



## SUMMARY

Investigations undertaken during this reporting period focussed on the feasibility of mining and processing black, brown and yellow pigments from the Long Plains magnetite, Bowry Creek umber and Main Creek ochre pigment deposits.

Archaeological and botanical surveys were undertaken in the vicinity of the Long Plains magnetite deposit. No Aboriginal sites were located or recorded as a result of the survey and there was no objection to the proposed mining activities from an Aboriginal Cultural Heritage perspective. The vegetation of the areas surveyed contains no species of vascular plants of high conservation significance and the *Eucalyptus nitida* community with rainforest understorey is common in western Tasmania.

Milling trials using magnetite from the Savage River and Long Plains deposits, were undertaken in Switzerland, Germany and Australia. Drying trials also were undertaken in Germany.

Savox® black pigments were trialed and tested by a number of Australian manufacturers of concrete masonry products (pavers and tiles). Weathering of bricks and tiles coloured by Savox pigments continue; results to date indicate that Savox pigments are inert, non-toxic and extremely light fast.

Implications of the possible cessation of mining activities at Savage River were addressed. Savage have obtained assurances from the relevant authorities that all essential services will be maintained regardless of any decision to close the operations at Savage River.

A Feasibility Study to provide capital and operating cost estimates was completed by Davy John Brown Pty Limited.

Joint venture discussions with Australian, North American and Asian companies are on-going.

® Savox is a registered Trade Name.

**EXPLORATION REPORTS**

The following annual and supplementary reports have been lodged with Tasmania Development Resources - Mineral Resources Tasmania:

- **annual:** 23 May 1988 to 23 May 1989;
- **supplementary:** 23 May 1988 to 23 May 1989;
- **supplementary:** 24 May 1989 to 31 Aug 1989;
- **annual:** 31 Aug 1989 to 22 May 1990;
- **annual:** 24 May 1990 to 23 May 1991;
- **annual:** 24 May 1991 to 31 Aug 1992 Volumes I and II;
- **annual:** 01 Sep 1992 to 30 Aug 1993 (DP&EMP);
- **annual:** 01 Sep 1993 to 23 May 1994 (Joint Report with CML 46M/90); and
- **annual:** 24 May 1994 to 23 May 1995 (Joint Report with CML 46M/90).

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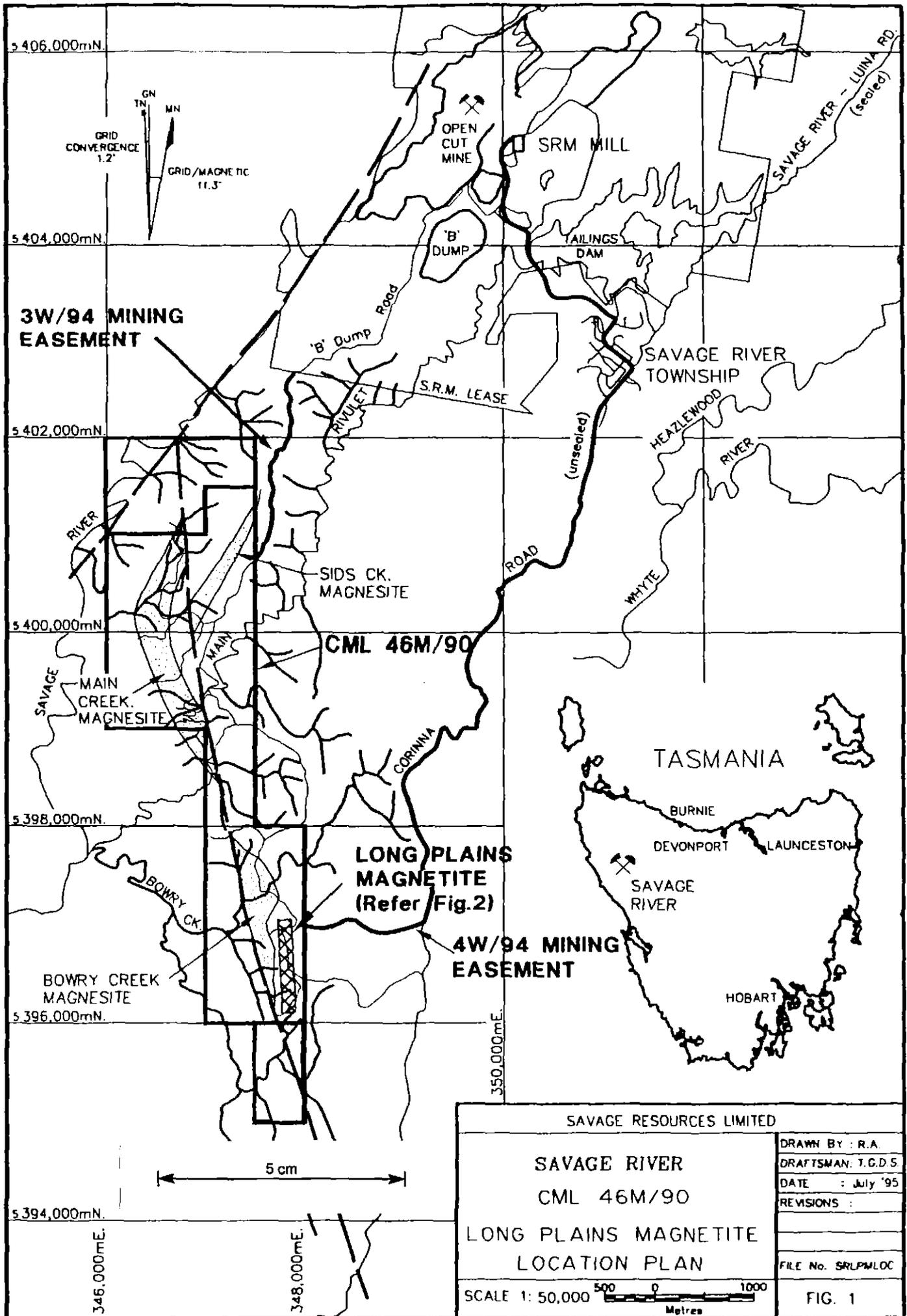
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SAVAGE RESOURCES LIMITED

SAVAGE RIVER  
 CML 46M/90  
 LONG PLAINS MAGNETITE  
 LOCATION PLAN

SCALE 1: 50,000

500 0 1000  
 Metres

DRAWN BY : R.A.  
 DRAFTSMAN: T.G.D.S.  
 DATE : July '95  
 REVISIONS :  
 FILE No. SR/PLM/LOC  
 FIG. 1

## 1. INTRODUCTION

The consolidated mining lease, retention licence and mining (haulage) easements are located approximately 6 km south-west of the Savage River Township.

Access to the ochre site is south along an exploration track (the *B dump road*) from the SRM iron ore operations, a distance of some 5 km. The umber site is located another 4 km to the south and 13 km by road from SRM, access is gained via a track that runs off the Waratah to Corinna road (Figure 1).

The northern most part of the Long Plains magnetite deposit is located a few hundred metres east of the Bowry Creek umber site; both deposits share a common access route.

## 2. TENURE

Tenure is held under Retention Licence 8802 (expires 23 May 1998), Consolidated Mining Lease 46M/90 (expires 31 July 2003) and two Mining (Haulage) Easements 3W and 4W/94 (expire 31 January 2005). The area comprises State Forest - Multiple Use Forest Land and Crown Land - Deferred Forest Land.

There has been no change to the status of the above tenements within the reporting period.

It is on record with the Savage River Mines taskforce, through Industry Safety and Mines, that Savage is actively seeking to secure title over a part of the SRM lease area, unencumbered of any liabilities or penalties, for the purposes of the proposed processing activities. The preferred location is immediately to the north and east of the SRM concentrator building on part of the disused "E" dump.

## 3. PLANNING APPROVALS

Minor (*evolutionary*) changes to the proposed Savox pigment project have not necessitated amendment or alteration of the conditions attached to Licence No. 5831 and have not required formal assessment under Section 29 of the Environment Protection Act 1973.

As of the 25 January 1996, under the Environmental Management and Pollution Control Act 1994 (EMPCA), the Savox pigment project is deemed a level 2 activity and thereby regulated by the Division of Environmental Management through the Board or the Director of Environmental Management.

The Wynyard-Waratah Planning Permit expires on the 11th January 1997.

## 4. EXPLORATION

### 4.1 HT Ochre Site

There has been no exploration this reporting period.

The *B-dump road* between the HT ochre site and the SRM mine site was surveyed to identify those parts of the haulage route (down load) where gradients exceed 10% (refer Mines Inspection Regulations 1991, 304 4(a)). Minor modifications to the existing track were recommended by the District Mines Inspector.

#### 4.2 The Bowry Creek (East) Umber Site

There has been no exploration this reporting period.

The track between the Bowry Creek umber site and the Waratah - Corinna Road was surveyed and haulage gradients determined. It was recommended that substantial "side-road" bunding was needed between the Long Plains magnetite deposit and the Bowry Creek umber site.

#### 4.3 Long Plains Magnetite Deposit

A botanical survey of the area likely to be affected by the proposed magnetite mining operation at Long Plains was conducted by the Tasmanian Herbarium over several days in September, 1995 (Appendix 1).

A survey for Aboriginal and Historic sites, over an approximate area of 20 hectares containing the Long Plains magnetite ridge, was undertaken by du Cros and Associates (Appendix 2) and Peter Scotney for the Tasmanian Aboriginal Land Council in September, 1995 (Appendix 3).

### 5. DEVELOPMENT ACTIVITIES

#### 5.1 The Pigment Project

Activities have focussed on the commercial viability of the pigment project. This has entailed the finalisation of the process flow sheets, engineering and site construction planning, market appreciation of the Savox pigments and financial analysis.

##### 5.1.1 Milling

Milling trials were undertaken in both Switzerland, Germany and Australia using horizontal stirred bead mills. The following milling parameters were optimised:

- mill type (type and number of agitator discs, grinding chamber dimensions, etc);
- grinding media size;
- grinding mode;
- packing density and fill size;
- slurry density and throughput speed; and
- grinding aids.



- electrical drawings and load study; and
- capital and operating cost estimates.

### 5.1.4 Market Studies

Savox pigments have been evaluated by a number of organisations (each organisation often has its own preferred evaluation methods). A few of the more common testing methods and results are given below, those pigments marked with a \* are Savox pigments.

#### (a) Colour of Dry Powder

This is used as a guide to the tinting strength in the draw down test.

Table 2. Colour of Dry Powder.

Sample	CIE - Lab Colour Co-ord		
	L	a	b
Calsiro*	33.6	10.9	7.9
Red Ochre*	43.9	22.5	32.0
Bayer Red 110	42.6	29.3	34.4
Yellow Ochre*	65.7	5.4	45.0
Bayer Yellow 420	70.6	6.3	59.3
Raw Umber*	31.6	6.3	18.2
Burnt Umber*	30.5	5.7	12.7
Bayer Brown 686	27.2	6.1	8.8

#### (b) Cement Paste Draw Down

This test measures the point at which the pigment saturates. All Savox pigments show good tinting strengths and saturation at 5% with very little increase in a\* and b\* values to 10%. Yellow ochre however requires a 10% level to achieve good saturation and tinting.

All Bayer products saturate at about 5% but they do not tint as well to the colour of their dry powder readings.

see over

Table 3. Cement Paste Draw Down

Sample	Oxide Level	CIE - Lab Colour Coordinates					
		After 24 hrs 100% RH			After 24 hrs 40°C		
		L	a	b	L	a	b
Calsiro*	5%	51.7	10.3	6.4	51.7	9.8	5.2
	10%	43.5	11.0	7.4	43.4	10.7	7.0
Red Ochre*	5%	54.5	20.5	31.3	54.7	20.5	31.2
	10%	50.1	21.6	31.7	49.7	21.6	31.5
Bayer 110	5%	49.9	28.2	28.4	50.5	28.1	27.3
	10%	46.7	28.2	28.0	47.4	28.3	27.6
Yellow Ochre*	5%	75.3	1.7	39.1	75.1	2.0	38.9
	10%	66.6	4.9	44.9	66.4	5.2	44.5
Bayer 420	5%	73.8	4.3	49.3	75.3	3.7	47.3
	10%	71.1	5.8	52.3	72.9	5.7	51.5
Raw Umber*	5%	52.9	4.5	18.6	52.7	4.7	18.2
	10%	44.6	4.8	17.4	44.6	5.4	17.4
Burnt Umber*	5%	45.8	5.3	12.5	45.8	5.3	12.6
	10%	40.9	5.1	10.7	40.9	5.1	10.7
Bayer 686	5%	40.4	5.6	6.4	40.9	5.6	6.4
	10%	35.0	5.2	5.1	36.2	5.2	4.5

## (c) Normal Consistency with Grey Cement

This test measures the amount of water to make a paste of designated consistency. The water is expressed as a percentage of the dry ingredients (600g). A more realistic figure to use is the ratio of the water required to the amount of the cement in the paste (w/c). The w/c ratio will usually increase when a pigment is used. This can have an adverse affect on strength especially for pigmented slurry coats used on roofing tiles.

Table 4. Normal Consistency with Grey Cement

Sample	Water (gm)	Normal Consistency (%)	W/C for 571 g cement
Calsiro*	151.0	21.1	0.260
Red Ochre*	157.0	26.2	0.275
Bayer Red 110	157.0	26.2	0.275
Yellow Ochre*	157.0	26.2	0.275
Bayer Yellow 420	167.0	27.8	0.292
Raw Umber*	160.0	26.6	0.280
Burnt Umber*	160.0	26.7	0.280
Bayer Brown 686	156.0	26.0	0.273

**(d) Autoclave Stability**

Most oxides/cement samples suffer a 1 to 3 unit change on autoclaving, with a colour difference of 1 unit being just perceptible to an average observer. Usually the colour difference is caused by a slight lightening of the sample which can be seen by an increase in L\*.

Table 5. Autoclave Stability

Sample	CIE-Lab Colour Coordinates						Colour Change
	Before Autoclave			After Autoclave			
	L	a	b	L	a	b	
Calsiro*							
Red Ochre*	33.3	7.2	12.2	36.3	4.6	10.8	4.21
Bayer 110	35.6	14.0	16.7	36.9	15.3	18.4	2.50
Yellow Ochre*	37.1	-1.1	12.2	41.0	-1.5	4.9	8.29
	37.2	-0.7	11.6	41.2	-1.1	4.7	7.99
Bayer 420	41.9	-1.5	20.4	43.6	-1.3	18.5	2.56
Raw Umber*							
Burnt Umber*	29.0	1.8	5.6	30.7	2.2	5.7	1.75
Bayer 686	27.5	2.6	5.1	29.0	2.4	4.0	1.87

**(e) Physical Testwork - Break Load and Flexural Strength**

The use of pigments in cement products may adversely affect the strength of the product. Physical testwork is performed on the end product to ascertain such features as break load and flexural strength. For example the CMAA standard for high volume foot paths is:

Characteristic Break Load	>5.00
Characteristic Flexural Strength	>3.00

see over

Table 6. Savox Pigments Break Load and Flexural Strength - 7 Days

Sample	Weight	Breaking Load	Flexural Strength
		Kilo Newtons	MPa
1H	3510.1	7.00	3.84
2H	3547.5	7.75	4.25
3H	3689.8	8.00	4.39
4H	3456.1	6.00	3.29
5H	3606.4	7.50	4.12
6L	3442.8	7.50	4.12
7L	3509.1	6.50	3.57
8L	3465.9	7.75	4.25
9L	3470.6	8.00	4.39
10L	3580.5	9.00	4.94
AVERAGE		7.50	4.12
C. Break Load		6.10	
C. Flexural Strength		3.42	

Table 7. Savox Pigments Break Load and Flexural Strength - 28 Days

Sample	Weight	Breaking Load	Flexural Strength
		Kilo Newtons	MPa
1H	3510.1	7.50	4.12
2H	3547.5	9.25	5.08
3H	3689.8	13.50	7.41
4H	3456.1	9.00	4.94
5H	3606.4	10.25	5.62
6L	3442.8	10.25	5.62
7L	3509.1	8.75	4.80
8L	3465.9	8.75	4.80
9L	3470.6	10.25	5.62
10L	3580.5	8.00	4.39
AVERAGE			
C. Break Load		6.78	
C. Flexural Strength		3.72	

## (f) Physical Testwork - Abrasion Index

An abrasion figure of 3.5 approximates to typical wear for high volume footpaths and pedestrian malls over 20 years.

Table 8. Savox Pigments Abrasion - 28 Days

Abrasion Index # SQ	Sample	Abrasion Index #
7.7	1H	2.78
13.1	2H	3.62
12.5	3H	3.54
9.7	4H	3.12
6.7	5H	2.58
15.0	6H	3.87
7.4	7H	2.72
9.0	8H	3.00
6.5	9L	2.55
7.6	10L	2.75
17.0	11L	4.12
17.0	12L	4.12
13.7	13L	3.70
11.6	14L	3.41
13.0	15L	3.60
10.5	16L	3.24
<b>MEAN AVERAGE</b>		<b>3.30</b>

## (g) Weathering Testwork

There are three principal methods to determine the changes in colouration with time and weathering:

- open air exposure;
- advanced weathering; and
- cycles of light and dark at varying temperatures and humidity.

A range of Savox pigments have been tested by all three methods; the first two methods by Allunga Exposure Laboratory in Townsville and the latter method by Boral Material Testing in Greystanes, Sydney.

Results of open air weathering on four Savox pigments over a nine month period are reproduced in Appendix 4.

Advanced or accelerated weathering uses mirrors to reflect sunlight onto the coloured surface; the mirrors track the movement of the sun throughout the day to maximise the amount of reflected light. This method exposes the coloured surfaces to between 4-5 times more solar radiation. The results from 21 months (on-going) of weathering are reproduced in Appendix 5.

The results from the exposure over 143 days, 12 hour cycles of 8 hours UVB at 70°C followed by 4 hours of dark condensation at 45°C, of bricks and tiles coloured by Savox pigments are reproduced in Appendix 6. The trials were undertaken by Boral Materials Testing. Note the reference to efflorescence is a function of the manufacture of the brick and not the result of the Savox pigment loading.

(h) Direct Comparison between Savox Black and Bayer 318 Standard

The iron oxide pigment industry is dominated by black. In order to gain an understanding of the pigmentary characteristics of the Savox black a number of tests were performed on both a Bayer 318 and the Savox black. The testwork and weathering trials have been undertaken by Boral Material Testing Services and Allunga (Appendix 7).

The Savox black performs as well as or better than the synthetic Bayer 318.

## 6. CONCLUSIONS

Savox pigments have been found to be comparable or better than commercially available natural iron oxide pigments. The Savox black pigment is comparable or marginally better than the synthetic Bayer 318 black although it is only approximately 65% the strength of the synthetic Silo 77 black (the strongest black currently available).

There is a considerable market in Australia, SE Asia and N. America for the Savox black but less so for the Savox brown and yellow pigments.

Subject to securing a co-venture partner, the Savox pigment project will be constructed in stages with Stage I consisting of the production of black only using magnetite from the SRM operations. In Stage II the Long Plains magnetite deposit would be mined and the material processed if and when SRM magnetite is no longer available. Yellow (ochre) and brown (umber) would be mined and processed in Stage III.

Co-venture discussions with a number of Australian and overseas companies have been, or are close to being, concluded.

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APPENDIX ONE

TASMANIAN HERBARIUM BOTANICAL REPORT

BOTANICAL SURVEY  
OF THE AREA AFFECTED BY A PROPOSED  
MAGNETITE MINING OPERATION AT LONG PLAINS,  
NEAR SAVAGE RIVER, TASMANIA

Report prepared by the Tasmanian Herbarium  
for  
Savage Resources Limited

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**BOTANICAL SURVEY OF THE AREA  
AFFECTED BY A PROPOSED  
MAGNETITE MINING OPERATION AT LONG  
PLAINS, NEAR SAVAGE RIVER, TASMANIA**

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**Report prepared by the Tasmanian Herbarium  
for  
Savage Resources Limited**

**A. C. Rozefelds and D. I. Morris**

**20 September, 1995**

## INTRODUCTION

This report describes the vegetation that would be affected by a proposed small mine in north western Tasmania. Savage Resources Limited proposes to mine an area along a ridge about nine kilometres south of the Savage River township, and one kilometre off the Savage River to Corinna Road. The deposit is referred to as the Long Plains, Northern Area Magnetite Deposit and has not been mined previously. The magnetite mined will be used in the production of pigments. Botanical surveys of other sites affected by proposed pigment (umber and ochre) mining operations have been previously undertaken in this area by the Tasmanian Herbarium (Buchanan, 1993).

The average annual rainfall at Savage River is 1957 mm. The wettest month is July with 241 mm, while February is the driest month with 74 mm. The mean maximum temperature in summer is 18°C and the mean minimum in winter is 4°C.

The site was inspected, and floristic data and brief notes on the structural components of the flora were recorded. Vegetation on either side of the track was examined in detail and forest areas away from the track that were less disturbed, were also examined. Plant species of importance are assigned a risk code according to the system of the Flora Advisory Committee (1994). An assessment of the importance of this particular area is provided based upon the plant species recorded. The uniqueness of the plant community recorded in this survey is also assessed on the basis of the available literature.

## SURVEYED SITE: LONG PLAINS, NORTHERN AREA MAGNETITE DEPOSIT

The proposed mining site is located on a ridge at 260-280 metres asl (grid reference 478 966; Meredith 1: 25,000 Sheet, No. 3439) above Bowry Creek, a tributary of Savage River (Fig. 1). The area surveyed is approximately nine hectares in extent and follows the top of the ridge line for approximately 800 metres (Fig. 2). It shows disturbance due to access tracks, preliminary diamond drilling associated with geological reconnaissance, and earlier forestry practices. The forest is regenerating from a wildfire in 1982.

### Taxa recorded

Thirty seven taxa, listed alphabetically, were recorded from the site. A number of taxa, particularly small herbs and graminoids, could not be identified to the species level because the plants were too young. Vascular plant nomenclature follows Buchanan (1995). The area surveyed appears relatively uniform, consisting of a mixed eucalypt/rainforest community. The area has been selectively logged in the past.

### Angiospermae

*Acacia melanoxylon* R.Br.  
*Acacia mucronata* Willd. ex Wendl.f. ssp *mucronata*  
*Agrostis* sp.  
*Anodopetalum biglandulosum* A.Cunn. ex Hook.f.  
*Anopterus glandulosus* Labill.  
*Cassinia aculeata* (Labill.) R.Br.  
*Cirsium vulgare* (Savi) Ten.  
*Coprosma quadrifida* (Labill.) Robinson  
*Cyathodes juniperina* (Forst.f.) Druce  
*Dianella tasmanica* Hook.f.  
*Eucalyptus nitida* Hook.f.  
*Eucryphia lucida* (Labill.) Baill.  
*Gahnia grandis* (Labill.) S.T.Blake  
*Gnaphalium collinum* Labill.  
*Gnaphalium* sp.  
*Hydrocotyle hirta* R.Br. ex A.Rich.  
*Hydrocotyle sibthorpioides* Lamk.  
*Isolepis subtilissima* Boeck.  
*Juncus bassianus* L.Johnson  
*Juncus planifolius* R.Br.  
*Leptospermum scoparium* Forst. & Forst.f.  
*Monotoca glauca* (Labill.) Druce  
*Nothofagus cunninghamii* (Hook.) Oersted  
*Oxalis* sp.  
*Phebalium squameum* (Labill.) Engl.  
*Pimelea drupacea* Labill.  
*Pimelea linifolia* Smith  
*Pomaderris apetala* Labill.  
*Pterostylis* sp.  
*Senecio gunnii* (Hook.f.) Belcher  
*Tasmannia lanceolata* (Poiret) A.C.Smith

**Gymnospermae**

*Phyllocladus aspleniifolius* (Labill.) Rich. ex Hook.f.

**Pteridophyta**

*Blechnum watsii* Tind.  
*Histiopteris incisa* (Thunb.) J.Smith  
*Hypolepis rugosula* (Labill.) J.Smith  
*Polystichum proliferum* (R.Br.) C.Presl  
*Pteridium esculentum* (Forst.f.) Cockayne

**Remarks**

The vegetation was burnt in the early 1980's, and the boles of old eucalypts attest to the forest being logged at an earlier time. The plant community is dominated by regrowth of young trees of *Eucalyptus nitida*, which form a broken canopy 5-10 metres high. Associated with the *Eucalyptus nitida* are occasional *Acacia melanoxylon* trees, which are more common in the southern part of the survey area. The understorey consists of small shrubs including *Pomaderris apetala*, *Coprosma quadrifida*, *Phebalium squameum* and *Monotoca glauca*. Associated with these species are juvenile rainforest taxa usually less than one metre in height. These rainforest taxa include *Nothofagus cunninghamii*, *Phyllocladus aspleniifolius*, *Eucryphia lucida*, *Anopterus glandulosus* and *Anodopetalum biglandulosum*. The ground cover is dominated by *Gahnia grandis*, particularly in the southern part of the survey area, with occasional plants of *Dianella tasmanica* and ferns (*Pteridium esculentum*, *Histiopteris incisa* and *Hypolepis rugosula*).

Along the verges of the prospecting tracks and in other disturbed areas, the shrubs *Acacia mucronata* and *Leptospermum scoparium* occur, along with other opportunistic plants including *Isolepis subtilissima* and species of *Juncus*, *Hydrocotyle*, *Agrostis*, and *Oxalis*. The only exotic weed recorded was *Cirsium vulgare*.

Mosses, liverworts and lichens are abundant on the decaying logs and trunks in the survey area but were not included in the survey.

The two principal parameters used to assess the botanical importance of the surveyed area are the presence of any endangered, vulnerable or rare taxa in the survey area and the uniqueness of the plant communities. This survey did not record any vascular plant species that have been allocated a risk code *sensu* the Flora Advisory Committee (1994).

Rainforest is considered the climax vegetation throughout most of this high rainfall region except in poorly drained infertile soils where open or scrubby moorland occur (Jarman *et al.*, 1984). Fire-induced successional forests and mixed rainforest/eucalypt forests are also widespread (Kirkpatrick *et al.*, 1988). The area surveyed includes *Eucalyptus nitida* and rainforest taxa and therefore is a community type that is not unique or unusual, and is quite common in western Tasmania.

### CONCLUSIONS

The vegetation of the area surveyed contains no species of vascular plants of high conservation significance and the *Eucalyptus nitida* community with rainforest understorey is common in western Tasmania.

## REFERENCES

- Buchanan, A. M. 1993. Botanical survey of sites affected by a proposed pigment mining operation at Savage River. [Unpublished Report prepared by the Tasmanian Herbarium for Savage Resources Limited]
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- Flora Advisory Committee, 1994. Native higher plant taxa which are rare or threatened in Tasmania. Parks and Wildlife Service, Hobart, 22pp.
- Kirkpatrick, J. B., Peacock, R. J., Cullen, P. J. and Neyland, M. G. 1988. The wet eucalypt forests of Tasmania. Tasmanian Conservation Trust Inc. 156pp.

## SYNOPSIS

A list, in family order, of all taxa recorded.

## DICOTYLEDONAE

## Apiaceae

*Hydrocotyle hirta* R.Br. ex A.Rich.

*Hydrocotyle sibthorpioides* Lamk.

## Asteraceae

*Cassinia aculeata* (Labill.) R.Br.

*Cirsium vulgare* (Savi) Ten.

*Gnaphalium collinum* Labill.

*Gnaphalium* sp.

*Senecio gunnii* (Hook.f.) Belcher

## Cunoniaceae

*Anodopetalum biglandulosum* A.Cunn. ex Hook.f.

## Epacridaceae

*Cyathodes juniperina* (Forst.f.) Druce

*Monotoca glauca* (Labill.) Druce

## Escalloniaceae

*Anopterus glandulosus* Labill.

## Eucryphiaceae

*Eucryphia lucida* (Labill.) Baill.

## Fagaceae

*Nothofagus cunninghamii* (Hook.) Oersted

## Mimosaceae

*Acacia melanoxylon* R.Br.

*Acacia mucronata* Willd. ex Wendl.f. ssp *mucronata*

## Myrtaceae

*Eucalyptus nitida* Hook.f.

*Leptospermum scoparium* Forst. & Forst.f.

## Oxalidaceae

*Oxalis* sp

## Rhamnaceae

*Pomaderris apetala* Labill.

## Rubiaceae

*Coprosma quadrifida* (Labill.) Robinson

## Rutaceae

*Phebalium squameum* (Labill.) Engl.

## Thymelaeaceae

*Pimelea drupacea* Labill.

*Pimelea linifolia* Smith

## Winteraceae

*Tasmania lanceolata* (Poiret) A.C.Smith

## MONOCOTYLEDONAE

## Cyperaceae

*Gahnia grandis* (Labill.) S.T.Blake

*Isolepis subtilissima* Boeck.

## Juncaceae

*Juncus bassianus* L.Johnson

*Juncus planifolius* R.Br.

**Liliaceae***Dianella tasmanica* Hook.f.**Orchidaceae***Pterostylis* sp.**Poaceae***Agrostis* sp.**GYMNOSPERMAE****Phyllocladaceae***Phyllocladus aspleniifolius* (Labill.) Rich. ex Hook.f.**PTERIDOPHYTA****Blechnaceae***Blechnum watsii* Tind.**Dennstaedtiaceae***Histiopteris incisa* (Thunb.) J.Smith*Hypolepis rugosula* (Labill.) J.Smith*Pteridium esculentum* (Forst.f.) Cockayne**Dryopteridaceae***Polystichum proliferum* (R.Br.) C.Presl

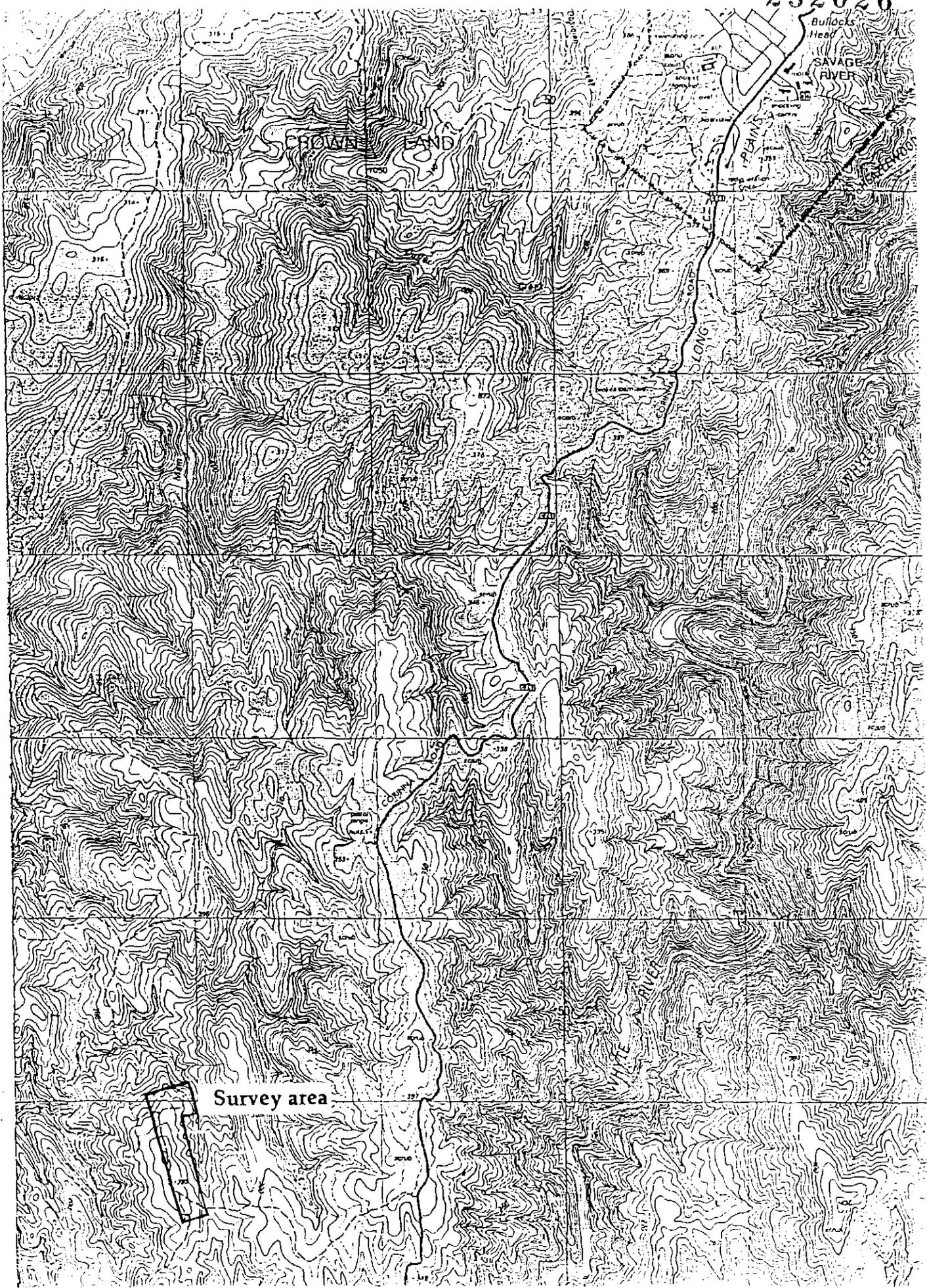
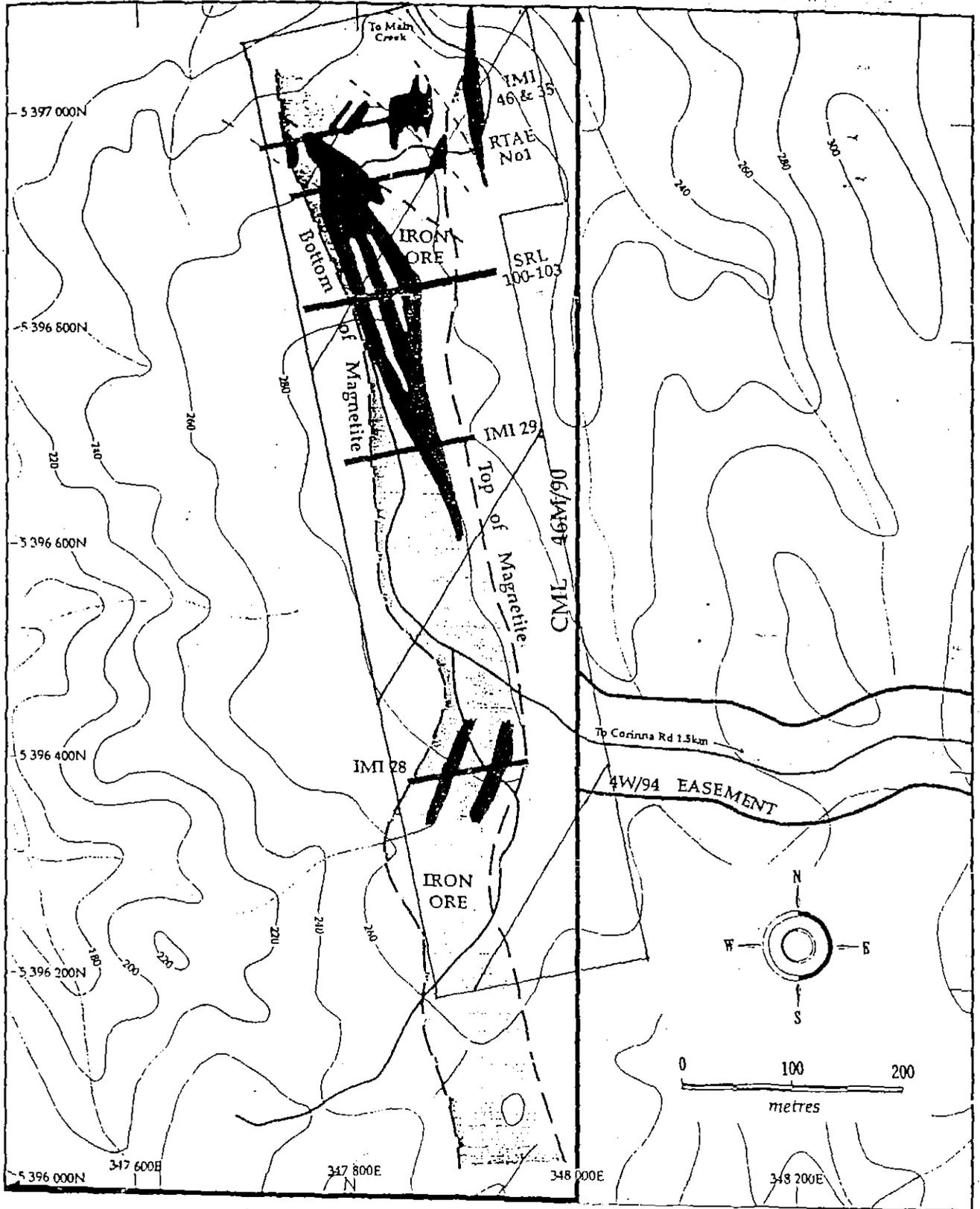


Fig. 1. Location of survey area (Map adapted from the Meredith and Savage River 1: 25,000 sheets).

5 cm

# LONG PLAINS NORTHERN AREA MAGNETITE DEPOSIT



5 cm

Fig. 2. Detailed map of Survey Area. (Map supplied by Savage Resources Limited).

APPENDIX TWO

DU CROS AND ASSOCIATES ARCHAEOLOGICAL REPORT

**An Archaeological Survey  
of the  
Long Plains Ore Body,  
Savage River, Tasmania**

**Steve Brown**

**Report to Savage Resources Limited**

**Report by du Cros and Associates  
322 Bay Street  
Port Melbourne  
Victoria**

**September 1995**

## SUMMARY

A survey for Aboriginal and Historic sites has been undertaken of the Long Plains ore body for Savage Resources Limited. This company is currently undertaking a feasibility study of the ore body. The study area comprises an area of 800m by 250m (20 hectares) situated 7km south-south-west of the town of Savage River (Figures 1 and 2).

Background information is provided in the report - this comprises an environmental description of the study area (Chapter 2) and a review of previous archaeological work in the region (Sections 3.2 and 4.1). Few Aboriginal and historic archaeological sites have been previously recorded in the vicinity of the study area.

No Aboriginal or historic archaeological sites were recorded during the survey of the Long Plains ore body, and no areas of archaeological sensitivity were noted. Coverage of the survey area was considered to be good since it was possible to examine a large and wide range of undisturbed and disturbed ground surfaces, including some sub surface ground profiles where recent cuttings have occurred (Section 3.3) - this is often difficult to achieve in such heavily forested parts of inland north west Tasmania.

Some simplistic and preliminary interpretations regarding the Aboriginal prehistory of the area, drawing on the results of Cosgrove's 1990 forestry study, are advanced which can be tested through future archaeological studies in the region.

Since no Aboriginal or historic sites were located during the field survey, and there are considered to be no areas of archaeological sensitivity within the study area, the range of management options for the study area are limited to:

1. no further investigation for Aboriginal and historic archaeological sites within the boundaries of the Long Plains ore body (Figure 2); and
2. monitoring of the ground surface of the Long Plains ore body for cultural remains when initial ground surface disturbance associated with the commencement of mining begins.

Since no Aboriginal or historic archaeological material was located during the field survey of the Long Plains ore body, and there is little potential for the occurrence of such material within this area, then Option 1 is preferable from an archaeological point of view and from a cultural point of view (see Scotney's 1995 report to TALC).

However if the mining development is to proceed, then it is recommended that further survey for Aboriginal and historic sites be undertaken for all areas outside of the boundaries of the Long Plains ore body impacted by proposed development including proposed new roads and tracks and other facilities associated with the mine.

Finally, management recommendations are presented (Section 5.2). The management recommendations are based on the absence of recorded Aboriginal and historic sites within the boundaries of the Long Plains ore body, and the low potential for significant cultural remains to occur within this area.

### 1. Long Plains Ore Body

Since no Aboriginal or historic archaeological material was located during the field survey of the Long Plains ore body and there is little potential for the occurrence of significant cultural remains within this area, it is recommended that no further archaeological work within this area is required to be carried out.

## 2. Location of Cultural Material During Development

If any Aboriginal cultural material, including stone artefacts and human skeletal material, is located during the development of the Long Plains ore body, then the find must be reported to the Department of Environment and Land Management and consultation with the Tasmanian Aboriginal Land Council and the Department of Environment and Land Management must take place regarding the future management of any such material.

## 3. Further Work

If the mining development is to proceed, then further survey for Aboriginal and historic sites should be undertaken for all areas outside of the boundaries of the Long Plains ore body impacted by proposed development including proposed new roads and tracks and other facilities associated with the mine.

## 4. Distribution of the Report

Copies of the final version of this report should be forwarded to the Tasmanian Aboriginal Land Council and the Aboriginal Heritage Unit, Department of Environment and Land Management, for comment.

### NOTE:

1. It should be noted that management recommendations presented in an archaeological report relating to Aboriginal archaeological sites will be independently reviewed by the Aboriginal Heritage Unit of the Department of Environment and Land Management and the Tasmanian Aboriginal Land Council. Although findings of a consultant's report will be taken into consideration, recommendations by an archaeological consultant for actions in relation to the management of an Aboriginal site should not be taken to imply automatic approval of those actions by the Tasmanian Aboriginal Land Council or the Department of Environment and Land Management. However it should also be noted that the recommendations in this report and in that of Scotney (1995) are in agreement.

2. This report should be read in conjunction with the report:

Scotney, P. 1995. Archaeological Survey Report: Savage River Survey of Proposed Pigment Extraction Area. A Report Prepared for the Tasmanian Aboriginal Land Council and du Cros and Associates Archaeological and Heritage Consultants (Cultural Heritage Consultancies, Tasmania).

## ACKNOWLEDGMENTS

For assistance in carrying out the fieldwork, I am grateful to Peter Scotney (Site Officer, Tasmanian Aboriginal Land Council) and for logistical assistance in the field to Leon Innes (representative, Savage Resources Limited). For assistance in providing information and services utilised in compiling this report I am grateful to the following people; Bob Annett (Savage Resources Limited), David Collett (Tasmanian Aboriginal Land Council) and Michael Hermes (Aboriginal Heritage Unit, Department of Environment and Land Management). David Rhodes (du Cros and Associates) commented on a draft of this report.

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<b>ABBREVIATIONS USED</b>	
DELM	Department of Environment and Land Management
TALC	Tasmanian Aboriginal Land Council
TASI	Tasmanian Aboriginal Site Index
THASC	Tasmanian Historic Archaeological Site Register

## 1. INTRODUCTION

### 1.1 Scope of the Work

A survey for Aboriginal and Historic sites has been undertaken of the Long Plains ore body for Savage Resources Limited. This company is currently undertaking a feasibility study of the ore body.

The study area comprises an area of 800m by 250m (20 hectares) situated 7km south-south-west of the town of Savage River (Figure 1). The survey area is adjacent to an area covered by the report:

du Cros, H. 1993. An Archaeological Survey of Proposed Pigment Extraction Areas, Savage River, North-Western Tasmania. Unpublished Report to Savage Resources Ltd. (du Cros and Associates, Melbourne).

The objectives of the survey were:

1. To locate Aboriginal archaeological sites and historic places within the project area, using a systematic survey strategy;
2. To record and interpret any Aboriginal archaeological sites and historic places found;
3. To establish the significance of any archaeological sites found, using criteria normally applied to the assessment of cultural heritage resources;
4. To identify any areas or landforms of high archaeological potential;
5. To establish the implications that the presence of any archaeological resources may have for the future management and/or development of the project area;
6. To establish the views of Aboriginal people, and of any other groups with a special interest in the archaeology of the project area, on matters such as the interpretation and significance of recorded sites, and on appropriate management procedures; and
7. To develop recommendations and guidelines for :
  - (i) management of any threatened archaeological sites or areas of high archaeological potential; and
  - (ii) methods to be used for carrying out any additional work, including information on permits/consents required if sites are to be disturbed or destroyed.

## 1.2 Consultation

Following initial contact by Bob Annett, Savage Resources Limited, the Tasmanian Aboriginal Land Council (TALC) was contacted by David Rhodes, Acting Manager, du Cros and Associates, in regard to the impending archaeological survey. David Collett, (Chairperson), TALC, was informed of the request by Savage Resources Limited for a survey and the location of the study area. David Collett indicated that the request would have to go to the Council for consideration and (because mineral resources were involved) to TALC's lawyers. Bob Annett was informed of the content of this discussion.

Subsequently, David Collett informed du Cros and Associates that Peter Scotney, Site Officer, TALC, had been nominated to participate in the survey as the TALC representative. David Collett stated that he preferred that any proposed management recommendations be discussed with Peter Scotney following the field survey and that Peter Scotney would be preparing a report on the results of the survey for TALC.

Prior to the commencement of the field survey, the Aboriginal Heritage Unit, Department of Environment and Land Management, was notified of the proposed survey. A 'Request for Access to Tasmanian Aboriginal Site Index' form was completed and submitted to the Tasmanian Aboriginal Land Council for approval to obtain information from the Aboriginal Heritage Unit, Department of Environment and Land Management, on Aboriginal and sites previously recorded in the area and relevant survey reports. Similar information was sought for historic places.

A field survey of the study area was undertaken on 14 September 1995 by Peter Scotney (Site Officer, TALC) and Steve Brown (Project Archaeologist, du Cros and Associates). Access to the study area and the location of the Long Plains ore body boundaries was provided through Leon Innes on behalf of Savage Resources Limited.

At the end of the survey, discussion was held with Peter Scotney regarding the adequacy of the archaeological survey and an outline of recommendations likely to be made in the archaeological report. Peter Scotney stated the need to discuss the proposed recommendations with TALC. A subsequent telephone conversation between Peter Scotney and Steve Brown was held (9/10/95) to finalise agreement on the proposed recommendations. Peter Scotney sent a copy of his report (Scotney 1995) to du Cros and Associates and that report should be read in conjunction with this report.

Liaison throughout all stages of the archaeological study, including arrangements for access to the study area prior to the survey, was maintained with Bob Annett, Savage Resources Limited.

## 2. BACKGROUND INFORMATION

This section provides a brief overview of the natural environment, including geology/geomorphology, landscape history, vegetation, fauna, climate and history of land use. The information provided focuses on those elements of the natural environment that are relevant to past human behaviour and archaeological site formation processes.

### 2.1 The Natural Environment

Long Plains ore body is situated 7km south-south-west of the town of Savage River and 25km inland of the Tasmanian west coast (Figure 1). It is 240m to 280m above sea level. The area is drained by Bowry Creek - Savage River, part of the Pieman River drainage basin.

Geologically the study area comprises Precambrian sedimentary rocks within the dissected hill country of the Savage River Land System (Sharples 1992). Tertiary basalt outcrops to the north of the study area. Over the study area, most of which is the top and upper slopes of a north-south oriented ridge (Figure 2), are outcrops, and scatters, of magnetite (iron ore) as well as numerous naturally occurring scatters of quartz fragments, and occasional quartz pebbles. The present climate of the area is cool temperate.

During the late Pleistocene, and in particular over the last 40,000 years, sea levels have fluctuated greatly, variously exposing and flooding large areas of Australasia's land surface. The climate during the period from about 30,000 to 11,500 years ago was dominated by the influence of glacial conditions. The maximum of the Last Glacial ('Ice Age') occurred about 20,000 to 18,000 years ago, at which time sea level was about 80m lower than at present. At this time Tasmania was linked via the Bassian Plain to Greater Australia.

At the maximum of the Last Glacial, the study area would have been considerably further from the coast than at present, though would have been topographically much as it is at present. The temperatures would have been some six or seven degrees lower than they are at present (Macphail 1979). Evidence from Pulbeena Swamp suggests a pattern of ongoing changes in climate and water regime in Late Pleistocene north west Tasmania (Holdaway and Porch 1995:75-78).

Gradual rise in sea level following the maximum of the Last Glaciation resulted in flooding of the Bass Strait land bridge about 8,000 years ago (Blom 1988:96). By at least 5,000 years ago sea level had stabilised and the shoreline, drainage systems and local topography of north western Tasmania had become much as it is at present.

The study area comprises the top and upper slopes of a ridge which falls away steeply at the sides to various tributaries of Bowry Creek. Vegetation of the study area is principally mixed forest, dominated by eucalypts on the top of the ridge and by rainforest species on the mid and lower slopes and valley floors. The vegetation was burnt during a major fire some 10 to 12 years ago (Leon Innes, pers. comm. 14/9/95).

The faunal species consistent with this habitat are varied and would have provided food and plant material resources for Aboriginal people. It is likely that few large mammal species occur in this environment, medium-sized marsupials (including the pademelon, ring-tailed possum and Tasmanian devil) are likely to be in low abundance with the dominant mammal fauna being small ground foragers (see Hocking and Guiler 1983).

## 2.2 Land Use History

The land use history for the region has been summarised by du Cros (1993):

*Aboriginal people were not observed by Europeans as being present in the area, mainly because the area has received little in the way of attention since European settlement in Tasmania. This does not mean that they were not using or travelling through the area before and during the contact period.*

Since European arrival in the area the main impact on the two survey areas have been from track construction and selective logging. Corinna Sawmills have been logging in the general area in recent years, but the tracks to the survey areas were constructed for prospecting in the 1960's. Either side of the survey area are tangible reminders of the region's mining history as Corinna Road connected mine fields at Waratah and Corinna which were at their peak at the turn of the century (du Cros 1992) (du Cros 1993:3).

Some of the early prospecting history of the region is contained in Binks (1988:28-30). Within the Long Plains ore body study area itself, little of the past land use history was noted during the survey, excepting some evidence of track formation and selective logging operations. Recent uses include the getting of timber for firewood and clearance of survey lines and drilling tracks associated with mineral exploration.

### 3. ABORIGINAL SITES

#### 3.1 Ethno History and Contact History

Very little has been recorded for the study area which gives an account of local Aboriginal life at the time of European settlement and exploration. The most detailed accounts can be found in Plomley (1966) and this information is reviewed in the regional studies of MacFarlane (n.d.) and Cosgrove (1990:18-20).

#### 3.2 Previous Archaeological Work

Aboriginal people have been in Australia for at least 40,000 years (O'Connor 1995) and arrived in Tasmania soon after this date (Cosgrove 1989). There is considerable evidence for the Aboriginal occupation of south west and central Tasmania during the Late Pleistocene (35,000 to 10,000 years ago). The nearest known Pleistocene site to the study area is Mackintosh 90/1 (Stern n.d.).

There is considerable archaeological evidence of Aboriginal occupation of the north and western coasts and coastal hinterlands of Tasmania after about 5,000 years ago. From that time there appears to be a considerable expansion into previously little used areas and changes in cultural traditions (see Brown 1991). These changes included development of watercraft, development of a regional rock carving tradition and construction of rock arrangements.

There is limited information on Aboriginal subsistence and settlement patterns for the inland regions of north west Tasmania. However some of the previous archaeological investigations which examine some of the inland areas of north west Tasmania are the regional studies of MacFarlane (n.d.) and Cosgrove (1990) and relevant localised survey reports include those by Cosgrove and Hughes (1983), MacFarlane and Coates (1990), Pocock (1991), Richards (1992) and du Cros (1993). A summary of these investigations is contained in du Cros (1993:3-6). There has been no previous archaeological survey of the present study area, and no Aboriginal archaeological sites have been previously recorded within it.

The dissected hills of the inland north west of Tasmania have been subject to limited investigation for Aboriginal archaeological sites, and there is little in the way of site location models proposed for the region. In a study of the Aboriginal archaeology of Tasmania's north west forests, Cosgrove (1990:112) proposed a number of predictive statements for the inland 'lowland slopes' (forested low hills and undulating plain) within the region. Cosgrove noted that:

- sites within this landform are rare;
- the majority of sites will contain single isolated artefacts and small artefact scatters; and
- the sites most commonly occur on ridges and flat bench areas on slopes, with the largest sites occurring on flat or gently sloping ground close to major creeks and rivers (Cosgrove 1990:112).

Cosgrove's study and other previous archaeological investigations suggest that the most likely site types to be found within the study area are scatters of stone artefacts. It is also possible that the area could have been utilised as a source of quartz which is common over the area, and is often of good quality (with few internal fracture lines). It appears unlikely that burials, rock arrangements or rock carvings will occur within the study area as such sites are not known in this landform. Additionally the local geology suggests that

caves or rockshelters (which can often contain archaeological remains) and ochre sources do not occur in the study area.

It has been noted that the ethno historical information for the study area is limited (Section 3.1) and it is possible through archaeological investigation and research to add considerably to our knowledge of Aboriginal society at the time of, and prior to, European settlement of the region.

### 3.3 Archaeological Survey - Methods

The archaeological investigation is undertaken within the theoretical framework of human ecology.

*This approach is primarily concerned with understanding the relationship between past human societies and their environment and with reconstructing past patterns of land use. This approach is currently dominant in Australian archaeology and is particularly useful for cultural resource managers since it focuses particularly on the distribution of the material remains of past human activities in the landscape. It therefore provides a basis for developing predictions about site distribution and characteristics (Bird 1992).*

The survey method involved a systematic examination of undisturbed areas where the ground surface was visible and of all areas of recent human land disturbance. Such disturbed areas included:

- road and track verges (it is estimated that two kilometres of roads/tracks were examined, including a recent dozer track leading to drill pads on the eastern slope of the ridge. On the drill pads, cuttings into the hill slope provided some sub surface visibility and these cuttings were closely inspected);
- survey transects through the area which have been cleared by hand (seven of these, estimated to total 500m in length were examined); and
- clearings around the base of trees that have been cut up by firewood collectors. These were mostly located near to the edge of the main access road through the area, and on the top of the ridge.

There were a few undisturbed areas with reasonable ground visibility (see Appendix 1 - Glossary) on the top of the ridge where magnetite outcrops in low, narrow ridges and also where there is a dense ground cover of magnetite nodules. These small sized areas mostly lie on the northern part of the ridge top (Figure 2) and ground visibility of up to 50% was noted at them. Notes on the approximate locations of these areas and the degree of ground visibility and site obtrusiveness were produced during the survey.

The survey was undertaken in overcast/drizzly weather over four hours by two people on Thursday 14 September. Leon Innes drove the survey team to the study area (as it required access by 4WD vehicle) and clearly indicated the location of the Long Plains ore body boundaries to the survey team.

In Tasmania, Aboriginal archaeological sites are defined in accordance with the Tasmanian Aboriginal Site Index site forms and sites located have to be recorded on the Department of Environment and Land Management 'Aboriginal Site Recording Form'.

### 3.4 Archaeological Survey - Results

No Aboriginal archaeological sites were located during the survey of the Long Plains ore body and no areas of particular archaeological sensitivity were noted. Coverage of the survey area was considered to be good since it was possible to examine a large and wide range of undisturbed and disturbed ground surfaces, including some sub surface ground profiles where recent cuttings have occurred (Section 3.3) - this is often difficult to achieve in such heavily forested parts of inland north west Tasmania.

A major difficulty in recognising Aboriginal stone artefacts within the study area was the natural and common occurrence of quartz fragments. Quartz is known to be a common raw material for Aboriginal stone artefact manufacture and it can be difficult to distinguish natural fracturing or shattering of quartz from human modification or flaking of quartz. Hence for the purposes of this survey, acceptance of a piece of a quartz piece as an Aboriginal artefact was based on any one of the following criteria:

1. it was associated with Aboriginal stone artefacts of a raw material other than quartz and showed evidence of human modification;
2. it is a formal tool type (such as a scraper or hammerstone); or
3. it has clear features characteristic of human stone working, including a bulb of percussion and striking platform for flakes; more than one clear negative flake scar for cores; more than one clear negative flake scar and bruising on both ends for bipolar pieces; and systematic intentional secondary flaking along one or more margins for a retouched flake, retouched flaked piece or retouched core.

No quartz pieces that fit any of these criteria, and hence could be considered an Aboriginal stone artefact, was recognised within the study area.

### 3.5 Archaeological Survey - Interpretation and Discussion

There is little that can be said about past local Aboriginal subsistence - settlement patterns because of the lack of material located during the survey for Aboriginal archaeological sites (Section 3.4) and the limited level of archaeological information known for this region generally (Section 3.2). However some simplistic and preliminary interpretations, drawing on the results of Cosgrove's 1990 investigation, can be advanced which can be tested through future archaeological studies in the region.

The study area comprises dissected hill country centred on a ridge top with steep slopes. The area is likely to have supported a native vegetation of dense mixed forest (Eucalypt and rainforest species) from at least 5,000 years ago. Principally because of the difficult access into this landform type, it is unlikely that large or frequently re-used Aboriginal campsite locations (represented by stone artefact scatters) occur. It is most likely that the area was only a 'transitional' zone for which past use was limited to:

1. exploitation of material (possibly including quartz and bark and wood from trees) and food resources by small groups of people foraging through the area, and possibly establishing short term, small scale and ephemeral camp sites (see Meehan 1982); and
2. groups of people travelling through the area en route between large and more permanent base campsite locations.

This scenario is by necessity simplistic and does not take into account changing patterns of past Aboriginal subsistence - settlement patterns which may have occurred over the relatively long time period of Aboriginal occupation of Tasmania.

## 4. HISTORIC SITES

### 4.1 History and Previous Archaeological Work

A brief outline of the history of the area is provided in du Cros (1993:6-8). The main historical themes associated with the area are exploration (land and geological surveys), prospecting and mining and forestry. The town of Savage River, which lies 7km to the north east of the study area, was established in 1967/68 in association with the open cut mining of iron ore (magnetite).

In regard to previous archaeological investigation of historic sites in the area, du Cros notes that:

*The nearest survey of historic remains was conducted by Lindy Scripps for the Forestry Commission (Scripps 1990). The nearest sites which were recorded in the fieldwork for the study were associated with the mining in Waratah and Corinna (eg. Mount Bischoff copper mining operations and the Corinna Hydraulic Mine). There are still many unrecorded sites along Rocky Creek, Main Creek and Specimen Creek which are outside the survey area (du Cros 1993:6).*

*There are no historic sites recorded within the study area that are contained in the Tasmanian Historic Archaeological Site Catalogue.*

### 4.2 Archaeological Survey

A field survey for historic sites was undertaken concurrently with the survey for Aboriginal archaeological sites. There are no obvious or large historic sites within the study area and examination for historic features and historic remains was conducted using the same survey strategy as for Aboriginal archaeological sites (Section 3.3) - that is all areas with reasonable ground surface visibility were inspected.

No historic sites were located during the survey. Evidence of past forestry operations comprising tracks and selectively cut trees and of past mineral exploration were not considered to be of historic value, either because they are recent or retain little in the way of archaeological/historic scientific value.

## 5. MANAGEMENT ISSUES AND RECOMMENDATIONS

### 5.1 Management Options

Management of archaeological resources/heritage places within Australia has most recently been reviewed and discussed by Pearson and Sullivan (1995) and the following discussion draws on this work.

Management consists of identifying the range of options available for each heritage place in accordance with its assessed significance, including scientific and cultural, and balancing these options with other considerations - such as availability of funding, human resources and potential conflict with other management/development aims (Pearson and Sullivan 1995:187-188).

Since no Aboriginal or historic sites were located during the field survey, and there are considered to be no areas of archaeological sensitivity within the study area, the range of management options for the study area are limited to:

1. no further investigation for Aboriginal and historic archaeological sites within the boundaries of the Long Plains ore body (Figure 2); and
2. monitoring of the ground surface of the Long Plains ore body for cultural remains when initial ground surface disturbance associated with the commencement of mining begins.

Since no Aboriginal or historic archaeological material was located during the field survey of the Long Plains ore body, and there is little potential for the occurrence of such material within this area, then Option 1 is preferable from an archaeological point of view and from a cultural point of view (see Scotney's TALC report).

However if the mining development is to proceed, then it is recommended that further survey for Aboriginal and historic sites be undertaken for all areas outside of the boundaries of the Long Plains ore body impacted by proposed development including proposed new roads and tracks and other facilities associated with the mine.

## 5.2 Recommendations

The recommendations below are based on the absence of recorded Aboriginal and historic sites within the boundaries of the Long Plains ore body, and the low potential for significant cultural remains to occur within this area.

### 5.2.1 Long Plains Ore Body

Since no Aboriginal or historic archaeological material was located during the field survey of the Long Plains ore body, and there is little potential for the occurrence of significant cultural remains within this area, it is recommended that no further archaeological work within this area is required to be carried out.

### 5.2.2 Location of Cultural Material During Development

If any Aboriginal cultural material, including stone artefacts and human skeletal material, is located during the development of the Long Plains ore body, then the find must be reported to the Department of Environment and Land Management and consultation with the Tasmanian Aboriginal Land Council and the Department of Environment and Land Management must take place regarding the future management of any such material.

The likelihood of finding such material is considered to be low because of the difficulty of access to this landform in the past and because of the limited range of food resources it would have contained.

### 5.2.3 Further Work

If the mining development is to proceed, then further survey for Aboriginal and historic sites should be undertaken for all areas outside of the boundaries of the Long Plains ore body impacted by proposed development including proposed new roads and tracks and other facilities associated with the mine.

### 5.2.4 Distribution of the Report

Copies of the final version of this report should be forwarded to the Tasmanian Aboriginal Land Council and the Aboriginal Heritage Unit, Department of Environment and Land Management, for comment.

#### NOTE:

It should be noted that management recommendations presented in an archaeological report relating to Aboriginal archaeological sites will be independently reviewed by the Aboriginal Heritage Unit of the Department of Environment and Land Management and the Tasmanian Aboriginal Land Council. Although findings of a consultant's report will be taken into consideration, recommendations by an archaeological consultant for actions in relation to the management of an Aboriginal site should not be taken to imply automatic approval of those actions by the Tasmanian Aboriginal Land Council or the Department of Environment and Land Management. However it should also be noted that the recommendations in this report and in that of the Scotney (1995) are in agreement.

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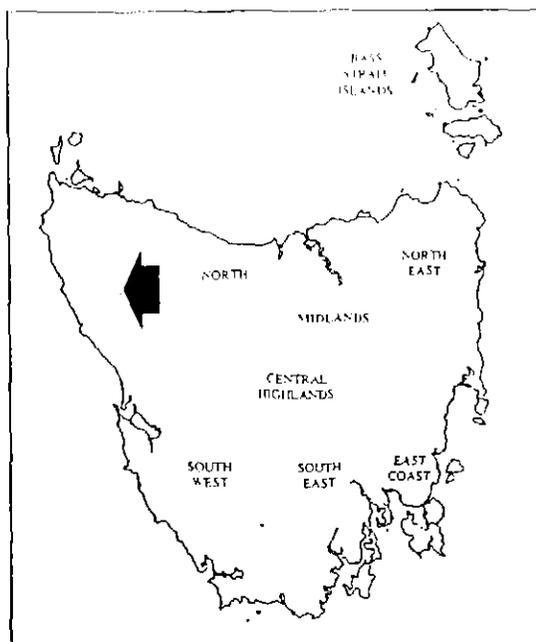
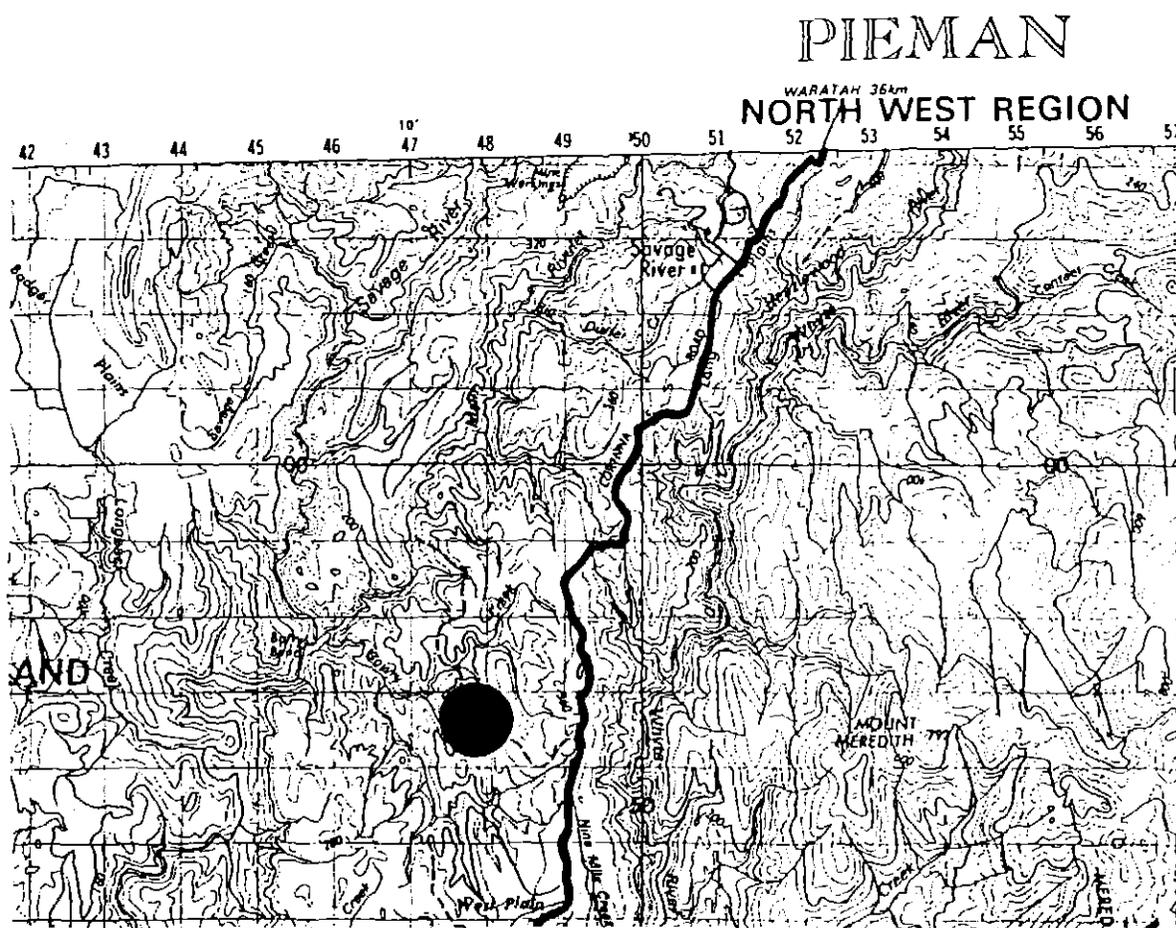


FIGURE 1. Long Plains Ore Body: Location of the study area



5 cm

(Extract from 1:100,000 Mapsheet 7914 - Pieman)

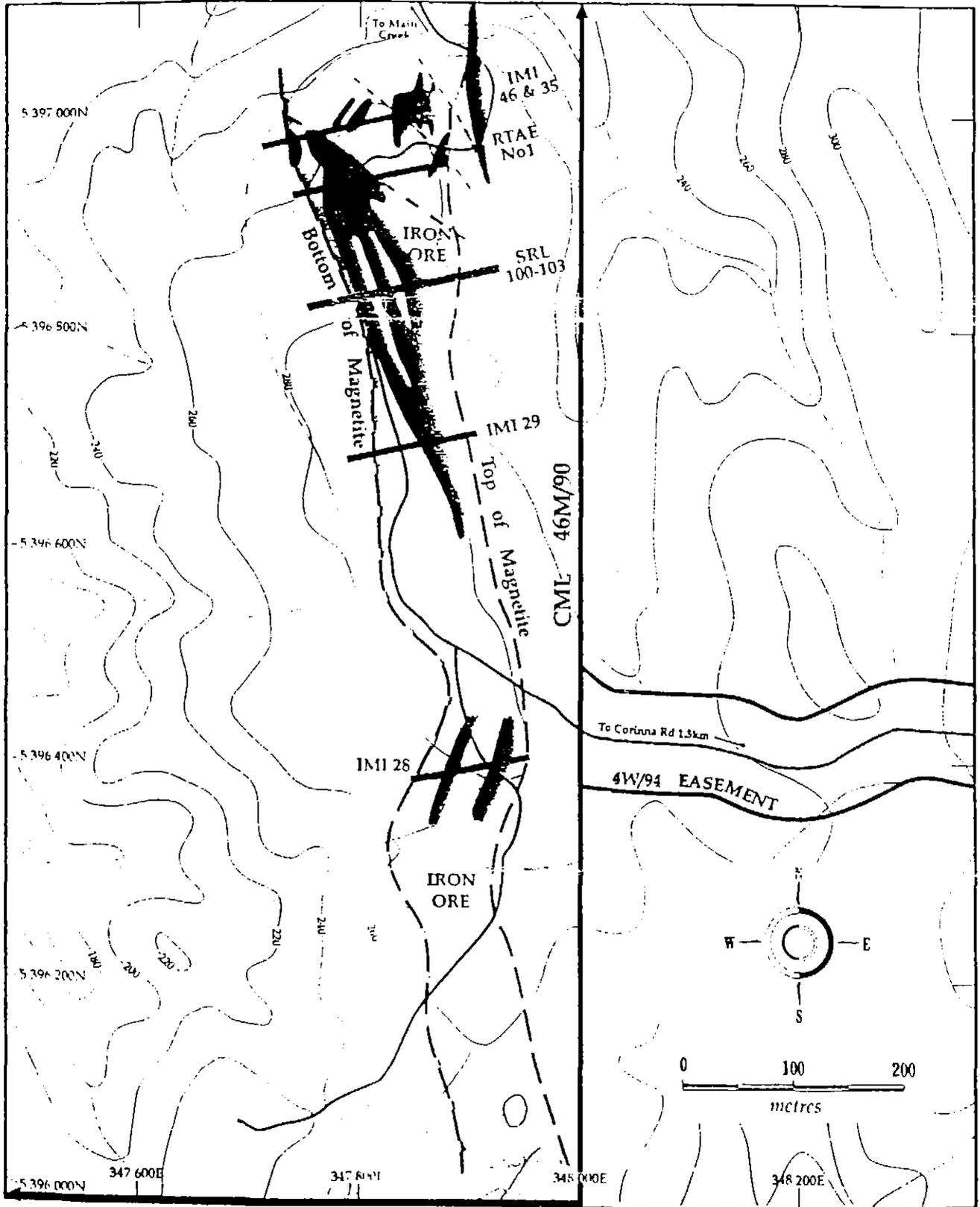


FIGURE 2. Long Plains Ore Body: Extent of Magnetite Deposit

5 cm

**APPENDIX 1**

**Glossary**

## GLOSSARY

Terminology Used in this Report for Heritage Places

**Heritage Place:** A place which has aesthetic, historic, scientific or social values for past, present or future generations - "... this definition encompasses all cultural places with any *potential* present or future value as defined above" (Pearson and Sullivan 1995:7). The term can be further sub-divided into **Aboriginal Place** and **Historic Place** (Figure 1).

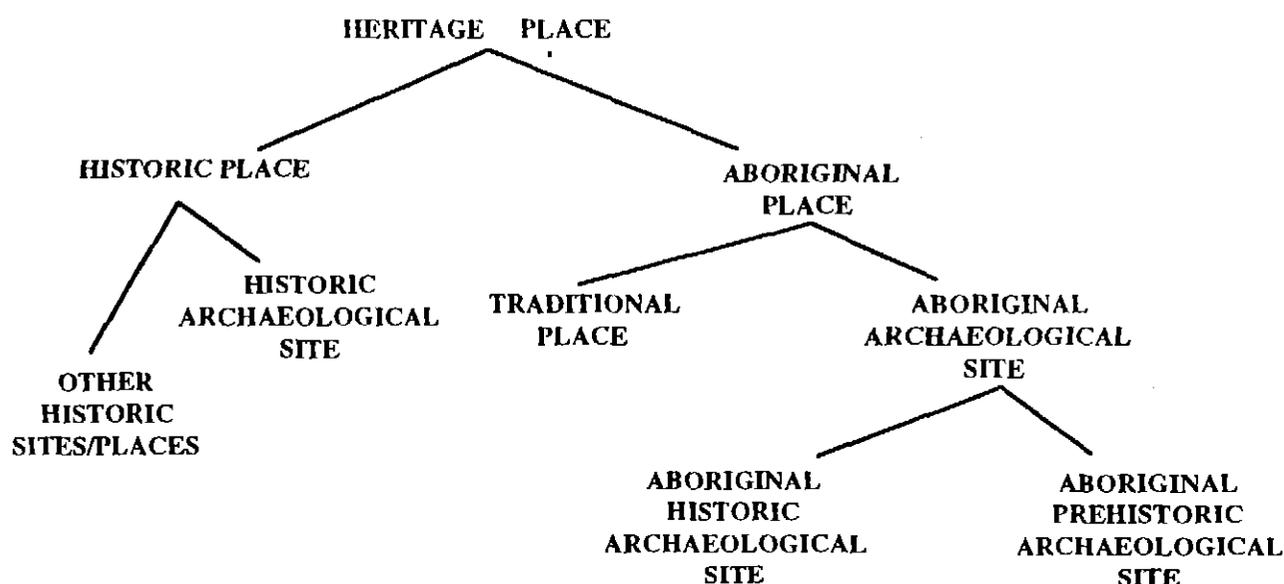


FIGURE 1. Terminology used for categories of Heritage Places.

### ARCHAEOLOGICAL SITE TYPES

**Aboriginal Historic Archaeological Site (or Contact Site):** Refers to either a site with an historic context such as an Aboriginal mission station or provisioning point; or a site which shows evidence of Aboriginal use of European/non-Aboriginal materials and ideas. The latter may include artefact scatter sites at which artefacts made, for example, from glass, metal or ceramics, are present.

**Aboriginal Prehistoric Archaeological Site:** Refers to a site that contains physical evidence of past Aboriginal use (for example a stone artefact scatter, scarred tree, burial or rock painting) which was formed or used by Aboriginal people either before or not long after European invasion.

**Historic Archaeological Site:** Refers to an archaeological site which was formed during the historic era that contains physical evidence of past human use (for example a structure, landscape or historic artefact scatter).

### Types of Aboriginal Prehistoric Archaeological Sites

**Artefact Scatter:** A surface scatter of stone artefacts which is defined as being the occurrence of five (5) or more items of cultural material within an area of about 100 square metres (AAV 1993:1j). Artefact scatters are often the only physical remains of places where Aborigines have camped, prepared and eaten meals and worked stone material.

**Burial:** A burial site is usually a sub-surface pit containing human remains and sometimes associated artefacts.

**Hearth:** Usually a sub-surface feature found eroding out of a river or creek bank or a sand dune - it indicates a place where Aboriginal people cooked food. The remains of a hearth are usually identifiable by the presence of charcoal and sometimes clay balls (like brick fragments) and hearth stones. Remains of burnt bone or shell are sometimes preserved within a hearth.

**Isolated Artefact:** An isolated artefact is defined as being the occurrence of less than five (5) items of cultural material within an area of about 100 square metres (AAV 1993:1j). It/they can be evidence of an ephemeral (or one-off) activity location, the result of an artefact being lost or discarded during travel or evidence of an artefact scatter which is otherwise obscured by poor ground visibility.

**Mound:** These sites, often appearing as raised areas of darker soil, are found most commonly in the volcanic plains of western Victoria or on higher ground near water bodies. The majority were likely formed by a slow build-up of debris resulting from earth-oven cooking, although some may have been formed by the collapse of sod or turf structures, and it has been suggested that some were deliberately constructed as hut foundations (Bird and Frankel 1991:7-8).

**Quarry (stone/ochre source):** An Aboriginal quarry site occurs where stone or ochre is exposed and has been extracted by Aboriginal people in the past. The rock types most commonly quarried for artefact manufacture in Victoria include silcrete, quartz, quartzite, chert and fine-grained volcanics such as greenstone.

**Scarred Tree:** Scars on trees may be the result of removal of strips of bark by Aborigines for the manufacture of utensils, canoes or for shelter; or resulting from small notches chopped into the bark to provide hand and toe holds for climbers after possums, koalas and/or views of the surrounding area.

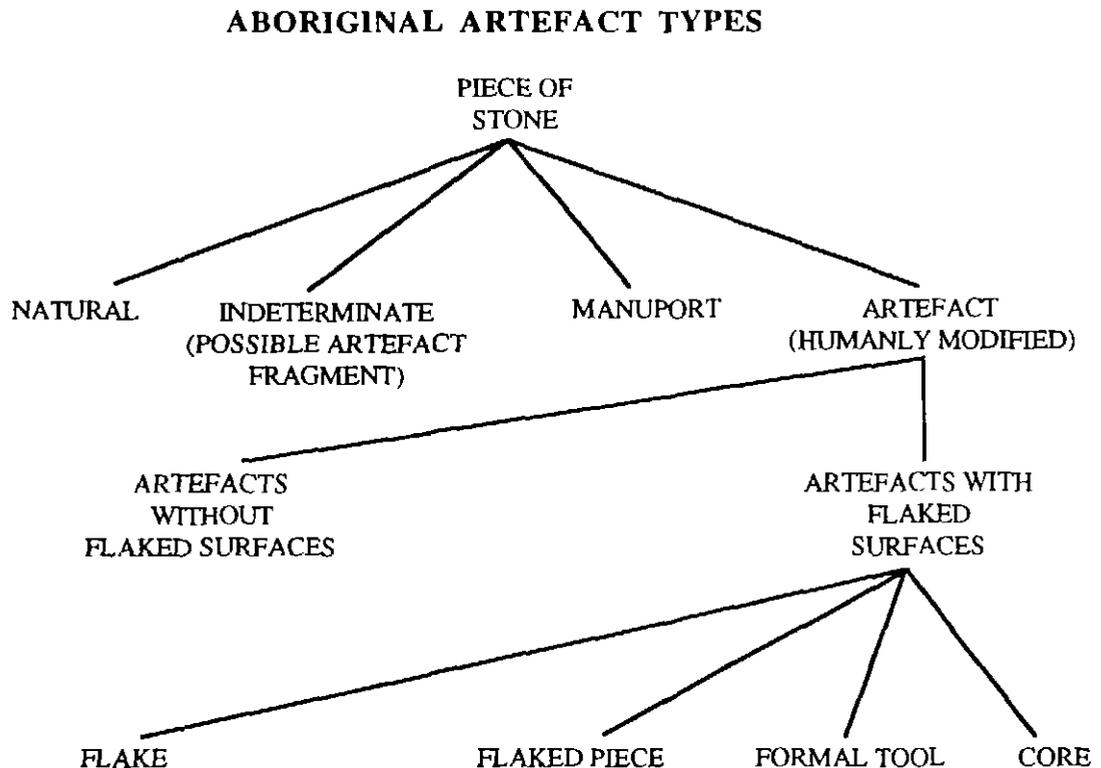
**Shell Midden:** A surface scatter and/or deposit comprised predominantly of shell, sometimes containing stone artefacts, charcoal, bone and manuports. These site types are normally found in association with coastlines, rivers, creeks and swamps - wherever coastal, riverine or estuarine shellfish resources were accessed and exploited.

**Structures:** This can refer to a number of different site types which are grouped here only because of their relative rarity and their status as built structures. Most structures tend to be of locally available rock, such as **rock arrangements** (ceremonial and domestic), fishtraps, dams and cairns, or of earth, such as **mounds** or some fishtraps.

**Rock Art:** Refers to "paintings, engravings and shallow relief work on natural rock surfaces" (Rosenfeld 1988:1). Paintings were often produced by mineral pigments, such as ochre, combined with clay and usually mixed with water to form a paste or liquid which was applied to an unprepared rock surface. Rock engravings were made by incising, pounding, pecking or chiselling a design into a rock surface. Rare examples of carved trees occasionally survive.

**Rockshelter:** Much as an artefact scatter, a rockshelter site may contain the physical remains of camping places where people prepared meals, flaked stone, etc. They are often classed as a different type of site due to their fixed boundaries and their resulting greater likelihood of containing sub-surface deposits. Rockshelters may also contain rock art.

**Rock-Well:** A natural or modified depression within a stone outcrop in which water collects. The most identifiable of these sites have been modified by Aboriginal people, either by deepening or enlarging.



**FIGURE 2.** Stone artefact types/categories

**Anvil:** A portable flat stone, usually a river pebble, which has been used as a base for working stone. Anvils which have been used frequently have a small circular depression in the centre where cores were held while being struck. An anvil is often a multi-functional tool used also as a grindstone and hammerstone.

**Backed Piece:** A flake or blade that has been abruptly retouched along one or more margins opposite an acute (sharp) edge. Backed pieces include backed blades and geometric microliths. They are thought to have been hafted onto wooden handles to produce composite cutting tools. Backed pieces are a feature of the 'Australian small tool tradition', dating from between 5,000 and 1,000 years ago in southern Australia (Mulvaney 1975).

**Blade:** A flake that is at least twice as long as it is wide.

**Burin:** A stone implement which is roughly rectangular shaped with a corner flaked to act as point for piercing holes in animal skins. The distinguishing feature is a narrow spall, usually struck from the distal end down the lateral margin of a blade, but sometimes across the end of a flake (McCarthy 1976:38).

**Core:** An artefact from which flakes have been detached using a hammerstone. Core types include single platform, multiplatform and bipolar forms.

**Cortex:** Original or natural (unflaked) surface of a stone.

**Edge Ground Implement:** A tool, such as an axe or an adze, which has usually been flaked to a rough shape and then ground against another stone to produce a sharp edge.

**Edge Modification:** Irregular small flake scarring along one or more margins of a flake, flaked piece or core which is the result of utilisation/retouch or natural edge damage.

**Flake:** A stone piece removed from a core by percussion (striking it) or by pressure. It is identified by the presence of a striking platform and bulb of percussion, not usually found on a naturally shattered stone.

**Flaked Piece:** A piece of stone with definite flake surfaces which cannot be classified as a flake or core.

**Formal Tool:** An artefact which has been shaped by flaking, including retouch, or grinding to a predetermined form for use as a tool. Formal tools include scrapers, backed pieces and axes.

**Grindstones:** Upper (handstone) and lower (basal) stones used to grind plants for food and medicine and/or ochre for painting. A handstone sometimes doubles as a hammerstone and/or anvil.

**Hammerstone:** A piece of stone, often a creek/river pebble/cobble, which has been used to detach flakes from a core by percussion. During flaking, the edges of the hammerstone become 'bruised' or crushed by impact with the core.

**Manuport:** Foreign fragment, chunk or lump of stone which shows no clear signs of flaking but is out of geological context and must have been transported to the site by people.

**Percussion:** The act of hitting a core with a hammerstone to strike off flakes.

**Platform Preparation:** Removal of small flake scars on the dorsal edge of a flake, opposite the bulb of percussion. These overhang removal scars are produced to prevent a platform from shattering (Hiscock 1986:49).

**Retouch:** A flake, flaked piece or core with intentional secondary flaking along one or more edges.

**Scraper:** A flake, flaked piece or core with systematic retouch on one or more margins. Scraper types follow Jones (1971).

**Striking Platform:** The surface of a core which is struck by a hammerstone to remove flakes.

**Utilised Artefact:** A flake, flaked piece or core which has irregular small flake scarring along one or more margins that does not represent platform preparation.

### Other Archaeological Terms

**Pebble/Cobble:** Terms used to describe natural stone fragments of any shape. Pebbles are 2 - 60mm in size and cobbles are 60 - 200mm in size (McDonald et al:1984:78).

**Heat Treatment:** The thermal alteration of stone (including silcrete) by stone workers to improve its flaking qualities (see Flenniken and White 1983).

**Visibility:** Refers to the degree to which the surface of the ground can be observed. This may be influenced by natural processes such as wind erosion or the character of the native vegetation, and by land use practices, such as ploughing or grading. It is generally expressed in terms of the percentage of the ground surface visible for an observer on foot (Bird 1992).

**Obtrusiveness:** Refers to how conspicuous a site is within a particular landscape, and thus the possibility of finding it. Some site types are more conspicuous than others. Thus a surface stone artefact scatter is generally not obtrusive, especially in areas of low ground surface visibility, while a scarred tree is (Bird 1992).

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**APPENDIX THREE**

**PETER SCOTNEY FOR THE TASMANIAN ABORIGINAL LAND COUNCIL**

**Archaeological Survey Report: Savage River Survey of  
Proposed Pigment Extraction Area**

**Prepared by P Scotney  
September 1995**

**A Report Prepared for the Tasmanian Aboriginal Land Council  
and du Cros & Associates Archaeological and Heritage  
Consultants**

Cultural Heritage Consultancies  
136 Tolosa st, Glenorchy  
Tasmania 7010

*Contents*

- Introduction
- Survey Method
- Vegetation
- Geology
- Community Consultation
- Results
- Discussion
- Recommendations

### *Introduction*

Please note that this report is structured within the TALC guidelines for survey reports. For further or more comprehensive information in regards to this survey please contact the author, the TALC or du Cros & Associates.

This survey is the archaeological component for a Development Proposal and Environmental Management Plan for an Iron Ore Pigment extraction area.

The archaeological field survey was carried out on the 13th & 14th of September 1995 and was undertaken by Steve Brown the archaeologist from du Cros and Associates and myself the Cultural Heritage consultant. The survey was commissioned by Savage River Resources

The study area was defined by Savage River Resources and is less than one square kilometre which is situated approximately 10 km south of the township of Savage River (see map).

### *Vegetation*

The vegetation in the study area was very thick typical west coast vegetation. For information in regards to the vegetation of the study area please refer to Brown Steve, Archaeological Survey Report of Proposed Pigment Extraction Area, September 1995 which can be obtained through du Cros & Associates Archaeological & Heritage Consultants.

### *Geology*

The geology of the study area is dominantly Iron Ore, surface scatters of quartz and basalt occurred in the area.

### *Survey Method*

The survey for Aboriginal sites was carried out on foot by Steve Brown and myself. A four wheel drive vehicle track transected through the middle of the study area running approximately due north south. In addition almost a dozen survey tracks which have been hand cut run approximately east west across the survey area. Both the four wheel drive vehicle track and the hand cut survey tracks were surveyed giving reasonable access to the study area.

### *Community Consultation*

The Aboriginal community should be informed and consulted on all matters referring to cultural heritage.

Prior to, during and upon completion of this survey the Tasmanian Aboriginal Land Council was consulted and informed on the particulars and outcome of the survey.

### *Results*

No Aboriginal sites were located or recorded as a result of this survey.

### *Discussion (Aboriginal Significance)*

All Aboriginal sites are of extreme significance to the Aboriginal community. These sites are the cultural heritage of the Aboriginal community and represent and maintain the links with our cultural and heritage.

When discussing and determining Aboriginal cultural/heritage significance of a site or area various factors must be taken into account.

Firstly it should be recognised that assessing cultural/heritage significance is very much personal feeling and can be interpreted differently by heritage officers and members of the Aboriginal community. However there are some underlying factors that assist in assessment of a site or area.

#### Site type

To say that the larger the site is, the more significant it is not so all the time, however it is a major factor. For example a single artefact in various environments where suitable stone material is sparse would have been of extreme significance to the maker. And is of extreme significance to the Aboriginal community today. Unique sites such as burials, rock art or stone arrangements for example are of extreme cultural significance as are all sites to the Aboriginal community as these sites represent and maintain the links with our cultural and heritage.

#### location/landscape

Heritage officers interpret sites in the landscape. We look for routes to and from sites and the resources that probably made people go to the area. If the community interpret sites in the landscape then the Aboriginal significance of an area may be diminished if the landscape is destroyed.

#### Spiritual

Is a feeling that is difficult to describe, it is a feeling that reflects and maintains links with our culture and heritage. This feeling can vary from site to site and can be interpreted differently. The Indigenous people of the world are and have been considered the custodians of mother earth and believe inevitably that what happens to mother earth will in turn happen to all mankind. The community today have a responsibility to preserve and protect as much of our cultural heritage as possible.

These are just contributing factors taken into account when assessing the cultural significance of a site or an area. For more comprehensive information contact the author.

*Recommendations*

There is no objection from an Aboriginal Cultural Heritage perspective that the proposed Pigment Extraction area proceed, providing that :

- If any Aboriginal site are located during the course of any works involved with the proposed pigment extraction that the following steps must be taken. The department of Parks Wildlife and Heritage and the Tasmanian Aboriginal Land Council should be informed. Consultation between all parties should establish a procedure which will ensure compliance with the Aboriginal Relics Act 1975

Under section 14 (1) a of the Aboriginal Relics Act 1975 Aboriginal sites can not be destroyed, damaged, defaced or otherwise interfere with unless a permit has been granted by the minister.



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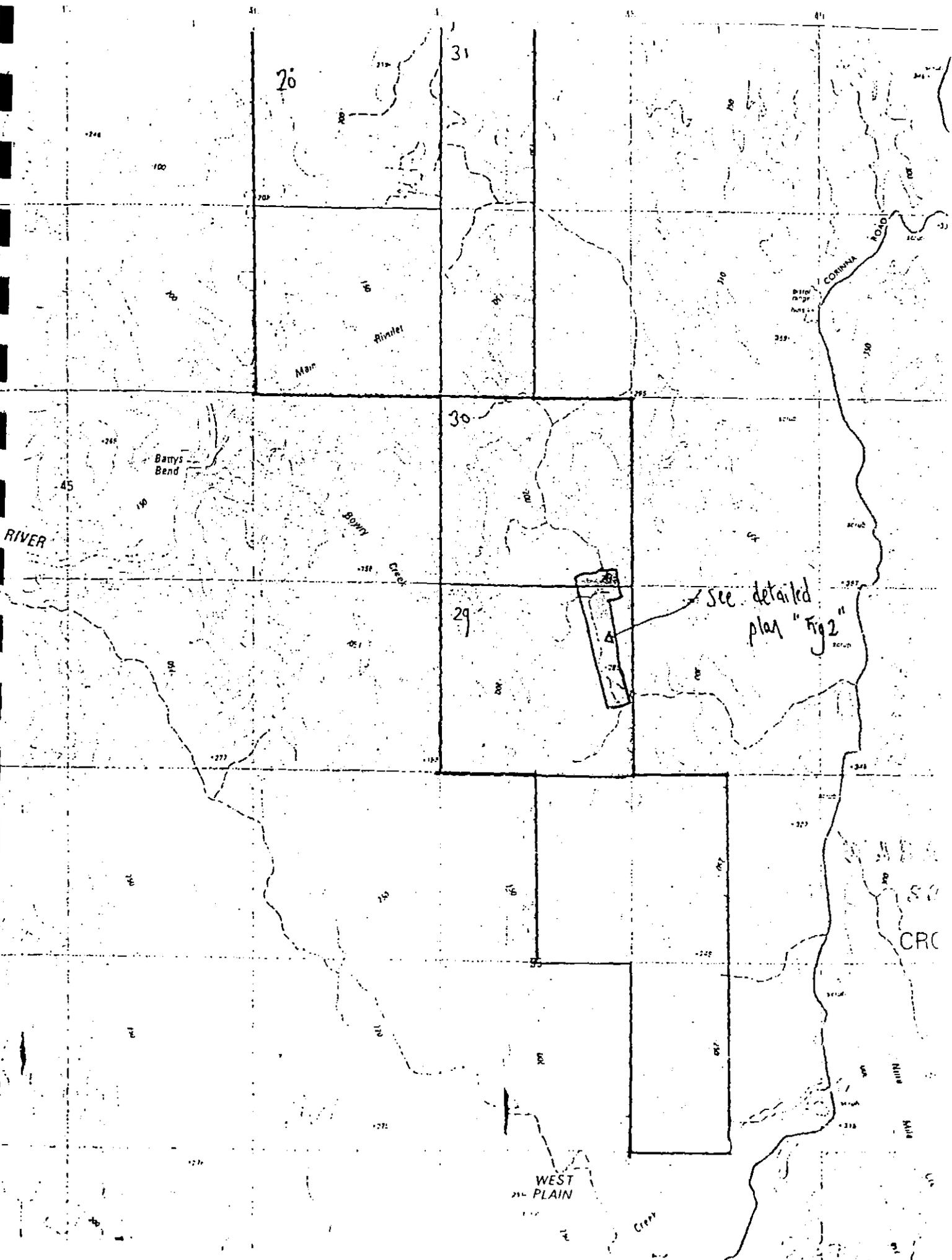
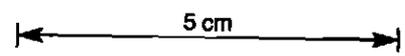
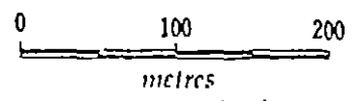
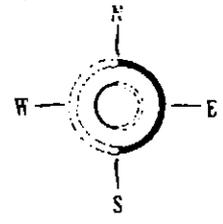
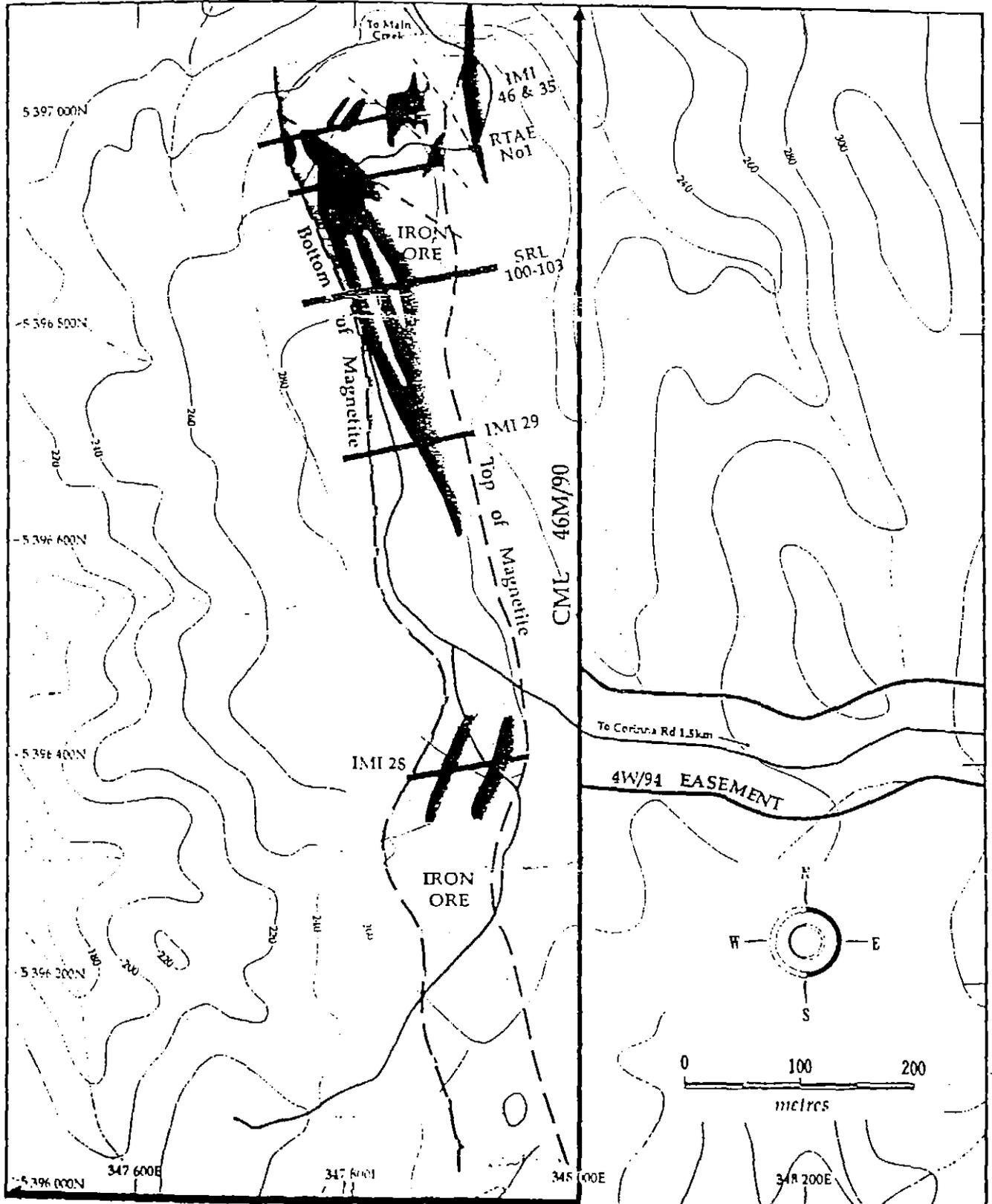


FIGURE 2

# LONG PLAINS NORTHERN AREA MAGNETITE DEPOSIT



**APPENDIX FOUR**

**ALLUNGA OPEN AIR EXPOSURE OF SAVOX PIGMENTS OVER 9 MONTHS**

**UMBER - Allunga Weathering Test Results, Open Air Method (exposed to contamination)**

**Start L 39.2, a 2.9, b 5.6**

	month 3	month 6	month 9
delta L		1.0	3.9
delta a		0.3	0.1
delta b		-0.7	-1.9
delta E	0.2	1.2	4.3
General appearance	10	9	9
Discolouration	10	9	8
Dirt collection		9	9
Colour change	10	10	9 L
Other, Etc	10	10	10

**GREY - Allunga Weathering Test Results, Open Air Method (exposed to contamination)**

**Start L 42.2, a 0.1, b - 0.2**

	month 3	month 6	month 9
delta L		2.2	4.8
delta a		0.0	-0.1
delta b		-0.3	-0.7
delta E	0.9	2.3	4.9
General appearance	10	9	9
Discolouration	10	8	8
Dirt collection		9	9
Colour change	10	9 L	9 I
Other, Etc	10	10	10

**NOTE:** Changes to both bricks as a result of discolouration coming from within the non-pigmented part of the block, also water dribble marks.

**YELLOW - Allunga Weathering Test Results, Open Air Method (exposed to contamination)**

**Start L 60.9, a 0.7, b 22.6**

	month 3	month 6	month 9
delta L		3.7	5.2
delta a		0.6	0.6
delta b		2.2	1.8
delta E	0.7	4.3	5.6
General appearance	10	9	9
Discolouration	10	9	8
Dirt collection		9	9
Colour change	10	9 TL	9 L
Other, Etc	10	10	10

**RED (BURNT OCHRE) - Allunga Weathering Test Results, Open Air Method (exposed to contamination)**

**Start L 47.6, a 12.7, b 14.4**

	month 3	month 6	month 9
delta L		-0.3	5.0
delta a		0.9	-0.9
delta b		-0.7	2.8
delta E	1.9	1.2	5.8
General appearance	10	8	8
Discolouration	10	8	7
Dirt collection		9	9
Colour change	9 TD	8 L	9 I
Other, Etc	10	10	10

At 9 months noted that most changes as a result of discolouration coming from within the non-pigmented part of the block.

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APPENDIX FIVE

ALLUNGA ALTRA EXPOSURE OF SAVOX PIGMENTS OVER 21 MONTHS

**UMBER - Allunga Weathering Test Results, Altra Method (advanced weathering)**

**Start L 39.2**  
**a 2.9**  
**b 5.6**

	month 1	month 2	month 3	month 4	month 5	month 6	month 7	month 8	month 9	month 10	month 11	month 12	month 13	month 14	month 15	month 16	month 17	month 18	month 19	month 20	month 21
dL	0.2	1.5	2.4	0.2	0.4	0.6	1.1	0.9	0.1	0.8	-2.5	-0.2	-0.3	-0.4		-0.9	-0.1	-0.4	0.0	-0.2	-1.2
da	0.1	0.2	-0.2	0.1	0.1	0.0	0.0	0.0	0.3	0.3	0.1	0.2	0.3	0.1		0.5	0.2	0.1	0.2	0.3	-0.1
db	0.2	-0.5	-0.3	-0.2	0.0	-0.3	-0.5	-0.4	-0.2	-0.4	-0.2	-0.4	-0.3	0.0		-0.1	0.1	0.1	0.1	0.0	0.0
dE	0.3	1.6	2.5	0.3	0.4	0.7	1.2	0.9	0.4	1.0	2.5	0.5	0.5	0.4		1.4	0.3	0.4	0.2	0.3	1.2

**GREY - Allunga Weathering Test Results, Altra Method (advanced weathering)**

**Start L 42.2**  
**a 0.1**  
**b -0.2**

	month 1	month 2	month 3	month 4	month 5	month 6	month 7	month 8	month 9	month 10	month 11	month 12	month 13	month 14	month 15	month 16	month 17	month 18	month 19	month 20	month 21
dL	1.2	0.0	0.6	1.1	-1.2	0.3	0.1	0.2	-0.6	0.8	-1.7	-1.1	-0.9	-1.6		-0.6	-1.3	-1.2	-1.4	-1.1	-0.8
da	0.1	-0.1	0.0	0.2	0.4	0.4	0.4	0.3	0.2	0.5	0.6	0.5	0.5	0.2		0.5	0.4	0.3	0.2	0.4	0.2
db	0.1	0.4	0.8	0.8	1.5	1.2	1.0	1.0	1.3	1.7	1.3	1.0	1.1	1.1		1.1	1.3	1.4	1.4	1.4	1.2
dE	1.2	0.5	1.0	1.3	2.0	1.3	1.1	1.1	1.4	2.0	2.2	1.6	1.5	1.9		0.4	1.9	1.9	2.0	1.8	1.5

**YELLOW - Allunga Weathering Test Results, Altra Method (advanced weathering)**

**Start L 60.9**  
**a 0.7**  
**b 22.6**

	month 1	month 2	month 3	month 4	month 5	month 6	month 7	month 8	month 9	month 10	month 11	month 12	month 13	month 14	month 15	month 16	month 17	month 18	month 19	month 20	month 21
dL	0.8	-0.1	0.1	0.6	0.0	0.0	0.0	-0.1	-0.1	0.3	2.2	-1.4	-0.3	-1.1		-0.4	-0.5	0.0	-1.6	-0.6	-0.7
da	0.7	1.0	0.8	-0.1	0.7	0.4	1.0	0.7	0.5	1.7	0.9	0.9	0.6	1.2		0.2	0.9	0.8	0.8	1.0	1.6
db	0.2	2.9	2.3	-0.5	3.3	2.6	4.3	3.6	2.3	4.0	1.8	0.4	2.2	2.9		-0.5	2.7	0.1	1.7	1.2	0.6
dE	1.0	3.1	2.5	0.8	3.4	2.6	4.3	3.7	2.4	4.4	3.0	1.7	2.4	3.4		2.4	2.9	0.8	2.5	1.7	1.8

**RED (BURNT OCHRE) - Allunga Weathering Test Results, Altra Method (advanced weathering)**

**Start L 47.6**  
**a 12.7**  
**b 14.4**

	month 1	month 2	month 3	month 4	month 5	month 6	month 7	month 8	month 9	month 10	month 11	month 12	month 13	month 14	month 15	month 16	month 17	month 18	month 19	month 20	month 21
dL	1.2	-0.7	0.1	0.3	-2.3	-0.3	-0.2	-0.5	-0.7	-0.6	-1.9	-1.4	-1.4	-1.8		-0.4	-1.0	-1.4	-1.9	-1.5	-1.9
da	0.4	0.5	0.4	0.0	1.4	0.3	0.8	0.8	1.1	1.1	0.9	0.9	1.1	1.1		0.7	1.3	1.9	1.4	1.2	1.0
db	0.7	-0.4	0.0	0.3	0.2	-0.4	-0.1	-0.2	0.2	0.8	0.3	0.4	0.6	0.4		1.7	1.0	1.4	0.9	0.8	0.1
dE	1.4	0.9	0.4	0.4	2.7	0.6	0.6	1.0	1.3	1.5	2.1	1.7	1.9	2.1		2.1	1.9	2.7	2.6	2.1	2.2

APPENDIX SIX

BORAL WEATHERING TRIALS

12 hr cycles of eight hrs UVB at 70°C followed by 4 hrs of dark condensation at 45°C  
285 cycles (143 days continuous)

Sample No.	Colour	Cycles	Surface Condition	CIE Colour			Colour Deviation from 0 cycle	Observations	
				L	a	b			
B1	Black	0	Dry	42.1	0.2	0.5	From 0 cycles	Efflorescence increasing slightly to 285 cycles	
		50		44.6	0.0	0.2	2.53		
		112		44.5	0.8	0.0	2.52		
		167		45.9	0.0	0.3	3.81		
		219		46.4	0.7	0.1	4.35		
		285	46.9	0.1	0.3	4.81			
		50	Wet	36.1	0.7	1.1	From 50 cycle		Insignificant change in colour from 50 cycles
		112		35.8	0.4	1.3	0.47		
		167		35.6	0.2	1.5	0.81		
		219		35.5	0.8	1.5	0.73		
285	34.9	0.7		1.6	1.30				
T6	Black	0	Dry	46.6	-0.3	-0.4	From 0 cycles	No further efflorescence appeared after 50 cycles.	
		50		53.0	-0.2	-1.1	6.44		
		112		52.0	0.5	-1.2	5.52		
		167		52.5	-0.7	-0.5	5.91		
		219		52.0	0.1	-0.6	5.42		
		285	52.1	0.6	0.1	5.60			
		50	Wet	39.1	0.5	-0.6	From 50 cycle		Insignificant change in colour after 50 cycles
		112		40.1	0.0	-0.2	1.19		
		167		39.4	0.1	-0.2	0.64		
		219		39.4	0.4	-0.1	0.59		
285	39.8	-0.1		0.1	1.16				
B2	Light Brown	0	Dry	47.3	7.6	13.5	From 0 cycles	No further efflorescence appeared after 50 cycles	
		50		62.3	5.1	6.9	16.58		
		112		61.7	5.2	7.7	15.71		
		167		61.6	5.5	7.6	15.61		
		219		61.7	5.0	7.9	15.67		
		285	61.7	4.8	7.8	15.74			
		50	Wet	45.7	7.6	9.9	From 50 cycle		Insignificant change in colour after 50 cycles
		112		46.1	7.0	10.7	1.08		
		167		45.4	7.5	11.1	1.24		
		219		45.3	7.5	11.2	1.36		
285	45.1	6.7		9.4	1.19				

## (cont) Various Oxide Tinted Blocks - Boral Materials Testing

Sample No.	Colour	Cycles	Surface Condition	CIE Colour			Colour Deviation from 0 cycle	Observations				
				L	a	b						
T4	Umber	0	Dry	45.6	2.6	10.9	From 0 cycles	No further efflorescence appeared after 50 cycles.				
		50		60.5	1.0	6.3	15.68					
		112		59.9	1.8	6.7	14.93					
		167		59.8	1.1	7.1	14.78					
		219		59.4	1.6	7.2	14.32					
		285		59.7	0.8	7.2	14.66					
		50	Wet	40.8	3.0	7.7	From 50 cycle	Insignificant change in colour after 50 cycles				
		112		42.4	2.5	7.9	1.69					
		167		41.7	2.7	8.1	1.03					
		219		41.3	2.5	8.2	0.87					
		285		41.1	2.3	8.3	0.97					
		B3		Red	0	Dry	47.5		17.6	18.2	From 0 cycles	No further efflorescence appeared after 50 cycles.
					50		57.3		13.1	13.4	11.80	
					112		55.8		15.4	13.6	9.74	
167	56.2		13.7		13.7		10.54					
219	55.6		14.7		13.4		9.85					
285	56.1		14.3		13.3		10.43					
50	Wet		42.8		19.2	18.8	From 50 cycle	Insignificant change in colour after 50 cycles				
112			44.1		18.8	19.5	1.53					
167			43.8		18.1	19.2	1.54					
219			43.9		18.8	19.0	1.19					
285			43.2		18.3	19.1	1.03					
T7			Red		0	Dry	48.2		12.5	14.5	From 0 cycles	Efflorescence increasing very slightly to 285 cycles.
					50		49.6		12.6	14.0	1.49	
					112		50.1		12.7	13.4	2.20	
	167	51.2		11.4	12.7		3.67					
	219	51.6		11.7	12.1		4.24					
	285	51.9		10.6	12.0		4.85					
	50	Wet		45.1	14.1	16.7	From 50 cycle	Insignificant change in colour after 50 cycles				
	112			44.6	14.2	16.4	0.59					
	167			43.8	14.5	16.7	1.36					
	219			43.9	14.4	16.1	1.37					
	285			43.2	13.9	16.8	1.91					

## (cont) Various Oxide Tinted Blocks - Boral Materials Testing

Sample No.	Colour	Cycles	Surface Condition	CIE Colour			Colour Deviation from 0 cycle	Observations							
				L	a	b									
B4	Dark Brown	0	Dry	40.4	3.5	5.7	From 0 cycles	No further efflorescence appeared after 50 cycles.							
		50		54.8	2.6	2.7			14.74						
		112		54.3	3.0	3.0			14.17						
		167		54.6	2.6	3.2			14.54						
		219		54.6	3.2	3.3			14.41						
		285		54.6	2.6	3.5			14.40						
		50	Wet	36.6	3.9	4.0	From 50 cycle		Insignificant change in colour after 50 cycles						
		112		50.9	1.8	3.1				3.03					
		167		50.6	2.3	2.7				2.80					
		219		37.7	3.6	5.2				1.66					
		285		37.9	3.4	5.2				1.84					
		T5		Burnt Umber	0	Dry				47.9	2.1	3.4	From 0 cycles	Efflorescence increasing very slightly to 285 cycles.	
					50					50.9	1.8	3.1			3.03
					112					50.6	2.3	2.7			2.80
167	51.3		1.7		2.7		3.49								
219	51.8		2.0		2.6		3.98								
285	51.9		1.7		2.7		4.08								
50	Wet		37.2		3.2	4.0	From 50 cycle	Insignificant change in colour after 50 cycles							
112			38.2		2.8	3.8			1.10						
167			37.6		2.4	4.0			0.89						
219			37.8		2.5	3.8			0.94						
285			36.9		2.4	3.9			0.86						
HFe (High Iron)			Burnt Umber		0	Dry			43.5	1.6	3.6	No visible change occurred on the surface.			
					62				43.5	1.7	4.0		0.41		
					117				44.7	1.2	4.5		1.55		
	169	44.9		1.7	4.2		1.53								
	235	45.7		1.0	4.7		2.53								
	0	Wet		28.7	1.5	4.1									
	62			30.6	1.5	4.1		1.90							
	117			30.8	2.1	4.1		2.18							
	169			30.9	1.7	4.2		2.21							
	235			31.3	0.8	4.5		2.72							

## (cont) Various Oxide Tinted Blocks - Boral Materials Testing

Sample No.	Colour	Cycles	Surface Condition	CIE Colour			Colour Deviation from 0 cycle	Observations
				L	a	b		
LFe (Low Iron)	Burnt Umber	0	Dry	41.9	1.0	3.4	1.00 1.60 1.77 1.84  1.77 1.06 1.50 1.87	No visible change has occurred on the surface.
		62		41.8	2.0	3.4		
		117		43.3	0.4	3.9		
		169		43.2	2.2	3.3		
		235		43.7	1.2	3.7		
		0	Wet	28.6	1.2	3.9		
		62		30.3	1.7	3.8		
		117		29.6	1.4	4.2		
		169		29.8	2.1	3.9		
		235		30.4	1.1	4.4		

## Various Oxide Tinted Blocks - Boral Materials Testing

Sample No.	Colour	Cycles	Surface Condition	CIE Colour			Colour Deviation from 0 cycle	Observations
				L	a	b		
T8	Black	0	Dry	45.1	-0.1	-1.2	1.09 1.52	Insignificant change in at 66 cycles
		66	Dry	44.2	0.5	-1.1		
		0	Wet	34.8	0.6	-0.6		
		66	Wet	33.4	0.3	-0.1		
T9	Light Brown	0	Dry	51.2	1.8	13.4	1.98 1.99	Insignificant change in at 66 cycles
		66	Dry	50.6	2.8	11.8		
		0	Wet	37.5	2.6	12.6		
		66	Wet	36.2	2.7	11.1		
T10	Red	0	Dry	52.3	10.4	14.3	1.72 1.75	Insignificant change in at 66 cycles
		66	Dry	50.9	11.2	13.7		
		0	Wet	37.0	10.7	13.9		
		66	Wet	36.3	12.3	14.0		

## Oxide Tinted Slurry Coat on Roofing Tile

Sample No.	Colour	Cycles	Gloss %	CIE Colour			Colour Deviation from 0 cycle	Observations
				L	a	b		
R1	Black - Poly'er coat	0	5.7	43.3	-0.2	-0.3	1.32	No change
		66	5.9	42.1	-0.4	0.2		
R2	Black - Slurry coat	0	1.5	39.0	0.2	-0.4	6.12	White efflorescence on surface
		66	1.0	45.0	0.2	-1.6		

**APPENDIX SEVEN**

**TESTWORK BY ALLUNGA AND BORAL MATERIAL TESTING SERVICES  
ON BAYER 318 AND SAVOX BLACK**

**SAVOX BLACK - Allunga Weathering Test Results, Open Air Method**

Start L 42.0, a 0.6, b -0.5

	Month	Month	Month	Month
	2	3	6	9
delta L	-1.4	-0.6	1.27	3.4
delta a	-0.0	0.1	-0.6	0.1
delta b	-0.1	0.5	-1.2	-0.4
delta E	1.4	0.8	1.9	3.4
General appearance	9	9	9	9
Discolouration	9	9	9	9
Dirt collection	9	9	9	9
Colour change	9 td	9 l	9 l	9 l
Other, Etc	10			

**BAYER 318- Allunga Weathering Test Results, Open Air Method (exposed to contamination)**

Start L 41.3, a 0.7, b 0.1

	Month	Month	Month	Month
	2	3	6	9
delta L	-1.5	0.6	1.53	4.0
delta a	0.2	-0.3	0.3	-0.4
delta b	0.0	0.1	-0.2	0.1
delta E	1.5	0.7	1.5	4.1
General appearance	9	9	9	9
Discolouration	9	9	9	9
Dirt collection	9	9	9	9
Colour change	9 td	9 tl	9 l	9 l
Other, Etc	10			

SAVOX BLACK (Pavers) Boral Material Testing Services  
BAYER 318 Compressive Strength Tests

### Compressive Strength (C) (Mpa)

Specimen Number	Sample Type S 150	Sample Type B 318
1a	35.7	36.1
1b	36.1	36.2
2a	33.6	29.1
2b	34.5	31.9
3a	32.0	33.8
3b	30.5	36.3
4a	28.6	34.1
4b	32.8	33.1
5a	34.6	33.6
5b	34.5	33.8
Average Compressive Strength (C) (Mpa)	33.3	33.8
Characteristic Compressive Strength (C) (Mpa)	29.4	30.2

SAVOX BLACK (Pavers) Boral Material Testing Services  
BAYER 318 Abrasion Index Tests

### Abrasion Index (I)

Specimen Number	Sample Type S 150	Sample Type B 318
1	1.90	1.63
2	0.96	0.79
3	0.92	2.26
4	1.24	2.03
5	1.59	1.08
Minimum Abrasion Index	0.92	0.79

**SAVOX BLACK (Pavers) Boral Material Testing Services**  
**BAYER 318 South Sydney Abrasion Test**

Specimen Number	Paver Density (g/cm <sup>3</sup> )		Paver Abraded Volume (cm <sup>3</sup> )	
	Sample Type S 150	Sample Type B 318	Sample Type S 150	Sample Type B 318
1	2.11	2.03	3.78	5.52
2	2.08	2.08	4.33	3.84
3	2.05	2.00	4.42	6.09
4	2.06	2.05	5.82	4.69
5	2.05	2.06	4.58	3.93
6	2.03	2.04	4.55	9.71
7	2.12	2.10	5.52	3.95
8	2.05	2.00	6.58	13.30
<b>Average</b>	<b>2.07</b>	<b>2.05</b>	<b>4.95</b>	<b>6.38</b>
<b>Lowest</b>			<b>3.78</b>	<b>3.84</b>
<b>Highest</b>			<b>6.58</b>	<b>13.30</b>

**SAVOX BLACK (Pavers) Boral Material Testing Services**  
**BAYER 318 Water Permeability Test**

**ELAPSED TIME (Minutes)**

Residual Head of Water (mm)	Sample type S 150		Sample Type B 318	
	Specimen 1	Specimen 2	Specimen 1	Specimen 2
1000	4.0	9.0	0.9	1.3
800	7.0	18.0	1.4	2.4
600	14.0	28.0	1.9	3.8
400	20.0	43.0	2.7	5.8
200	>30.0	>60.0	3.7	>8.5

SAVOX BLACK  
BAYER 318

Boral Materials Testing

Results after 52 cycles (26 days continuous exposure)

Sample No.	Colour	Cycles	Surface Condition	CIE Colour			Colour Deviation from 0 cycle	Observations
				L	a	b		
2457	Black S150 Paver	0	Dry	45.4	0.5	0.3		No visible change has occurred on the surface.
		25		42.9	0.5	-0.1	2.53	
		52		42.3	0.8	0.2	3.12	
	0	Wet	0	30.7	0.6	0.6		No visible change has occurred on the surface.
			25	29.0	0.5	0.9	1.73	
			52	31.0	0.6	1.2	0.67	
2458	Bayer 318 Paver	0	Dry	43.3	0.7	0.1		No visible change has occurred on the surface.
		25		41.4	0.6	0.3	1.91	
		52		41.3	1.0	0.6	2.08	
	0	Wet	0	28.4	0.1	0.3		No visible change has occurred on the surface.
			25	30.2	0.9	0.9	2.06	
			52	29.3	1.2	1.0	1.58	