 4 (SD4)

SD4 some rill erosion and bare ground during very dry conditions

4.2.3 Soils Assessment

A detailed soil assessment had been completed by SLR Consulting on 10 September 2014 at Enhance Place Mine and results documented in their report dated 10 November 2014 *Soil Assessment and Recommendations for Rehabilitation Areas at Enhance Place Mine* (SLR 2014). As such no further soil assessment was conducted at the site as part of this assessment.

No surface cracking in soils was observed during the survey. No lenticular peds or slickensides were evident within soil samples. There was some evidence of settling along the edge of the old open cut mining limit (highwall) in transect 7 and to the west of the 'wetland' area.

4.2.4 Infrastructure

Infrastructure at Enhance Place generally includes power lines, fence lines and access tracks. The power lines are not owned or managed by Enhance Place and were not inspected as part of this audit. The access tracks were generally in good condition with limited erosion or other water damage. Fence lines were generally in good condition and a number of new fence lines had been installed by Enhance Place to create several additional paddocks to assist with stock management (see **Plate 4**).

Plate 4: Fencing

New fencing installed near quadrate 2, generally in good condition.

Stock found within Crown Blocks

4.3 Vegetation

Approximately 21 ha of the study area has been rehabilitated to pasture. An additional 1.2 ha has been planted with trees and shrubs. Pastures were sown with *Cox's River Mix*, comprising:

- 40% Fescue;
- 25% Cocksfoot;
- 20% Subterranean clover;
- 6% Perennial rye grass; and
- 5% White clover and 4% Phalaris.

Flora species identified along and within the vicinity of each transect are listed in **Appendix B**.

4.3.1 Pasture rehabilitation areas

Comparison of percentage vegetation cover (2011, 2012, 2014 and this survey) is presented in **Appendix A** and discussed below:

Species diversity was generally consistent with the April 2014 survey within quadrats 1, 2, 3 and 4, with 5-10 shrub and 34-40 groundcover species identified.

There has been a noticeable reduction in the density of sifton bush (*Cassinia acuate)* in quadrats 1, 2 and 4 following targeted spraying of this species throughout the year. The targeted spraying program has been effective in reducing the density of this species in these areas.

Quadrats 1, 2, and 4 - supported a sparse dominated shrub layer over groundcover of broadleaf herbs and mixed native and exotic grasses. Species diversity appeared to be similar within each of the quadrats. These quadrats, were being grazed by miniature horses (approximately 14) and cattle (approximately 6) at the time of the survey. There was a decrease in the total living cover observed in previous survey efforts which is likely attributable to very dry conditions and grazing pressure.

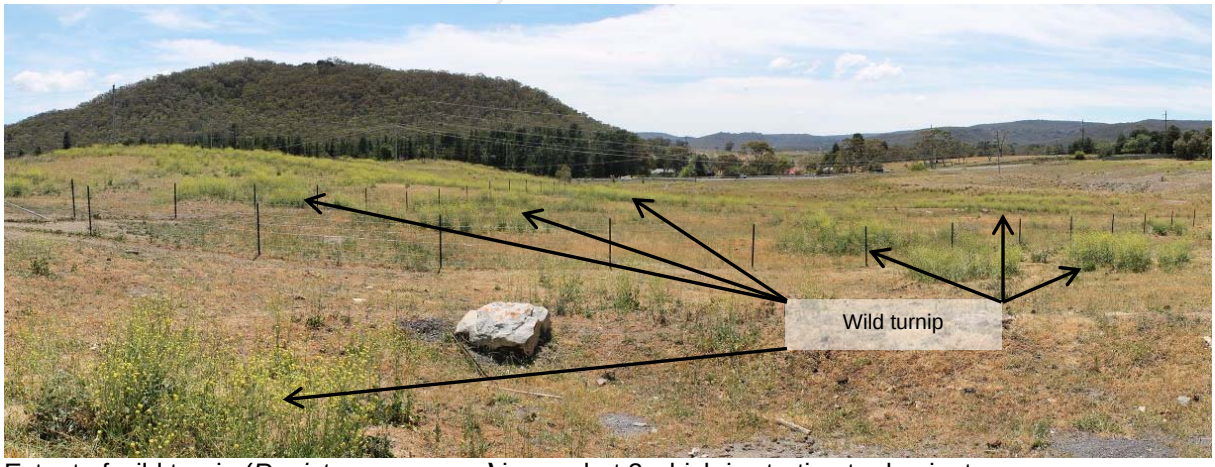
Quadrat 3 located in the Crown Block had a total living cover consistent with previous years in the order of 90%. This is an excellent result and highlights the potential impact grazing can have during dry conditions in particular when compared to quadrates 1, 2 and 4.

Comparison indicates that percentage living cover and bare earth litter has fluctuated over time and appears to be largely influenced by seasonal conditions such as rainfall. Areas of bare ground are evident across the rehabilitated area at Enhance Place.

Localised areas of bare ground are present throughout Enhance Place which are evident particularly during the dry conditions which occurred during the survey.

Rapistrum rugosum commonly known as 'Wild turnip' has been found to have invaded the rehabilitated area at Enhance Place. Wild turnip dominated quadrats 2 and 4 and was present in most other areas of the site. Wild turnip is not a noxious weed in NSW however; it is an undesirable environmental weed. The extent of wild turnip can be seen in quadrat 2 in **Plate 5**.

Plate 5: Wild turnip in Quadrat 2



Extent of wild turnip (*Rapistrum rugosum**)*** in quadrat 2 which is starting to dominate some areas

Rubbish adjacent Quadrate 2 in pasture rehabilitated area

4.3.2 Treed rehabilitation areas

Species density and diversity were generally consistent with previous survey efforts. The area of transect 7 continues to support scattered trees and a sparse shrub layer dominated by C. acuata. An improvement was noted in the reduction of E. curvula following the successful targeted spraying for this species in this area. Approximately 20% of the area was exposed soil and surface erosion was evident. Greater than 45 flora species were identified within transect 7.

Plate 6: Transect 7

Native tree plantings along transect 7 interspersed with *C. acuate*.

Species density and diversity were generally consistent with previous survey efforts. The area of transect 8 continues to support a sparse shrub layer dominated by *C. acuata* with some juvenile native trees and shrubs. The target weed spraying has successfully reduced the presence of African love grass (see **Plate 7**). Approximately 20% of the area was exposed soil and surface erosion was evident. More than 45 flora species were identified in transect 8.

Plate 7: Transect 8, view South

Transect 8 – African love grass prior to treatment (Apr 2014), growing well

Transect 8 – African love grass following treatment (Nov 2014), >98% strike rate

Plate 8: Transect 8, view East

View along transect 8 (Apr 2014)

View along transect 8 (Nov 2014), note dryer conditions and effectiveness of targeted spraying of African love grass.

4.4 Photo point monitoring

Photopoint coordinates for each transect are included in **Appendix A**. Photos taken at quadrats 1, 2, 3 and 4 are presented in **Appendix C** which compares photos taken during previous monitoring surveys.

4.5 Noxious weed species

Noxious weed species identified within and in the vicinity of each quadrat and transect are recorded in **Appendix A** and summarised in **Table 2**.

Table 2 Location of target weed species

Noxious weed species	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4	Transect 5	Transect 6	Transect 7	Transect 8
St John's Wort *Hypericum perforatum*	X	X	X	X	X	X	X	
African Lovegrass *Eragrostis curvula*			X				X	
Blackberry *Rubus fruticosus* sp. *agg.*			X					
Sweet Briar *Rosa rubiginosa*	Property entrance, near transect 8							
Willow *Salix* spp.	SD3 adjacent to Castlereagh Highway							

There has been a significant decrease in the presence of African love grass following the targeted spraying of this species prior to the November survey. The spraying has been very successful in eradicating the species from quadrats 1, 2 and 4. Quadrate 4 has had the greatest decrease from 75% cover in April 2014 to less than 5% in November 2014. A comparison of survey results for African lovegrass is provided in **Table 3**.

Table 3 African love grass % Comparison

	African love grass %		
	Nov 2012	**Apr 2014**	**Nov 2014**
Quadrat 1	6	25	<5
Quadrat 2	3.5	25	<5
Quadrat 3	32.5	25	15
Quadrat 4	15	75	<5

Significant decreases in the density and presence of African lovegrass were also noted in transects 5, 6, 7 and 8. A very high strike rate has been achieved in these areas with little evidence of the species surviving the targeted spray campaign.

5. REHABILITATION STATUS

A high level assessment against the status of the MOP performance indicators and completion criteria are summarised in **Table 4**.

Table 4 Status of rehabilitation completion criteria

Performance indicator	Completion criteria	Status
Erosion	*Stable landform, suitable for grazing and horses* *No exposed highwalls and adits to underground mine workings*	Ongoing. Active surface erosion present in treed rehabilitation areas. No highwalls or adits observed at time of survey.
Surface cracks	*Limited areas of high concentration with cracking due to soil settling*	Complete. No cracks observed at time of survey.
Landform	*Shape and form is visually similar to adjacent land* *Landuse suitable for cattle grazing and horses*	Complete. Landform and shape is visually consistent with adjacent land. Land is suitable for supporting cattle and horse grazing.
Ponding of water	*Sediment ponds constructed* *Contour drains constructed* *Relief ensures water flows as designed and directs water off site*	Complete. Sediment ponds and contour drains have been constructed. Relief facilitates flow of water as designed.
Access tracks, fences and gates	*Site access tracks constructed* *Fences erected* *Gates installed*	Complete. Site access tracks have been constructed. Fences and gates have been installed.
Noxious weeds	*Adequate control of noxious weeds achieved comparable to local area*	Ongoing. Targeted spraying of noxious weeds is effective particularly with African lovegrass and sifton bush. Ongoing weed spraying is required to ensure total control of invasive weeds in the area.
Rural Land Capability	*Pasture Rehabilitation areas are assessed to have a Rural Land Capability Class VI or better (suitable for grazing)*	Ongoing Pasture areas are currently grazed. Grazing management practices are recommended to improve quality of pasture.
Cattle and horses	*Area has successfully supported stock and/or horses for > 12 months at modest rats*	Ongoing. Pasture is currently grazed. Current stocking rates are impacting rehabilitation performance.
Species composition	*Establishment of pasture comprising approximately 70% perennial grass*	Ongoing

Performance indicator	Completion criteria	Status
	and 20% annual legume, representative of species at analogue sites.	Grazing management practices are recommended to improve establishment of pasture.
Weed presence	*Weeds including African Lovegrass to comprise <10% of the pasture sward*	Ongoing Targeted spraying of noxious weeds is effective particularly African lovegrass and sifton bush. Ongoing weed spraying is required to ensure control of invasive weeds in the area.
Vegetation health	*More than 75% of planted species are assessed to be healthy and growing at Year 5*	Ongoing Additional tube stock, fertiliser and mulch is recommended in treed area.
Vegetation distribution	*Native trees planted in designated areas as generally shown in MOP Plan 3*	Complete. Pasture and native trees have been planted in designated areas as per MOP.
Ground cover	*Ground cover - vegetation, leaf litter, mulch >70%*	Ongoing Pasture and treed area improvements works are recommended to be undertaken
Visual amenity	*Completion of bulk earthworks to create final landform* *Completion of seeding and tree plantings*	Complete. Final landform has been created. Pasture and native trees have been planted in designated areas as per MOP.

6. KEY FINDINGS AND RECOMMENDATIONS

6.1 Key findings

Key findings of field surveys conducted in April and November 2014 indicate that:

General findings

a) The landform continues to be stable and is visually similar to adjacent land;
b) Site access tracks have been installed and are in good condition;
c) Fences and gates have been installed and require some maintenance;
d) Noxious weed species are present in low numbers across the property and are subject to ongoing control consistent with statutory requirements; and
e) The targeted weed spraying program for African Lovegrass and Sifton Bush has been very effective in controlling these species in previously impacted areas.

Pasture rehabilitation areas

f) Pasture rehabilitation areas comprise locally occurring pasture species including native and introduced grasses and broad leaf herbs;
g) There is evidence of undesirable species in pasture rehabilitated areas which require further treatment;
h) Several bare areas are evident in pasture rehabilitated areas and particularly adjacent to several sediment basins (SD5 and SD4).
i) Wild turnip has invaded rehabilitation areas;
j) There is evidence of some waste material (plastic) at Enhance Place;
k) Horses and cattle are continuing to graze pasture rehabilitated areas;
l) Horses were observed to be entering through the fence into the Crown Land Block; and
m) Pasture areas have been demonstrated by current owner to support low horse stocking rates.

Treed rehabilitation areas

n) Some surface erosion is evident and would benefit from mulching around tube stock whilst vegetation matures;
o) Some plastic bags to protect trees appear to be inhibiting their growth;
p) There is a high portion of bare ground in treed areas with little mulch and groundcover; and
q) The density of Sifton Bush is considered high in treed areas.

6.2 Recommendations

The following recommendations for mitigation and management are consistent with intervention and adaptive management measures contained within the C&M MOP.

Pasture rehabilitation areas

a) Consult with the horse owner to recommend reducing stock rate and implement stock management practices to allow better establishment of pasture.
b) Continue to implement integrated weed management control methods for noxious weeds as recommended in First Field (2014). This has been reproduced in Appendix D.

c) Implement soil and pasture management strategies and treatment methods as recommended by SLR (2014);
d) Remove minor waste material (plastics) from pasture rehabilitated areas;
e) Treat bare ground adjacent sediment basins.

Treed rehabilitation areas

f) Undertake target weed spraying of noxious weeds;
g) Treat existing erosion channels; and
h) Mulch and resew exposed surfaces with fast-growing groundcover herbs and grasses.

7. REFERENCES

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Appendix A

Quadrat monitoring data

Note that previous coordinates were provided as AMG and have been subsequently converted to WGS84/GDA94-MGA56.

Quadrat 1 monitoring data

Quadrat location				
Corner peg	Easting		Northing	
Northwest	227099		6303904	
Southwest	227099		6303804	
Southeast	227199		6303804	
Northeast	227199		6303904	
Landform and soils				
Slope	Upper slope gently inclining (4-10%) to the southwest.			
Erosion	Not significant. Some sedimentation present on exposed soils. Limited by slope and ground cover.			
Cracking soils	Not present.			
Surface drainage impediments	No significant drainage impediments. Some surface water pooling limited to localised open depressions.			
Vegetation				
Vegetation structure	Sparse *Cassinia acuata* dominated low shrub layer. Groundcover dominated by exotic broadleaf herbs. Grasses dominated by exotic species.			
Species diversity	Shrub layer consists of <5 species, including *C. acuata* and *Rubus fruiticosus sp. agg.* Diverse groundcover dominated by >40 broadleaf herb species. 13 exotic and 6 native grass species identified.			
Cover classification	% cover at each observation			
	Sep 2011	Nov 2012	Apr 2014	Nov 2014
Total living cover	90	94	90	78
Annual living cover	22.75	14.5		
Perennial living cover	67.25	79.5		
Litter cover	7	6	10	22
Bare surface	3	0		
Noxious & other weed presence				
Weed species	% cover		Area (m^2)	
Eragrostis curvula	<5		<50	
Hypericum perforatum	Present		<20	
Rubus fruiticosus sp. agg.	Present		<10	
Rapistrum rugosum	~20		>100	

Quadrat 2 monitoring data

Quadrat location				
Corner peg	Easting		Northing	
Northwest	227264		6303966	
Southwest	227264		6303866	
Southeast	227364		6303866	
Northeast	227364		6303966	
Landform and soils				
Slope	Upper slope gently inclining (4-10%) to the east.			
Erosion	Not significant. Some sedimentation present on exposed soils. Limited by slope and ground cover.			
Cracking soils	Not present.			
Surface drainage impediments	No significant drainage impediments. Some surface water pooling limited to localised open depressions.			
Vegetation				
Vegetation structure	Groundcover dominated by exotic broadleaf herbs with a mix of native and exotic grass species.			
Species diversity	Diverse groundcover dominated by >34 broadleaf herb species. 6 native and 6 exotic grass species recorded.			
Cover classification	% cover at each observation			
	Sep 2011	Nov 2012	Apr 2014	Nov 2014
Total living cover	94.5	91	90	72
Annual living cover	27.75	14.5		
Perennial living cover	66.75	76.5		
Litter cover	3.5	6.5	10	28
Bare surface	2	2.5		
Noxious & other weed presence				
Weed species	% cover		Area (m^2)	
Eragrostis curvula	<5		<50	
Hypericum perforatum	Present		<20	
Rubus fruiticosus sp. agg.	Present		<10	
Rapistrum rugosum	~20		>100	

Quadrat 3 monitoring data

Quadrat location				
Corner peg	Easting		Northing	
Northwest	226973		6304068	
Southwest	226960		6303971	
Southeast	227060		6303962	
Northeast	227083		6304052	
Landform and soils				
Slope	Relatively flat.			
Erosion	Not significant. Some sedimentation present on exposed soils. Limited by slope and ground cover.			
Cracking soils	Not present.			
Surface drainage impediments	No significant drainage impediments. Some surface water pooling limited to localised open depressions.			
Vegetation				
Vegetation structure	Sparse *Cassinia acuata* dominated low shrub layer. Groundcover dominated by exotic broadleaf herbs with a mix of native and exotic grass species.			
Species diversity	Shrub layer consists of <10 species, including *C. acuata*, *Acacia spp*. and *Rubus fruiticosus sp. agg.* Diverse groundcover consisting of >38 broadleaf herb species. 7 native and 7 exotic grasses identified.			
Cover classification	% cover at each observation			
	Sep 2011	Nov 2012	Apr 2014	Nov 2014
Total living cover	87.5	92	90	93
Annual living cover	21.75	17		
Perennial living cover	65.75	75		
Litter cover	6	2.5	10	7
Bare surface	6.5	5.5		
Noxious & other weed presence				
Weed species	% cover		Area (m^2)	
Eragrostis curvula	<10		<100	
Hypericum perforatum	Present		<20	
Rubus fruiticosus sp. agg.	Present		<100	
Rapistrum rugosum	<5		<20	
Cassinia acuata	~15		2,500	

Quadrat 4 monitoring data

Quadrat location				
Corner peg	Easting	Northing		
Northwest	227102	6304154		
Southwest	227088	6304054		
Southeast	227188	6304054		
Northeast	227202	6304154		
Landform and soils				
Slope	Upper slope gently inclining (4-10%) to the southwest.			
Erosion	Not significant. Some sedimentation present on exposed soils. Limited by slope and ground cover.			
Cracking soils	Not present.			
Surface drainage impediments	No significant drainage impediments. Some surface water pooling limited to localised open depressions.			
Vegetation				
Vegetation structure	Sparse *Cassinia acuata* dominated low shrub layer. Groundcover dominated by exotic broadleaf herbs with a mix of native and exotic grass species.			
Species diversity	Shrub layer consists of <10 species, including *C. acuata*, *Acacia dealbata subsp. dealbata* and *Rubus fruiticosus sp. agg.* Diverse groundcover consisting of >38 broadleaf herb species. 6 native and 6 exotic grass species identified.			
Cover classification	% cover at each observation			
	Sep 2011	Nov 2012	Apr 2014	Nov 2014
Total living cover	88.5	89.5	85	86
Annual living cover	22.75	13		
Perennial living cover	65.75	76.5		
Litter cover	5	6.5	15	14
Bare surface	6.5	4		
Noxious & other weed presence				
Weed species	% cover	Area (m^2)		
Eragrostis curvula	<5	<10		
Hypericum perforatum	Present	<20		
Rubus fruiticosus sp. agg.	Present	<10		
Rapistrum rugosum	~25	2,500		

Transect 5 monitoring data

Transect location		
Easting	Northing	
227161	6304091	
227194	6304070	
Landform and soils		
Slope	Transect located along contour of upper slope moderately inclining (~15%) to the southwest.	
Erosion	Not significant. Some sedimentation present on exposed soils. Limited by slope and ground cover.	
Cracking soils	Not present.	
Surface drainage impediments	No significant drainage impediments.	
Vegetation		
Vegetation structure	Sparse shrub layer dominated by C. acuata. Groundcover dominated by exotic broadleaf herbs with a mix of native and exotic grass species.	
Species diversity	Groundcover consisting of >30 broadleaf herb species. 6 native and 6 exotic grass species identified.	
Cover classification	% cover at each observation	
	Apr 2014	Nov 2014
Total living cover	95	78
Annual living cover		
Perennial living cover		
Litter cover	5	22
Bare surface		
Noxious & other weed presence		
Eragrostis curvula		
Hypericum perforatum		
Cassinia acuata		
Rapistrum rugosum		
Rubus fruiticosus sp. agg.		

Transect 6 monitoring data

Transect location		
Easting	Northing	
227421	6304003	
227447	6303954	
Landform and soils		
Slope	Transect located along contour of upper slope gently inclining (4-10%) to the southwest.	
Erosion	Not significant. Some sedimentation present on exposed soils. Limited by slope and ground cover.	
Cracking soils	Not present.	
Surface drainage impediments	No significant drainage impediments.	
Vegetation		
Vegetation structure	Groundcover dominated by exotic broadleaf herbs with a mix of native and exotic grass species.	
Species diversity	Groundcover consisting of >30 broadleaf herb species. 6 native and 6 exotic grass species identified.	
Cover classification	% cover at each observation	
	Apr 2014	Nov 2014
Total living cover	90	92
Annual living cover		
Perennial living cover		
Litter cover	10	8
Bare surface		
Noxious weed presence 2014		
Eragrostis curvula		
Hypericum perforatum		

November 2014

Transect 7 monitoring data

Transect location		
Easting	Northing	
227325	6304082	
227362	6304060	
Landform and soils		
Slope	Transect located along contour of mid slope, moderately inclining (~30%) to the southwest.	
Erosion	Active erosion is evident in areas of exposed soils and is associated with increased slope angle.	
Cracking soils	Not present.	
Surface drainage impediments	No significant drainage impediments.	
Vegetation		
Vegetation structure	• <5% tree cover, 4-8 m height • 15% shrub cover, Mixed juvenile native trees and *Cassinia acuata*, 1.5 m height • 73% groundcover with some mixed native and exotic broadleaf herbs and grasses	
Species diversity	• ~4 native tree species • ~8 native and exotic shrub species • Groundcover of >30 native and exotic broadleaf and grass species	
Cover classification	% cover at each observation	
	Apr 2014	Nov 2014
Total living cover	90	73
Annual living cover		
Perennial living cover		
Litter cover	10	27
Bare surface		
Noxious weed presence 2014		
Eragrostis curvula		
Hypericum perforatum		
Cassinia acuata		

November 2014

Transect 8 monitoring data

Transect location		
Easting	Northing	
227150	6304234	
227192	6304205	
Landform and soils		
Slope	Transect located along contour of mid slope, moderately inclining (~30%) to the southwest.	
Erosion	Active erosion is evident in areas of exposed soils and is associated with increased slope angle.	
Cracking soils	Not present.	
Surface drainage impediments	No significant drainage impediments.	
Vegetation		
Vegetation structure	• <5% tree cover, 5 m height • <10% shrub cover, Mixed juvenile native trees and *Cassinia acuata*, 1 m height • 90% groundcover with some mixed native and exotic broadleaf herbs and grasses	
Species diversity	• ~3 native tree species • ~8 native and exotic shrub species • Groundcover of >30 native and exotic broadleaf and grass species	
Cover classification	% cover at each observation	
	Apr 2014	Nov 2014
Total living cover	90	88
Annual living cover		
Perennial living cover		
Litter cover	10	12
Bare surface		
Noxious weed presence 2014		
Eragrostis curvula		
Cassinia acuata		

Appendix B

Flora species list

Scientific name	Q1	Q2	Q3	Q4	T5	T6	T7	T8	Incidental
Acacia dealbata subsp. *dealbata*			X	X					
Acacia dorothea			X						
Acacia longifolia subsp. *longifolia*			X						
Acacia rubida			X						
Amaranthus sp.	X	X	X	X	X	X			
Ambrosia sp.	X	X	X	X	X	X			
Amphipogon carcinus var. *carcinus*	X	X	X	X	X	X			
Austrodanthonia sp.			X						
Austrostipa sp.	X	X	X	X	X	X			
Bromus catharticus	X	X	X	X	X	X			
Bromus mollis									
Cassinia acuata	X	X	X	X	X	X	X	X	
Chenopodium album	X								
Chloris gayana	X	X	X	X	X	X			
Chondrilla juncea	X	X	X	X	X	X			
Cirsium vulgare	X	X	X	X	X	X			
Conyza bonariensis	X	X	X	X	X	X	X	X	
Conyza sumatrensis	X	X	X	X	X	X	X	X	

Scientific name	Q1	Q2	Q3	Q4	T5	T6	T7	T8	Incidental
Cotula australis	X	X	X	X	X	X			
Cyperus eragrostis			X						
Dactylis glomerata	X								
Echinochloa esculenta	X	X	X	X	X	X			
Echinochloa frumentacea	X	X	X	X	X	X			
Echium plantagineum	X	X	X	X	X	X			
Eleusine tristachya									
Eragrostis curvula			X				X		
Eragrostis parviflora	X	X	X	X	X	X			
Eragrostis tenuifolia	X	X	X	X	X	X			
Eragrostis trachycarpa	X	X	X	X	X	X			
Erodium crinitum	X	X	X	X	X	X			
Eruca sativa	X		X	X	X				
Geranium molle var. *molle*	X	X	X	X	X	X	X	X	
Geranium retrorsum	X	X	X			X			
Gnaphalium luteo-album			X						
Gonocarpus sp.			X						
Helminthotheca echioides	X	X	X	X	X	X			

Scientific name	Q1	Q2	Q3	Q4	T5	T6	T7	T8	Incidental
Hibbertia obtusifolia			X						
Holcus lanatus									
Hypericum calycinum	X	X	X	X	X	X			
Hypericum perforatum	X	X	X	X	X	X	X		
Hypochaeris radicata	X	X	X	X	X	X	X	X	
Juncus sp.	X		X	X	X				
Lepidium bonariense	X	X	X	X	X	X			
Lobelia sp.	X	X	X	X	X	X			
Lolium perenne	X								
Malus pumila									X
Malva sp.	X	X	X	X	X	X	X	X	
Modiola caroliniana							X	X	
Panicum simile	X	X	X	X	X	X	X	X	
Paspalum dilatatum	X	X	X	X	X	X	X	X	
Phalaris aquatica	X		X						
Pinus radiata									X
Plantago lanceolata	X	X	X	X	X	X	X	X	
Plantago varia	X	X	X	X	X	X	X	X	

Scientific name	Q1	Q2	Q3	Q4	T5	T6	T7	T8	Incidental
Poa sp.	X								
Polygonum aviculare	X	X	X	X	X	X			
Rapistrum rugosum	X	X	X	X	X				
Ranunculus sp.	X	X	X	X	X	X	X	X	
Reseda luteola				X					
Rorippa sp.	X	X	X	X	X	X			
Rosa rubiginosa								X	
Rubus fruiticosus sp. *agg.*			X						
Rumex sp.	X	X	X	X	X	X	X	X	
Salix sp.									X
Senecio jacobaea	X	X	X	X	X	X			
Senecio quadridentatus		X	X	X	X	X			
Setaria parviflora	X								
Sisymbrium officinale	X	X	X	X	X	X	X	X	
Sonchus asper	X								
Taraxacum officinale	X								
Trifolium arvense	X	X	X	X	X	X			
Trifolium campestre				X	X				

Scientific name	Q1	Q2	Q3	Q4	T5	T6	T7	T8	Incidental
Trifolium repens	X	X	X	X	X	X	X	X	
Trifolium subterraneum	X	X	X	X	X	X			
Urtica dioica	X	X	X	X	X	X			
Verbascum virgatum	X	X	X	X	X	X			
Verbena bonariensis	X								

Appendix C

Photo point monitoring 2012-2014

Quadrat 1 – View from southwest looking northeast	
	
Cunningham (Nov 2012)	*FirstField (Mar 2014)*
	Blank
Enhance Place (Nov 2014)	

Qadrat 2 – View from southwest looking northeast	
	
Cunningham (Nov 2012)	*FirstField (Mar 2014)*
	Blank
Enhance Place (Nov 2014)	

Qadrat 3 – View from southwest looking northeast	
	
Cunningham (Nov 2012)	*FirstField (Mar 2014)*
	Blank
Enhance Place (Nov 2014)	

Qadrat 4 – View from southwest looking northeast	
	
Cunningham (Nov 2012)	*FirstField (Mar 2014)*
	Blank
Enhance Place (Nov 2014)	

Appendix D

Integrated weed management schedule

Species	Control class *	Control method	Summer			Autumn			Winter			Spring		
			December	January	February	March	April	May	June	July	August	September	October	November
African Lovegrass *Eragrostis curvula*	4	Flupropanate 745 g/L (trade name *Taskforce*) 300 mL per 100 L of water (note 14 day stock withholding period) **Non-chemical options:** appropriate grazing management	X	X	X							X	X	X
Blackberry *Rubus fruticosus* aggregate species	4	Triclpyr 300 g/L + Picloram 100 g/L + Aminopyralid 8 g/L **(trade name *Grazon Extra*)** 350 or 500 mL per 100 L water **Non-chemical options:** slashing of young bushes and use of biological control agents	X	X	X									X
St. John's Wort *Hypericum perforatum*	4	Triclpyr 300 g/L + Picloram 100 g/L + Aminopyralid 8 g/L **(trade name *Grazon Extra*)** 500 mL per 100 L of water **Non-chemical options:** appropriate grazing management and use of biological agents	X											X
Sweet Briar *Rosa rubiginosa*	4	Triclpyr 300 g/L + Picloram 100 g/L + Aminopyralid 8 g/L **(trade name *Grazon Extra*)** 500 mL per 100 L of water **Non-chemical options:** mechanical removal or grubbing	X	X	X								X	X

* Noxious weed control class