

**Report on Works undertaken ~ 2001 – 2002 Financial Year for the
REHABILITATION OF MINING LANDS TRUST FUND
Project: rehabilitation of alluvially mined land, North East Tasmania**

Report by: Revel Munro

September 2002



Photograph: South Mt Cameron / Endurance area, NE Tasmania, 2002

Report on Works undertaken 2001 - 2002 - Rehabilitation of Mining Lands Trust Fund
Rehabilitation of Mining Lands Trust Fund
Project : rehabilitation of alluvially mined land
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Report on works undertaken 2001 - 2002
financial year for the Rehabilitation of
Mining Lands Trust Fund : project :
rehabilitation of alluvially mined land,

REHABILITATION OF MINING LANDS TRUST FUND

Report on Works undertaken ~2001 - 2002 Financial Year

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Planned Works 2002 - 2003

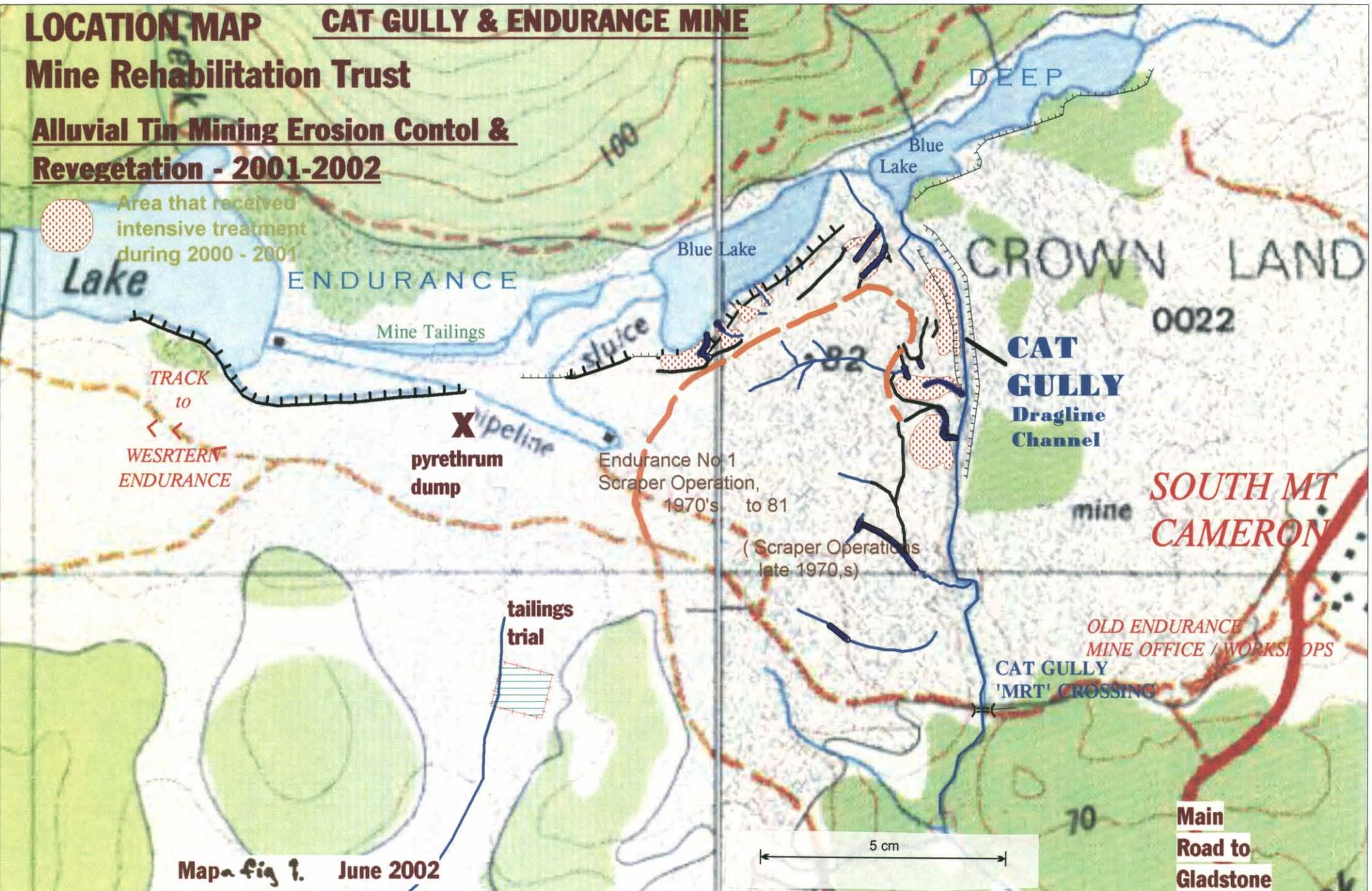
LOCATION MAP CAT GULLY & ENDURANCE MINE

Mine Rehabilitation Trust

Alluvial Tin Mining Erosion Control & Revegetation - 2001-2002



Area that received intensive treatment during 2000 - 2001



Mapa fig 1. June 2002

Main Road to Gladstone

REHABILITATION OF MINING LANDS TRUST FUND

Report on Works undertaken ~2001 – 2002 Financial Year

Introduction

This report details rehabilitation of abandoned alluvial tin mining operations in the Gladstone / South Mt Cameron area undertaken in the past year. These works are a continuation of sites first targeted by the Trust in 1997 for rectification. They are based on appraisals of mine rehabilitation needs on abandoned alluvial tin mines by D Cook, (1997) and also on reports and on ground works undertaken by consultants, SEMF in the period 1997 to 1999.

This report details projects that have expanded, maintained or rectified the three principal SEMF identified localities in need of treatment. These are known locally as: *Endurance*, at South Mt Cameron, *Star Hill*, NE of Gladstone, and *Monarch* at the foot of Mt Cameron on the northern coastal side.

This year most programmed works were completed. A change of emphasis within the period resulted in a more intensive approach being implemented on the more severely eroded gullies. This variation included a larger number of gullies than first intended. They were more comprehensively treated, and therefore less rehabilitation of tailings works was achieved. Fortunately, delays such as weather constraints, plant and personal availability were minimal. More frustrating has been the disinterest and lack of commitment of those engaged to spread fertilizers and mulches.

Mining rehabilitation techniques utilized here has continued to be medium to low "tech", with moderately high labour input, low cost local materials and flexible practical, non-prescriptive approaches to implementing the works program.

An analysis of the funds expended this year, *on a hectares of severely eroded gullies per dollar input* basis would clearly be the best to date. This is largely due to the versatility and dependability of the local contractor and his skilled excavator work. The stable and committed performance from a team of four local workers who undertook irregular employment, usually on weekends contributed greatly to the successful completion of large area intensively treated this year.

The mining rehabilitation procedures and outcomes for the seven NE projects undertaken are detailed with the aid of many photographs and summary maps. The projects are listed below in decreasing scale of the works undertaken this year. Recommendations for the 2002 – 03 period are included.

1 Cat Gully area adjacent to Blue Lake, Endurance Mine, South Mt Cameron.

Background

A detailed report and plan for remedial work for the Cat Gully area, entitled; *A proposed program to rectify severe gully erosion in the vicinity of Cat Gully, the Endurance Mine, South Mt Cameron, NE Tasmania*, outlines an action plan to address very active gully erosion fronting Cat Gully. In this the second year of remediation the area has been expanded to include similar severe and adjacent gulling, off a portion of the Endurance Deep Lead scarp.

Full details of the 2000 – 2001 works are contained in last years report. Most efforts in that period were directed to halting gully head cuts through the creation of cutoff drains and some rock lined drainage channels. Although a considerable area of bare ground was also treated, the large and steeply incised gullies were left intact until the current year.

The general features of the ongoing Cat Gully Project area are shown on Figure 1. The area was once a part of the Endurance No1 BMI scraper area. The eroding gullies catchment area, of about 15 ha was sparingly rehabilitated by Boral in the 1980's and was supplementarily treated with scarifying, seed, fertiliser and mulch last year to decrease runoff and encourage vegetative growth. The area lies to the east of the access road sign, **pictured right**.

Figure 2 is an enlargement of Figure 1. It shows the location of the gullies listed in Table 1 as well as cutoff drains, rock lined drains and the areas intensively treated during this period.



Rehabilitation Treatment ~ Planned and undertaken

a. Gullies

The works undertaken in 2000 – 2001 most successfully withstood the winter wet season. There was no back cutting of treated gullies and all ground treated was stable. Erosion only occurred in two limited areas where cutoff drains were breached due to insufficient levee bank height. Though easily repaired by hand, one breach, **pictured right**, amply demonstrated the erosive power of flowing water across unconsolidated sediments.

Confident in the ability to adequately address the erosion component of the rehabilitation task, utilizing the techniques of the previous year a more radical landscaping approach was used this year on all large gullies. Many of the before and after photographic illustrations in this report, clearly show the radical way in which the gullies have been reshaped using cut and fill means. Although native cement and tight clays were, the predominance of soft kaolinitic



Cat Gully Rehabilitation proposals and actions -Endurance Mine, South Mt Cameron

Table 1

Works to alleviate severe gully erosion - Funded by the Rehabilitation of Mining Lands Trust Fund

R. Munro

to June 30th 2002

Gully Code	Description and Notes	Degree	Average Dimensions			Height of gully	Estimated Volume	Catchment*	Pri- rity	X sec- tional	Longit- udinal	Rehabilitation Actions
		of	Lx	W	x H	Head	m3	size m3		Profile	Profile	
		Activity										
on a Scale 1 to 10 ~ 1 is low priority / small / not severe												
A	OLD RACE ~circa 1973~only a little backcutting~over hard Fe rich sed-130m	2	16	2	1.5	1.5	48	1000	1	V	Steep	Reshaped, Drains, Jute matting, Scrubbed
A.1	on Blue lake side parallell and close to lake -inaccessable~hard Fe sed.	5	18	3.5	3.5	4	221	600	4	U	Moder	Reshaped, Drains, Jute matting, Scrubbed
B	OLD RACE 130m long~circa 1973 ~ back cutting` harder Fe rich sed	3	30	6	4	1.6	720	1000	3	U	Steep	Reshaped, Fill added, Drains, Jute matting e
B.1	"multi pod" offshot from race	6	21	5.5	4	4	462	2700	5	U	Moder.	Fill added, Drains, Jute matting etc
B.2	small , slumping	6	16	3	3	2.5	144	400	4	V	Steep	Reshaped, Fill added, Drains, Jute matting e
C	White gravel, older erosion, small branches not entrenched	1	25	2	2	1	100	150	1	V	Steep	A Little rertiliser only
D	Small, linear, some veg. growing	2	15	2.5	2	1	75	150	1	V	Steep	Fertilised
E	Bent, narrow, in harder ground, some veg stabilization (large a. sophore) pt drain	3	85	1.5	1.5	nil	191	800	3	V	V Steep	Part Reshaped, Jute matting etc
F	Linear, abundant soft slumping, tributaries forming	8	20	2	3	0.5	120	150	5	V	Steep	Reshaped, Drains, Jute matting etc
G	Deep wide gulch	7	20	6	5	5	600	150	4	U	Mod	Compleetly Reshaped, Drains, Jute matting e
H	Deep, "poddy", with narrow angled upper reach following drainage line	7	60	3	4	2	720	1000	6	U	V Steep	Part Reshaped, Part filled, Jute matting etc
I	Small, linear	3	10	2	2	1	40	150	3	V	Steep	Compleetly Reshaped, Drains, Jute matting
J	Modified by SEMF / Stornoway rehad attempt.	9	60	5	4	nil	1200	1300	9	V	V Steep	Part Reshaped, Part scrubbed, Jute matting
J.1	sth small trib.	6	8	3.5	3	2	84	150	7	V	V Steep	Reshaped, Drains, Jute matting etc
K	Major gully ~old channel with active head & tribs on nth, sth bank stable veg,	5	120	8	5	3.8	4800	1200	9	U	Flat	Fill and pyrethrum added, cut off drains
K.1	Stubby gully ~ nth side	4	8	6	6	5	288	300	4	V	Steep	Only fertilised
K.2	Stubby gully ~ nth side	4	15	4	4	3.5	240	300	4	V	Steep	Only fertilised
K.3	Stubby gully ~ nth side	4	10	4	4	3.5	160	300	4	V	V Steep	Reshaped, Rock drains,
K.4	Stubby gully ~ nth side	5	5	5	3	3	75	200	5	V	V Steep	Fill and pyrethrum added, cut off drains
L	Major gully ~old channel with active head & tribs on sth, nth bank stable veg,	4	140	15	7	3.5	14700	150	3	U	Flat	Partly Reshaped, Drains, Jute matting etc
L.1	Gully trib, nth side, old, well veg, carries the largest stream,	2	25	7	5	3	875	23400	8	U	mod	Compleetly Reshaped, Drains, Jute matting
L.2	Linear very active trib, sth side	9	45	5.5	4.5	2	1114	800	9	V	Steep	Compleetly Reshaped, Drains, Jute matting
L.3	Linear very active trib, sth side	9	55	4.5	3.5	1	866	300	9	V	Steep	Compleetly Reshaped, Drains, Jute matting
L.3.1	Short trib	9	10	4	3.5	2.5	140	50	9	V	V Steep	Compleetly Reshaped, Drains, Jute matting
L.4	Slump / "sink hole type structures	7	7	4	3	2.5	84	50	6	N/A	lump ho	Compleetly Reshaped, Drains, Jute matting
L.5	Slump / "sink hole type structures	7	7	4	3	2.5	84	50	6	N/A	lump ho	Compleetly Reshaped, Drains, Jute matting
L.6	Slump / "sink hole type structures	7	7	4	3	2.5	84	50	6	N/A	lump ho	Compleetly Reshaped, Drains, Jute matting
M	Slumping flank of Cat Gully	9	9	35	6	2	1890	100	6	N/A	Scarp	Fill and pyrethrum added, some jute matting

LOCATION MAP **CAT GULLY**

Mine Rehabilitation Trust

Alluvial Tin Mining Erosion Control & Revegetation - 2001-2002

Enlargement showing intensive treatment area

rock drains

diversion channels

Blue Lake

CRO

CAT GULLY Dragline Channel

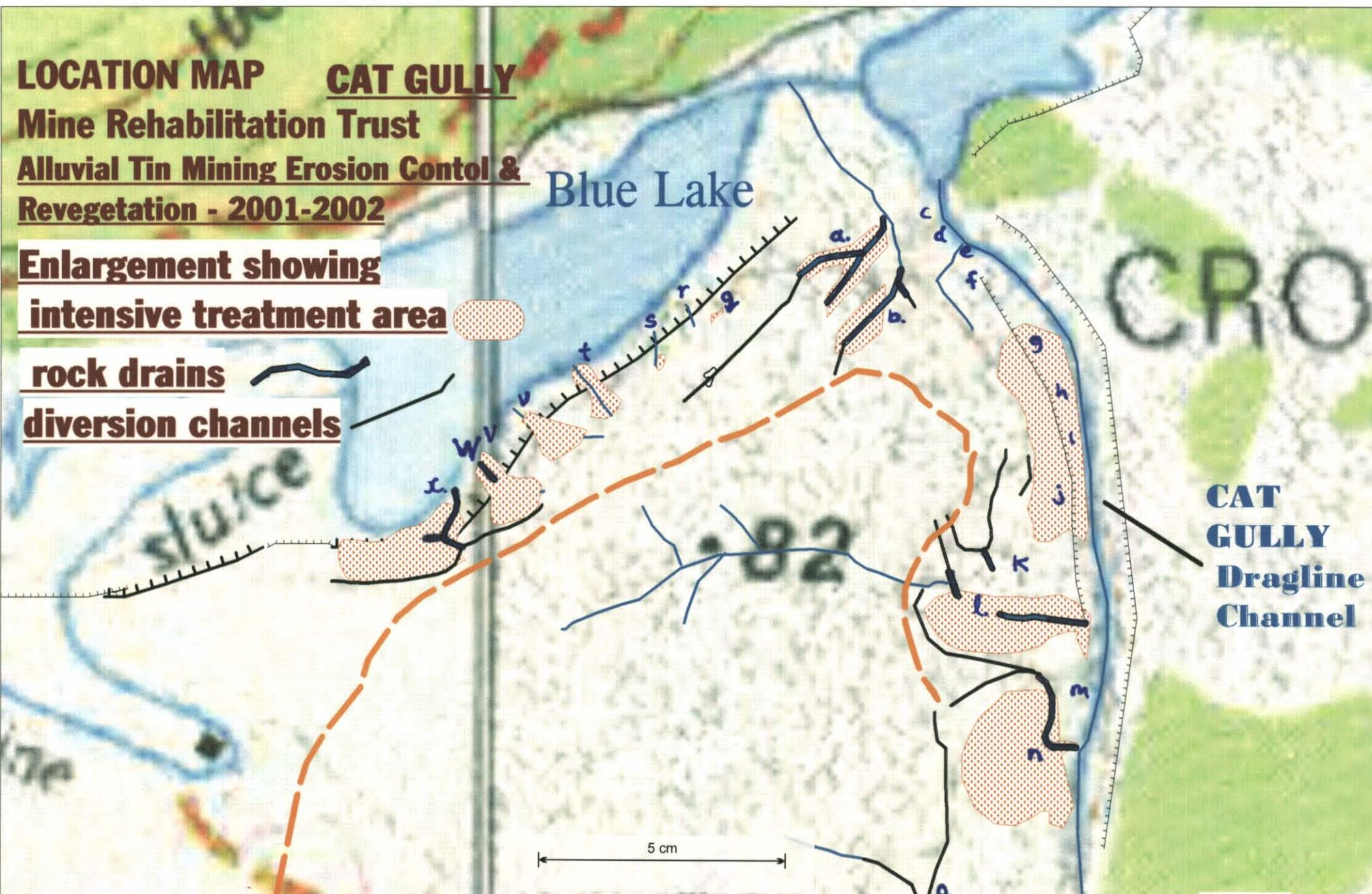


figure 2.

weathered granite provided easy digging for the excavator. The initial conversion of the series of dendritic, narrow incised gullies known as gully 'n' to a shallow basin occupying 0.4 ha in less than two days, **[see page of photos ~ figure 8]** stimulated confidence to similarly treat the two other large gullies bordering Cat Gully.

Neighbouring 'l' gully system, the deepest with very active branch gullies and the conveyer of most catchment runoff, was similarly reshaped. As per usual a geotextile lined rock drain was constructed, this time damming the upper portion of the main gully. Benching of the steep portions of the gullies was required. **[Gully 'l' works are also depicted on a page of photographs ~ figure 6].**

Similarly the very irregular series of gullies, slumps and small cliffs bordering Cat Gully listed as gullies 'g, h, i and j' were reshaped and amalgamated to form a continuous sloping bank.

Building on the better-than-anticipated experiences rehabilitating the Cat Gully facing gullies, a similar though not initially planned program of treatment of gullies bordering a section of the Endurance Deep Lead was then undertaken. Sizeable steep gullies shown as 't' through to 'x' located on figure 2 and also listed and ranked in table 1, amounted to approximately one third of this year's expenditure. Before and after photographs of gully 't' **[figure 9]** and gully 'x' **[figure 7]** accompany this report.

b. Hinterland

The 15 ha of catchment associated with these gullies systems was treated last year. No further works were needed apart from further top dressing this year. The response from the previous application of pyrethrum mulch and fertiliser was profound. Spring growth on existing vegetation such as *Banksia marginata*, **[pictured right]**, *poa* sp. and mosses **[also photographed, figure 16]** was most apparent.





Gully 'a' ~ rock drain construction



Gully 'x' ~ Cut off drain construction

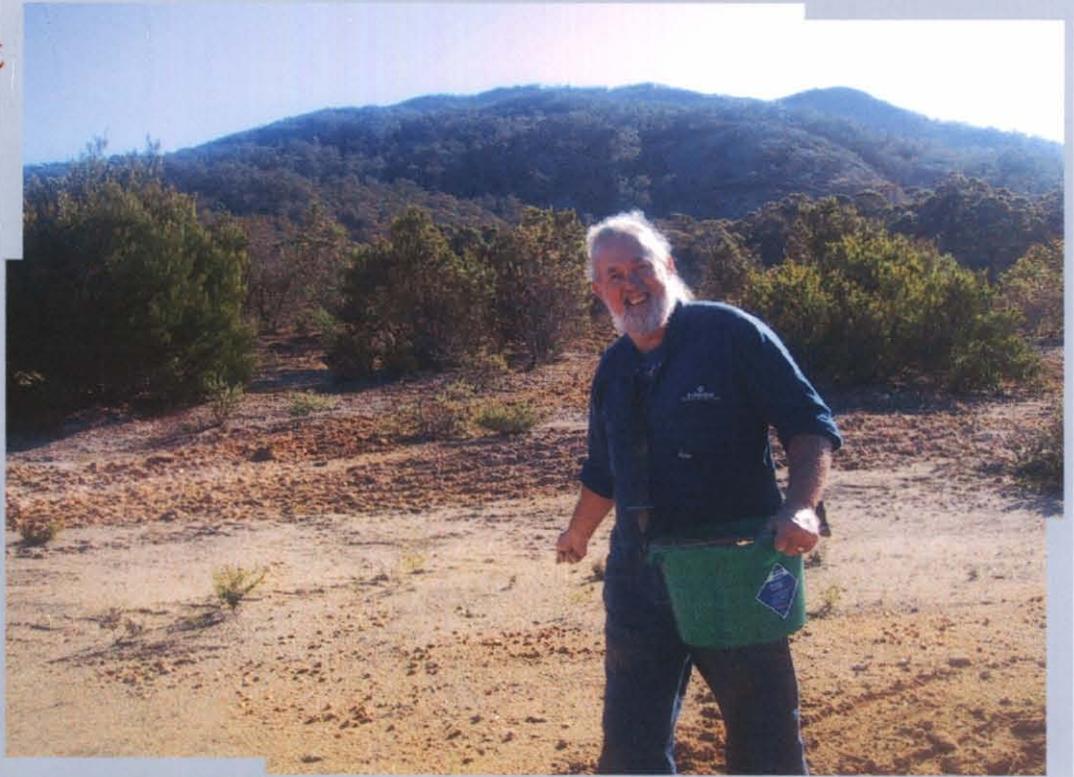
Machine Based Activities

Gully 'm' ~ battering vertical face and benching



Gully 'v' ~ shaping

Hand sowing & fertilizing



Acacia sophorae &
Acacia mucronata
collecting

**More Labour Based
Activities**



Gullies 'g , h, i & j'
~ laying jute matting

figure 4



Gully 'n' ~ "Fluffing old seasons straw, big square bales"

Tree Planting

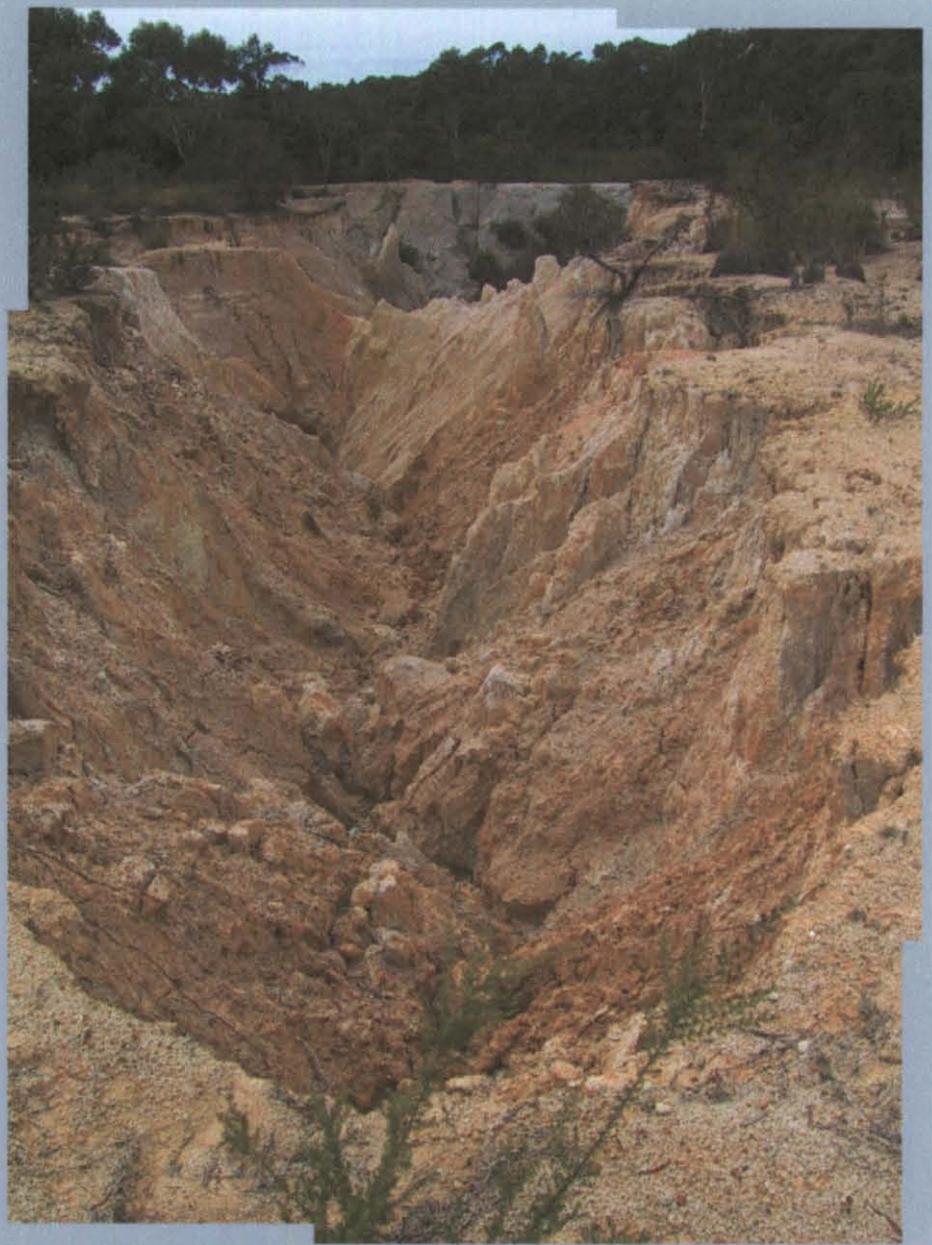


Labour Based Activities



Gullies 'g & h' ~ erecting vermin proof fence around plantings

Before
Treatment



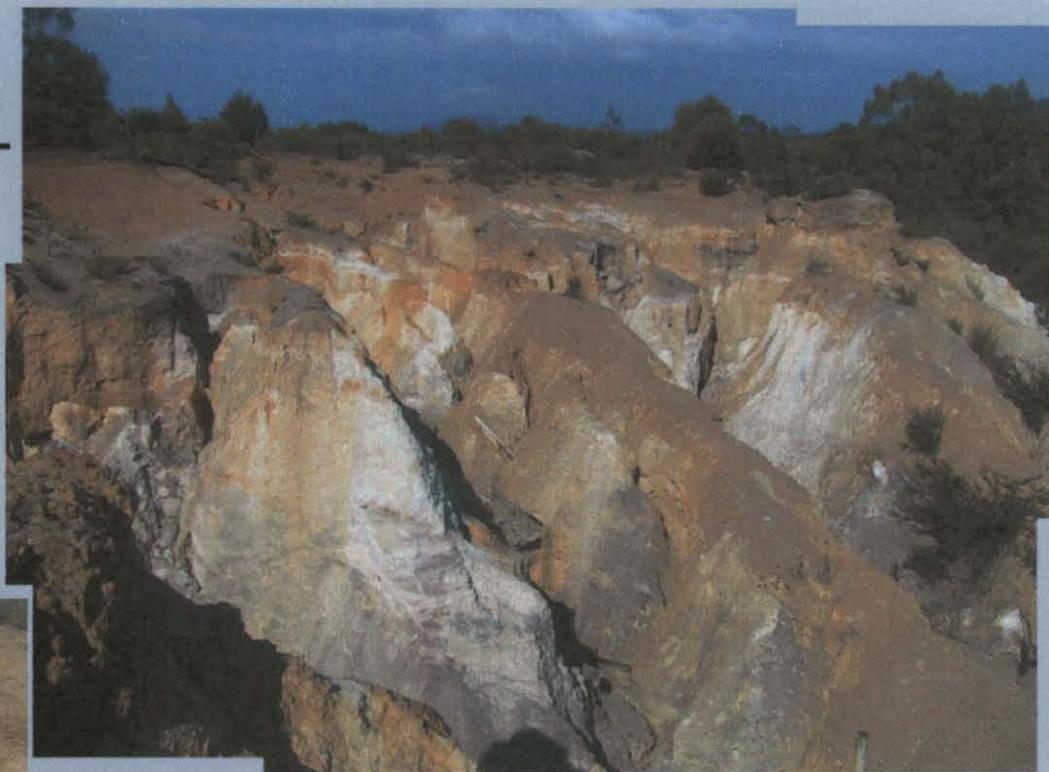
Gully 'I', the largest that now incorporates a small impoundment



Final
Treated
Product

figure 6

Before
Treatment



Lined Cutoff
Drain

Gully 'x' before
and after treatment

Final
Treated
Product



figure 7

*Intermediate
Treatment
Stage*



The "Bowl"
of Gully 'n'



*Final
Treated
Product*

figure 8

Mining Rehabilitation Trust Fund /

Mineral Resources Tasmania

Gully Rehabilitation ENDURANCE MINE

left: 14 Jan. 2002

below: 16 Jan. 2002

*Gully battered and filled . Erosion control
using straw, slash, and jute matting
treatment with associated organic
mulching, fertilising, liming and direct
seeding to follow*



Gully 't'

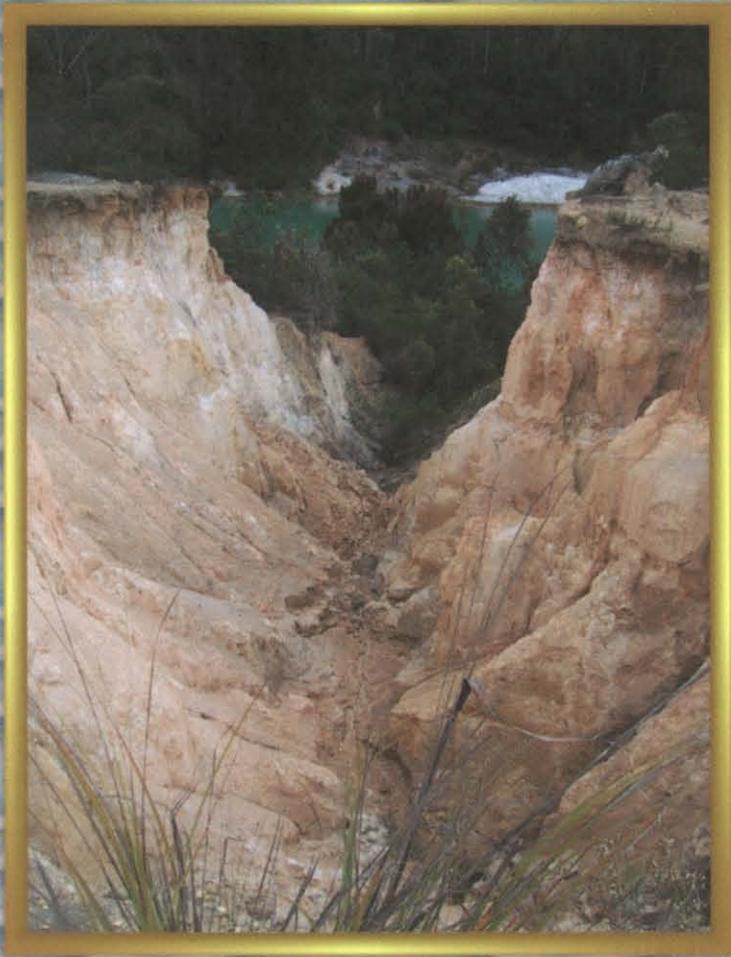


figure 9

Table 2**Materials used ~ Mine rehabilitation 2000 / 2001 & 2001 / 2002**

Materials	Quantity Used 2000 -2001	Quantity Used 2001 -2002
Rock (silcrete and forkings from Endurance mine)	200 m ³ / 25 loads	Nil ~ all exhausted
Rock (basalt for drains)	nil	50 plus x 8m3 loads
Tailings (from Endurance mine)	560 m ³ / 70 loads	nil
Pyrethrum (spent marc)	360 m ³ / 6 loads	480m3 / 8 loads
Lime (agricultural)	40 m ³ / 2 loads	nil
Gypsum (conditioner)	20 x 50kg bags	Balance of stock 12 x 50kg bags
Fertiliser (high analysis, maybe with trace elements)	6 t, (of low analysis)	7 t bulk of 3.15.13 2 t in 25 kg bags of 3.15.13
Jute Matting @ 500m x1.2m + staples	13 bales	30 bales
Geotextile	Approx 2 rolls	Approx 1 roll
Grass seed –e.g. cheap tamma ryegrass	nil	nil
Scrub	15 trailer loads	10 trailer loads
Straw	Nil big square	58 big square
Hay / straw	50 round bales	4 round bales
Hay / straw	100 bales	700 bales
Sandbags	nil	8
Native Seed	Balance of stock bar 2kg mixed natives	<i>Balance of stock plus Wildseed</i> order of about 16kg
Native Seed Collected (<i>Acacia sophore</i> of local providence)	4 kg	4kg mixed acacia seed
Seedlings	Nil	1000 @ \$0.40 each
Temporary Fencing	Nil	Approx. 500m
Misc.- Materials	Extra skewers	Extra skewers

Materials & Techniques used ~ Cat Gully rehabilitation 2001 / 2002**a. Gullies**

The techniques used in 2001-2002 are a refinement of those utilized in the previous year and are described in detail in the earlier report. The increased use of an excavator to shape gully rehabilitation is detailed in the previous section. Variations, observations about, or differences to previous techniques are as follows:

- “Fluffed” straw with an overlay of pinned jute matting was used wherever possible. This amounted to a labour intensive 1.52ha being covered at this site. [**See Labour based activities photos, figures 4 & 5**]. A number of sources of straw were used. Some scotch thistles and cape weed were introduced from the large bales. The cape weed has not persisted. The small bales of oaten hay were easiest to deal with. Some hay on the very windy exposed sites blew away if left uncovered.
- Where possible, the native seed was hand broadcast as a split application, i.e. before treatment and after the laying of the hay and jute.
- The laying of scrub was limited to steep banks.
- Some 272 m of rock drains have been constructed at this site. Many loads of basalt rock has been imported from the Winnaleah – Derby area. All rock drains are proving to be very stable and are superior to gabions.

- A further 225 m of jute lined, cutoff and subsidiary drains have also been constructed.
- Two areas were selected to trial the establishment of seedlings behind a temporary net wrap fence. It was envisioned that, similar to bale wrapping, several laps of the enclosed area would make the area vermin proof. Shortage of net wrap (a hard to obtain S/H roll indicated to contain about 2km of material by the seller only measured at about 800m of length in the field) limited the fence to one lap. Though the fence worked for several weeks a very high browsing pressure increasingly breached the fence, particularly at corners. The fence would have needed to be browsing animal proof for at least 6 months to allow seedling establishment. After 1 month most of the seedlings had been heavily browsed. Many of the *Poa lab.* had been pulled out.
- Close observation of the germination of the previous sowing has demonstrated the severe impact that rabbits, wallaby and possums are having on the success of the revegetation effort. Rare localities where animals cannot reach have volunteer grasses and vigorous native regrowth while accessible areas are often grazed to the ground. Species thought not to be browsing targets such as peppermint and melaleuca growth from sown seed were also found to be suffering. The application of fertilizers and mulches may have resulted in these plant species being more palatable than those growing on neighbouring impoverished ground.
- Three soil samples were collected on the 15th July 2001 and submitted to Impact for soil testing from an agronomic basis. The results were somewhat as expected ~ generally impoverished with only sulphur being optimum. Aluminum and manganese were at a near toxic level of abundance in the two 'clay' samples. The full results are **appended** to this report.

Results {Using Impact standards on the basis of maintenance of dryland pasture are used as comparisons} from the report are presented below as **TABLE 3:**

Analyte	Samle 1	Sample 3	Clay soil	Sample 2	Sandy Soil
	typical pure, soft decomposed granite, kaolin dominant.	Buff colored, gritty sands and clays. Typical Tertiary sediment mix	Standard	Quartz granule and sand based tailings	Standard
Ca	0.1	0.07	5	0.07	2
Organic C	0.1	1	>2.2	0.30	>2.2
P Olsen	2	2	40	2	15
P Colwell	14	2	110	6	35
K	0.03	0.04	0.72	0.02	0.38
Cu	0.1	0.1	0.3	0.1	0.3
Zn	0.20	0.3	1	0.2	1
Mg	0.35	0.13	1.6	0.09	1.6
Mn	1.0	1.0	4 to 50	1.0	4 to 50
B	0.2	0.10	1	0.10	1
S	53	18	20	4	20
PH	4.9	4.6	5.4+	5.0	5.4+
Al	2.18	2.16	<1.1	0.36	<1.1
Na	0.13	0.11	<1.0	0.04	<1.0
Fe	2.0	701	4 to 100	63	4 to 100

b. Cat Gully Hinterland.

Approximately 3.5 t of 3.15.13 high analysis fertiliser was spun on by tractor on some 15.3ha as a continued top dressing of the area. Photos, **figure 16**, at the rear of this report depict the vigor that this vegetation now exhibits, as a result of nutrient enrichment.

2. Clay Pit Gully, Endurance Mine, South Mt Cameron.

Background

The Clay Pit gully was a elongate [see **picture right**] (250 metre) gully that lies to the north of the rehabilitated N2 gully. It deepened significantly from its mid point downwards and was probably an old tailrace structure that was only back cutting slowly. **Figure 11** and the 2002 aerial photo enlargement, **figure 10** show the location and shape of the treated site.

Rehabilitation Treatment ~ Planned and undertaken

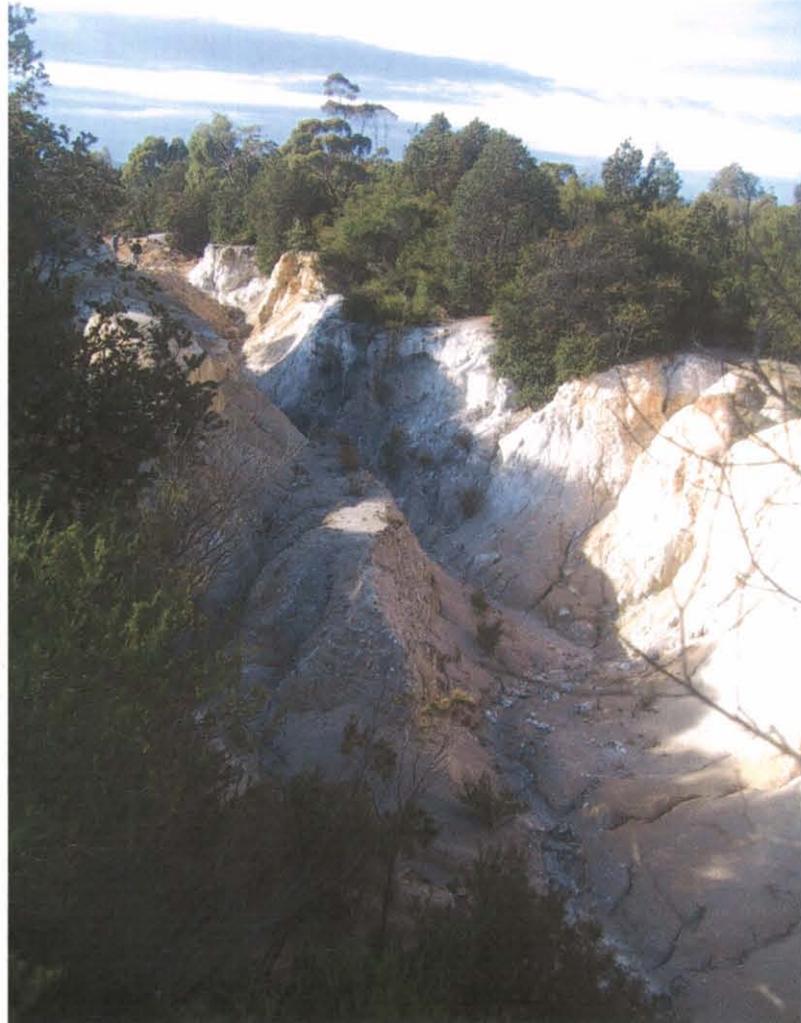
The Clay Pit gully has now been fully rehabilitated. It amounts to an area of 0.9ha once landscaped. The works, both in terms of machine and labour team resources equated to about 30% of the year's effort and expenditure. Excavator cut and fill techniques have again been very successfully applied.

Materials & Techniques used ~ Clay Pit Gully rehabilitation 2001 / 2002

All but the steepest banks have been treated in the same manner as the Cat gully sites. A page of photographs

[figure 12] is included. The lower photo shows the central rock drain 125 m long flanked by hayed and jute covered slopes. The upper portion of the drain is a jute and hay lined spoon drain structure of a similar length.

Although precise figures are not available, this gully has been rehabilitated much more cost effectively than the neighbouring N2 (1998 –99 treated) in terms of erosion control. A comparison in terms of revegetation can only be made in several years time.



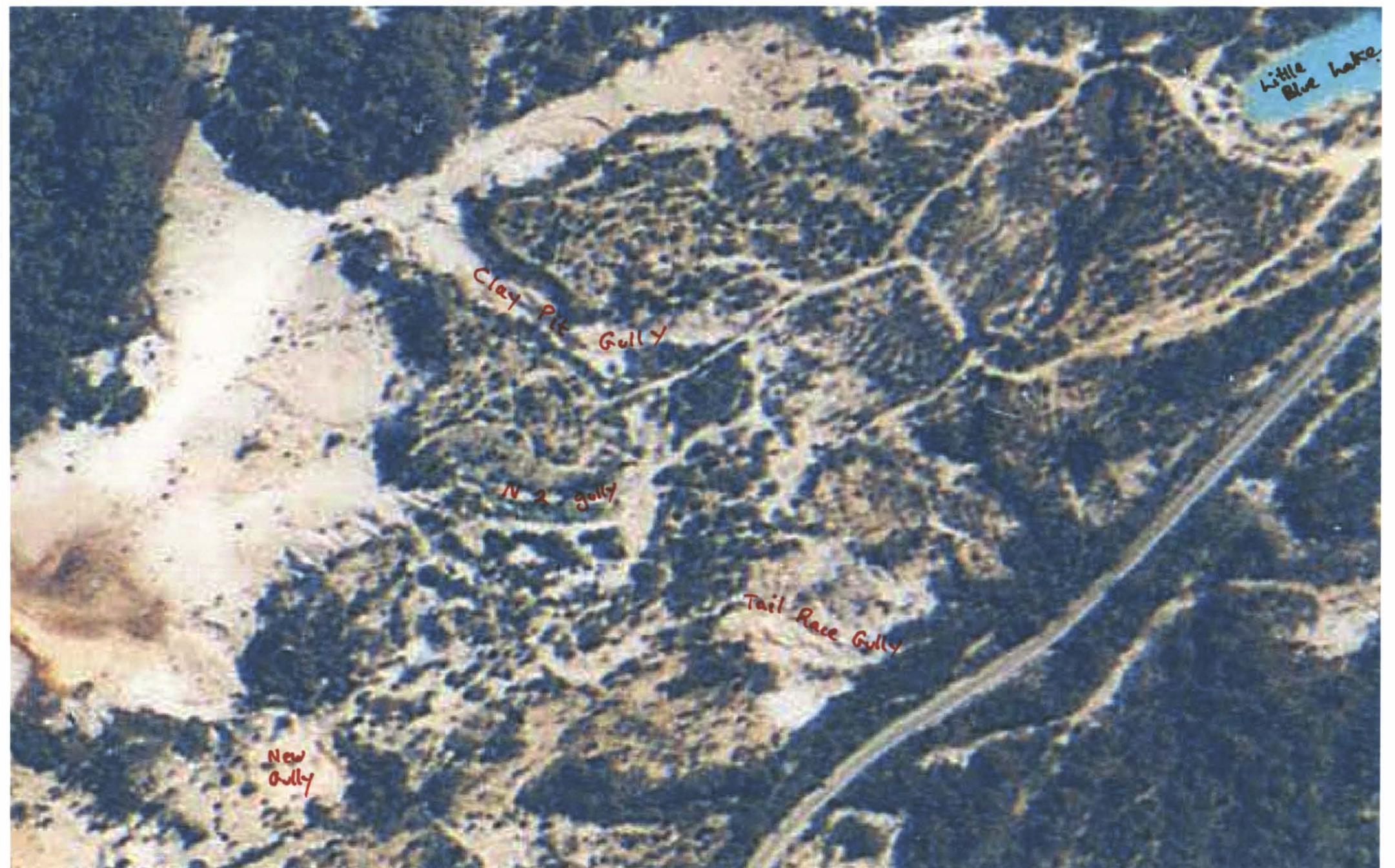


figure 10. Clay Pit 2002 aerial photo enlargement

Location Map ~ Clay Pit Area, South Mt Cameron

Mine Rehabilitation Trust Fund. ~ Alluvial Tin Mining Gully Erosion Control Works 2001- 2002

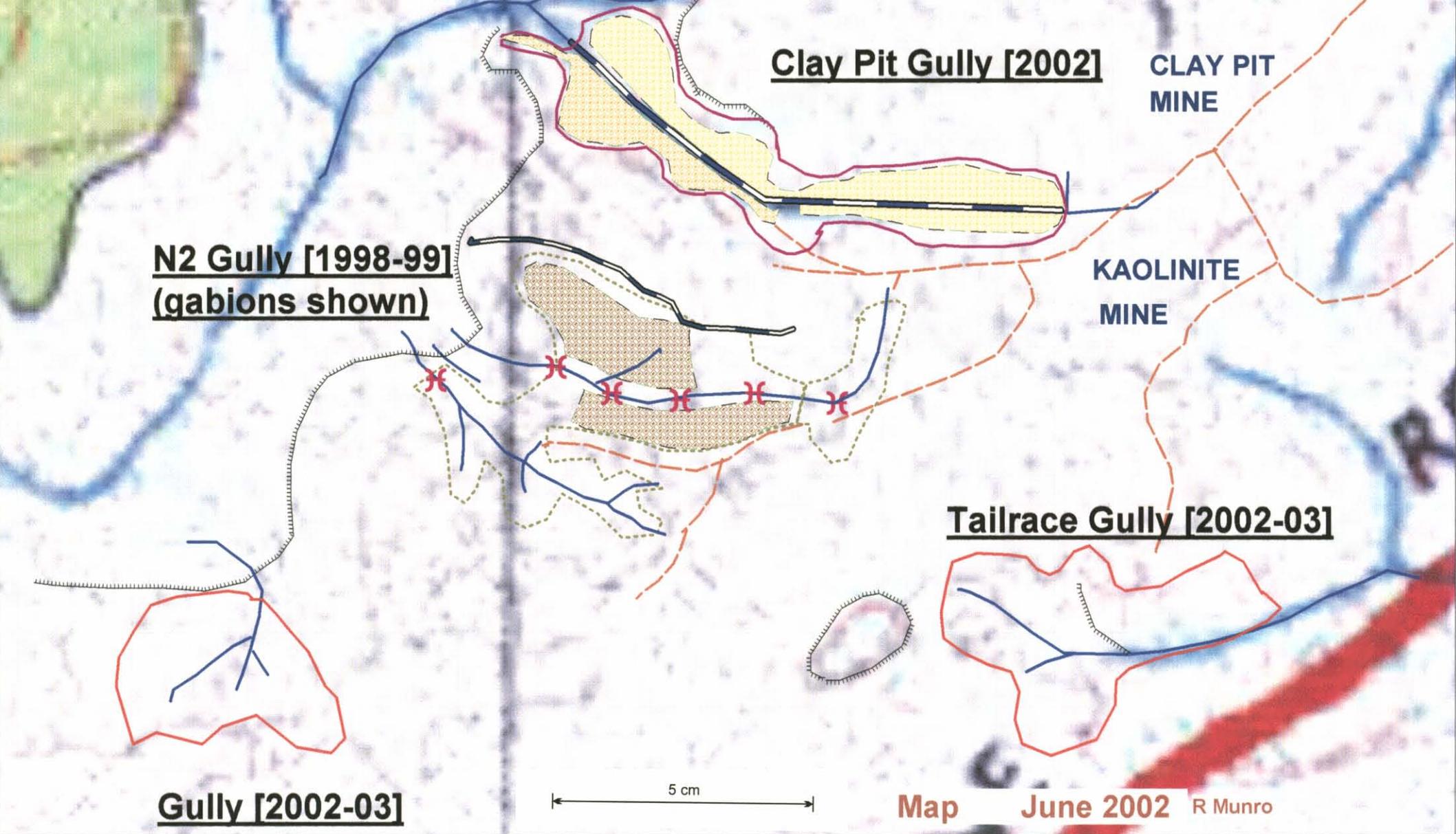


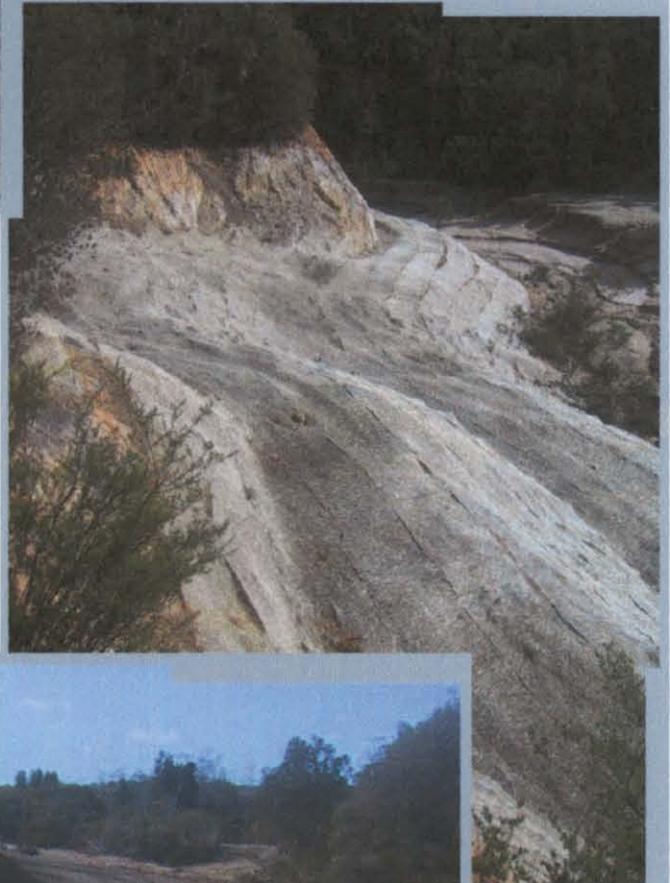
figure 11.



Lower Portion

Clay Pit
Gully
2002
Treatment

Benched
western section



Middle
portion

figure 12.

3. Endurance No1 Scraper Workings, South Mt Cameron.

- **Background**

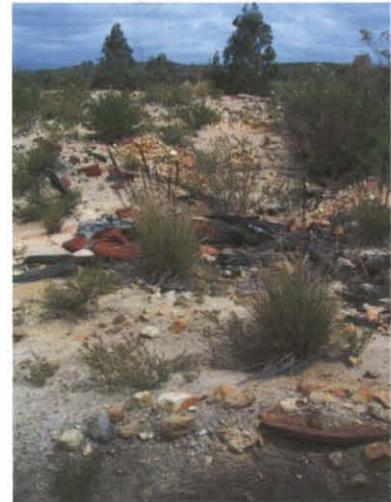
The area immediately to the west of Cat Gully is termed the Endurance No 1 scraper Workings. See Figure 1. Much of the area is flat "clay" site with lenses of hard native cement. The road to Western Endurance dissects the area, with the southern portion being rilled and sloping towards the southern tailing fans. Situated on the Endurance No 1 Scraper Workings are:



- ❖ The remains of the last Deep Lead Endurance Tin Mining Co. treatment plant (their only jig plant of the late 1960's) ~ **see left**, some disturbed excavations and concrete pads of the area
- ❖ Remnants of the scraper fed Endurance No1 stockpile heap with associated ground sluice race. The remains consist of oversize forkings and scrap steel, **see below**.

The company Boral rehabilitated the complete area in the mid 1980's. Vegetation is sparse over most of the areas and minor erosion gullies have

formed. Exotic species such as *Acacia pravissima*, *Acacia baileyana*, *Callistomen* species and *Acacia retinoides* have been planted. Most are struggling to survive though it is evident that *Acacia retinoides* is thriving and is becoming a weed.



- **Rehabilitation Treatment ~ Planned and undertaken**

The program for the current season entailed fertilizing and mulching the total area together with scarifying and native seeding areas most devoid of vegetation. The area treated amounted to 13.2 ha.

- **Materials & Techniques used ~ Endurance No1 rehabilitation 2001 / 2002**

High analysis fertiliser (3.15.13) was applied at 250kg / ha to 13.2ha. Native seed was applied with gypsum as a bulking agent to about 4ha. The area treated is shown on **figure 13** . The area sown with native seed was subsequently scarified.



A further eight loads of pyrethrum spent marc, was delivered by a large walking floor prime mover. This dry and dusty organic matter was dumped in the middle of this treatment area. **See photo, left**. One load was used on Cat Gully 'x'. A small proportion was dispersed by the wind. The balance [bar wet "left overs"] was eventually spread over half this area. It is apparent that fertiliser spreading

contractors are not keen to apply this dusty mulch. The wait was over six months before a contractor undertook the task, and then only with mediocre performance.

LOCATION MAP CAT GULLY & ENDURANCE MINE

Mine Rehabilitation Trust

Alluvial Tin Mining Erosion Control & Revegetation - 2001-2002



Area that received intensive treatment during 2000 - 2001

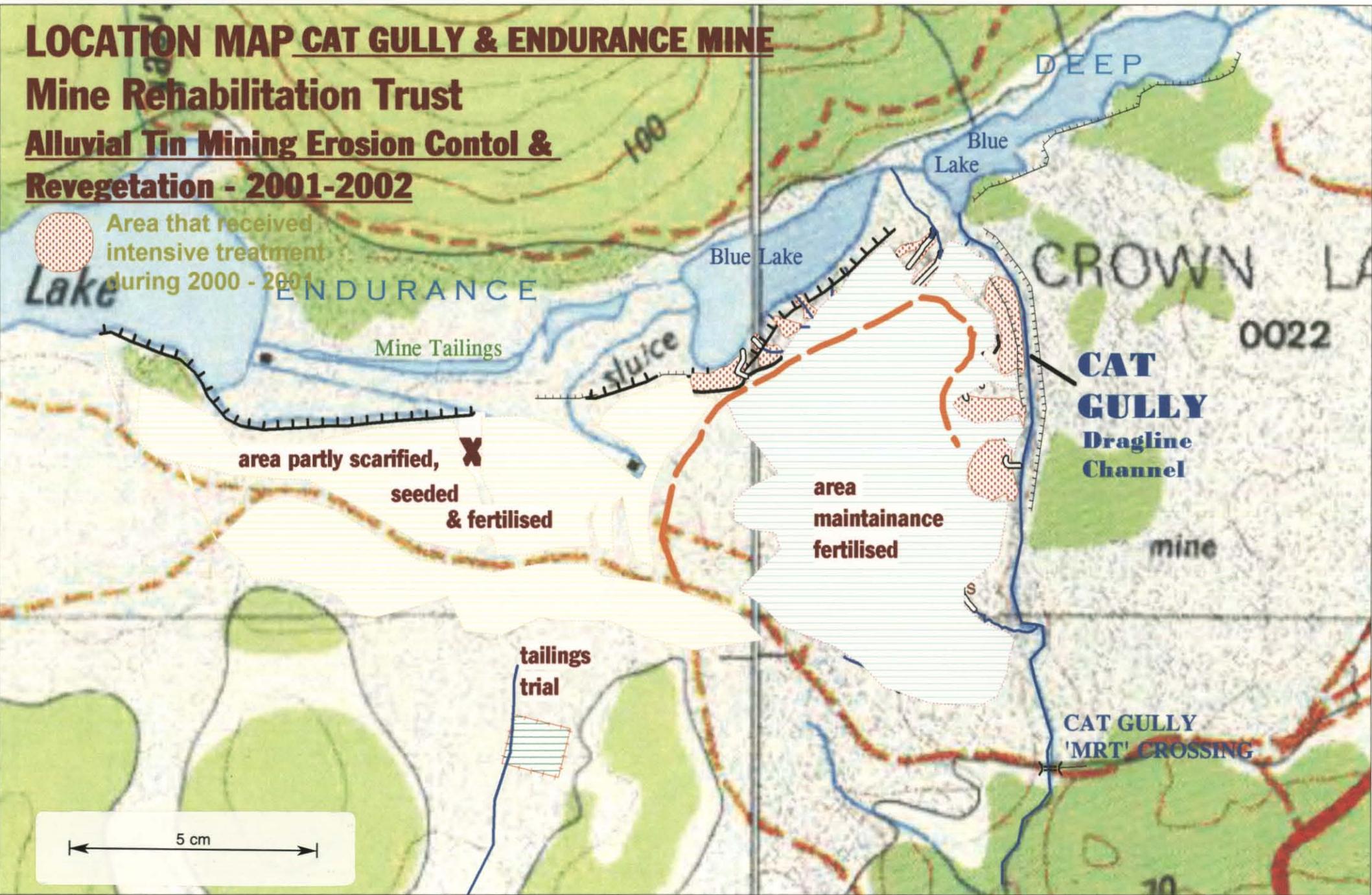


figure 13

MINES REHABILITATION TRUST FUND
NE TAS TIN MINE REHABILITATION PROJECT
Location Photo-Map -FIGURE
Endurance Tailings Proposed Works

Proposed
Tailing Rehabilitation strips
Fig 14.

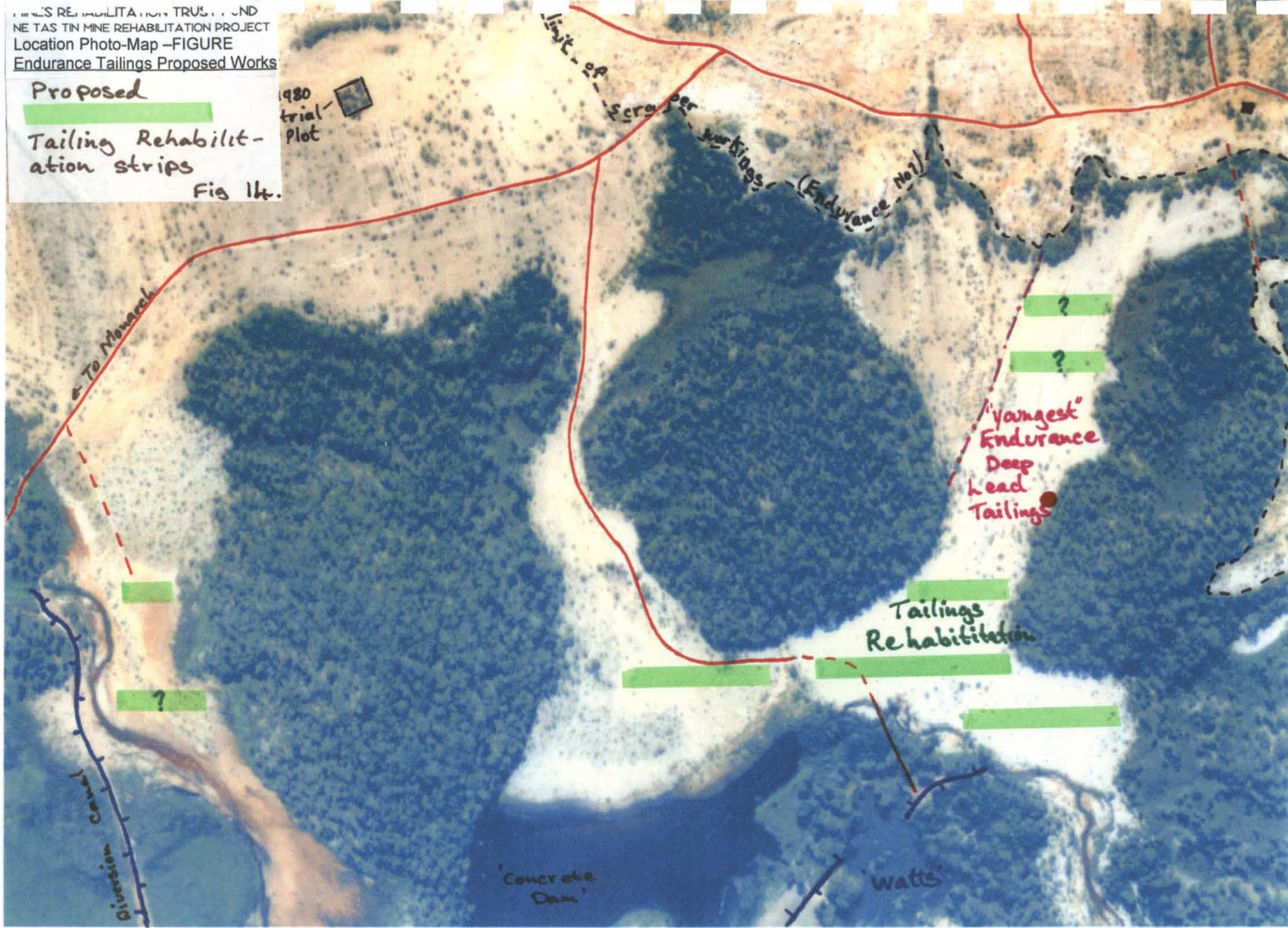
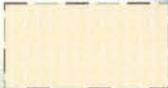
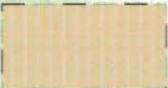
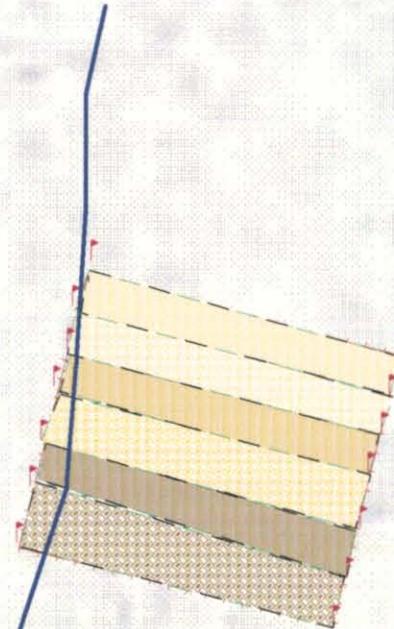


figure 14

**LOCATION MAP -Endurance Tailings
Mine Rehabilitation Trust Fund
Tailings revegetation trial strips
Native seed sown May 2002**

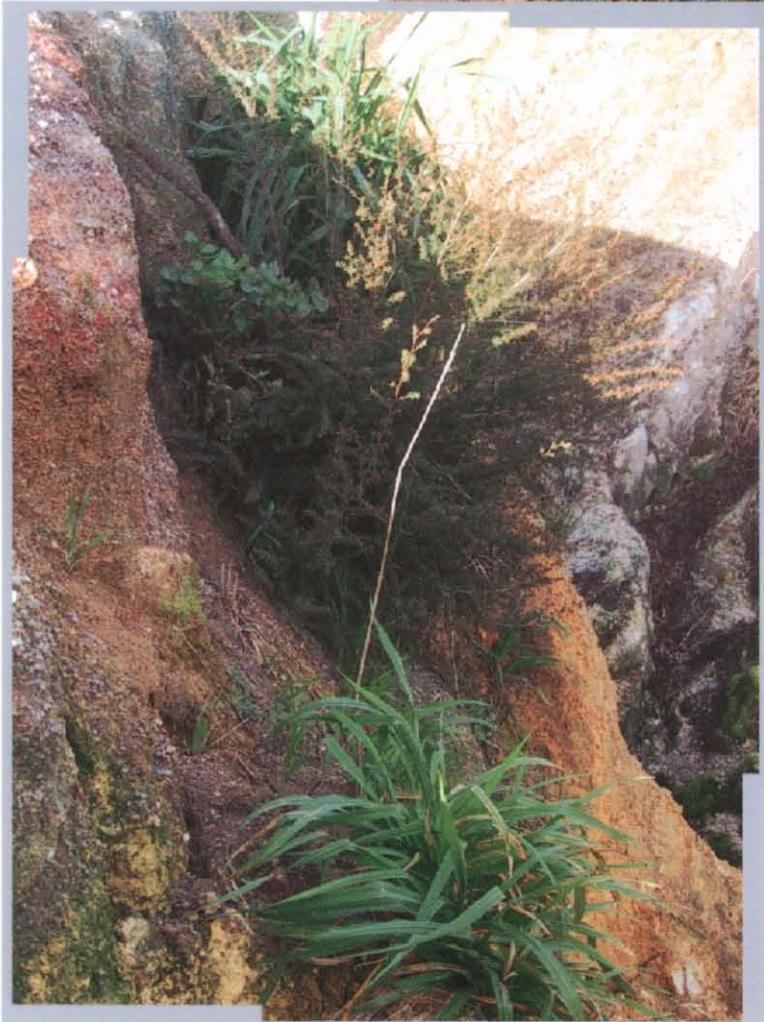
-  **Scarified / 1 unit of NPK fertiliser**
-  **Scarified / 2 units of NPK fertiliser**
-  **Scarified / 4 units of NPK fertiliser**
-  **None Scarified / 1 unit of NPK fertiliser**
-  **None Scarified / 2 units of NPK fertiliser**
-  **None Scarified / 4 units of NPK fertiliser**



Map - figure 15 June 2002



Response to fertiliser and mulch
~ vigorous growth of moss



Peppermint and melaleuca
germination ~ 8 months

Abundant growth where
browsing not possible

figure 16

4. Endurance Tailings, Ruby Creek Diversion, Riffle and Channel Erosion, vicinity of the Endurance Mine, South Mt Cameron.

- **Background and Observations 2001 / 2002**

Accelerating regrowth on the three tailings fans formed by the southward drainage pattern of tailings discharged for the Endurance Deep Lead series of sluice boxes has for several years, been a goal for Trust funding.

- **Rehabilitation Treatment ~ Planned and undertaken**

Planned rehabilitation strips for this period are shown on the aerial photo, **figure 14**. The actual smaller test strips created in May 2002 are located on **figure 1**, with attribute details of the six specific test strips depicted on **figure 15**. The strips should test revegetation response to ground disturbance and fertiliser level. A recent preliminary inspection shows responses to fertiliser application per say.

5. N2 Gully Maintainance, Endurance Mine, South Mt Cameron.

- **Background and Works 2001 / 2002**

The N2 gully continues to show excellent vegetation growth across a range of substrates and environs. A small area with suspected sulphur / pyritic contamination remains bare. The annual application of about 100 kg/ha of high analysis fertiliser over an area of 1.12ha has continued. Some of the best regrowth is pictured, **left**.

Maintenance to several gabion structures was necessary.



6. Star Hill [Garfield, Lawrys] Mine, Gladstone.

- **Observations 2001 / 2002**

The results of the last (second) rehabilitation phase (2000 – 2001) to date have been assessed as disappointing. Rilling has been extensive, especially where ripping and direct seeding did not follow contours. In the first phase, rapid plant colonization was able to stem an initial erosion phase. In the case of last year's works, seedling germination and/of survival has been poor. Again there is evidence of severe browsing pressure. The area should be monitored this year with a view to either undertaking remedial works, fertilizing or leaving alone.

7. Shallamar Creek Gully Restoration, Old Monarch Mine,

- **Observations 2001 / 2002**

The rock channel / chute structures constructed to replace failed gabions are stable and have required no maintenance. The direct access road to this area is scheduled for closure as it has allowed uncontrolled access to Scottsdale High School Field Study Center facilities resulting in vandalism.

Planned Works 2002 – 2003

Major Works

- Complete restoration of "Tailrace Gully", Clay Pit area, South Mt Cameron.
An area of 0.75 ha pictured right that drains into the Ringarooma River and was once use for the conveyance of deep lead tailings to the river in conjunction with a tunnel under the Gladstone Road. These workings are located on **figure 11**
- Similar complete rehabilitation of a steep and active unnamed gully system backcutting from the mine face of old deep lead Endurance workings. The area of 0.5 ha is also located on **figure 11** and photographed, **right**.
- Revegetation works on the lower reaches of the Endurance tailings fans. See **figure 14** for approximate locations.



Minor Works

- Continued topdressing with high analysis fertiliser of all works completed to date at South Mt Cameron and Monarch.
- Landscaping, revegetation and minor gully control of spoil and clay sites bordering the eastern side of the Cat Gully channel.

Proposed works for consideration by the Trust

- Additional treatment including erosion control to aid recovery of poor rehabilitation performance at Star Hill. See the discussion in **section 6**.
- *Acacia retinoides* weed control. A weed introduced by previous mine rehabilitation agencies.
- *Pinus radiata* and other *Pinus* species weed control. Radiata pine is an active weed of the Gladstone Land System. It is a colonizer of bare clay sites. Mining companies have extensively planted Radiata pine in the late 1970's and early 1980's as a mined ground rehabilitation tool. The spread of pines is most apparent at South Mt Cameron and Star Hill. A strategic pine control approach is proposed. Removal of pines to incorporate current rehabilitation techniques along a road facing section of the Gladstone Road, vicinity of "the Post Office Show" is also suggested.

APPENDIX (next pages)

Soil Analysis for three sites, Endurance Mine: Decomposed Granite, Tailings, Clay Site.



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To convert meq/100g Incitec report levels to Impact ppm
Report levels used previously.

Multiply K x 390

Multiply Ca x 200

Multiply Mg x 122

There will always be percentage errors associated with soil tests when comparing results from one laboratory to another laboratory.

The approximate confidence limits should be as below.

Analyte tested - pH(1:5 Water) +/- 0.1 pH unit.

P (Colwell) +/- 10% of result.

P (Olsen) +/- 10% of result eg +/- 1mg/kg for 10 mg/kg
That is previous result of 10 mg/kg may be now 9- 11 mg/kg.

K +/- 5% of result

Ca +/- 5% of result

Mg +/- 5% of result.

*ASPAC limits for proficiency program +/- 2 standard deviations.= 20% of result.

All other tests now reported are by different procedures and as such no comparison to old Impact tests can be made.



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SOIL ANALYSIS NOTES

WARNING

Misuse of trace elements can cause problems with stock. It is recommended that trace elements not be applied in paddocks where stock are grazing until 10mm of rain has fallen or 14 days has elapsed.

A GENERAL GUIDE TO DESIRABLE SOIL NUTRIENT LEVELS FOR IMPACT SOIL TESTING SERVICE USING INCITEC LABS GENERAL DRY LAND LOW RAINFALL PASTURE MAINTENANCE ONLY

	Sandy Soils	Loam Soils	Clay Soils
Ca (calcium)	2	2	5
Electrical Conductivity (EC)	below 1.0	below 1.0	below 1.5
Organic Carbon	above 2.2	above 2.2	above 2.2
P (phosphorus) Olsen	15	25	40
P (phosphorus) colwell	35	60	110
K (potassium)	0.38	0.53	0.72
Cu (copper)	0.3	0.3	0.3
Zn (zinc)	0.8	0.8	1
Mg (magnesium)	1.6	1.6	1.6
Mn (manganese)	4 - 50	4 - 50	4 - 50
B (Boron)	1 (2 forage)	1 (2 forage)	1 (2 forage)
S (sulphur)	for monitoring only maybe 20		
pH (water)	5.4+	5.4+	5.4+
pH (CaCl ₂)	4.4+	4.4+	4.4+
Al	below 1.1	below 1.1	below 1.1
Na	below 1.0	below 1.0	below 1.0
Fe	4 - 100	4 - 100	4 - 100

All Impact Fertilisers standard single super with trace elements listed on the price list are formulated for use at 250kg/ha. If fertilisers are used at a different rate the addition rate of trace elements must be adjusted accordingly.

REMEMBER INTERACTIONS BETWEEN ELEMENTS IMPORTANT

Suggestions are based on information received and results from Laboratories, as many other influences are involved no guarantees can be given.

WARNING: When using trace elements ie. zinc, copper, molybdenum, etc., there is a withholding period of 2 weeks (14 days) or sufficient rain (10mms) before stock can graze treated areas.



Recommendation & Status Report

Trading Name	Mineral Resources Tas.	Field Name	Endurance 1
Location	Telita	Section of Field	ALL
Contact Name:	Revel Munro	GPS Latitude	
Work Phone:		Sample Type	Soil
Adviser:	Leonard Youd	Lab Report No:	g0153247
Phone:		Crop:	TREES
Interpretation:	09-Aug-2001	Growth Stage:	
Chart:	FORESTRY MAINTENANCE-DRYLAND- i1780M	Planting:	
		Longitude:	
		Depth:	0 - 7.5 cm
		Sample:	17-Jul-2001
		Target Yield (t/ha)	0
		Soil Textures: All soils- Tasmania.	

The following information and recommendations are suggested for your consideration and are the opinion of the interpreter.

Analyte	Value	Def <small>Plant Tests only</small>	Low	< Opt/Norm or Mod	Generally Satisfactory	> Opt/ Norm	High	Excess or Toxic
pH (1:5 Water)	4.90		■					
pH (1:5 CaCl2)	4.10				■			
Organic Carbon %C	0.10		■					
Nitrate Nitrogen mg/kg	1.20							
Sulfate Sulfur (MCP) mg/kg	53.00				■			
Phosphorus (Colwell) mg/kg	14.00							
Phosphorus (Olsen) mg/kg	2.00		■					
Potassium (Amm-acet.) meq/100g	0.03		■					
Calcium (Amm-acet.) meq/100g	0.10		■					
Magnesium(Amm-acet.) meq/100g	0.35		■					
Aluminium (KCl) meq/100g	2.18						■	
Sodium (Amm-acet.) meq/100g	0.13							
Elect. Conductivity dS/m	0.03							
Copper (DTPA) mg/kg	0.10		■					
Zinc (DTPA) mg/kg	0.20			■				
Manganese (DTPA) mg/kg	1.00		■					
Iron (DTPA) mg/kg	2.00		■					
Boron	0.20		■					
Molybdenum								
Cation Exch. Cap. meq/100g	2.79							
Calcium/Magnesium ratio	0.28		■					
Aluminium Saturation %	78.20							
Sodium % of cations (ESP)	4.65				■			

Amendment/ Recommendation

pH (1:5 Water) 4.9 Value - Low - Very strongly acidic. Check subsoil pH. Liming may be advisable for some species especially conifers, pines or deciduous trees. The acidifying effect of eucalyptus/acacia forestry may be overcome with the addition of 0.5ton/ha lime every 10 yrs.

Organic Carbon %C 0.1 % C w/w - Low

Calcium (Amm-acet.) meq/100g 0.1 meq/100g - Low - Confirm with plant tissue analysis. Use gypsum containing fertilisers eg SSP or SSP blends.

Magnesium(Amm-acet.) meq/100g 0.35 meq/100g - Low - Confirm with plant tissue analysis. Include Causmag at standard rates with fertiliser and/or apply a test strip of magnesium oxide (Causmag AL7) at up to 200 kg/ha. Soil amendments are best broadcast and incorporated into top 100mm of the soil a minimum of 3 months prior to planting. If K low use K-Mag at 2%Mg.

Aluminium (KCl) meq/100g 2.18 meq/100g - High - Lime to pH(w) 5.5. Consider the pH and



NUTRIENT ADVANTAGE

Recommendation & Status Report

Trading Name	Mineral Resources Tas.	Field Name	Endurance 1		
Location	Telita	Section of Field	ALL		
Contact Name:	Revel Munro	GPS Latitude		Longitude:	
Work Phone:		Sample Type	Soil	Depth:	0 - 7.5 cm
Adviser:	Leonard Youd	Lab Report No:	g0153247	Sample:	17-Jul-2001
Phone:		Crop:	TREES		
		Growth Stage:			
Interpretation:	09-Aug-2001	Planting:		Target Yield (t/ha)	0
Chart:	FORESTRY MAINTENANCE-DRYLAND- i1780M	Soil Textures:	All soils- Tasmania.		

The following information and recommendations are suggested for your consideration and are the opinion of the interpreter.

aluminium of the surface and profile samples prior to lime application.
Calcium/Magnesium ratio 0.28 Ratio - Low - Consider lime at up to 6 t/ha in conjunction with other factors.

Top Dressing 1

150.0 kg/ha Impact CSM 0 - 17 - 8 - 1

Phosphorus: Not Chart Referenced, Low - Apply a minimum of 180 gms/P per tree. Radiata pines (and conifers and deciduous trees) may need 2 times this amount. (Radiata pines can remove 3-5 times as much P as native trees. Apply after establishment.)

Potassium: Low - Apply a minimum of 100gms/K per tree. Radiata pines (and conifers and deciduous trees) may need 1.5 times this amount. (Radiata pines can remove up to 3 times as much K as native trees.)

Apply after establishment.

Copper: Low - Confirm status with plant tissue analysis. Where deficiency is confirmed broadcast and incorporate 1kg/ha Cu (5kg/ha copper sulfate) into the soil prior to planting. Copper may need to be applied every 5 to 8 years. Low Cu can result in severe stem deformation in P. Radiata.

Manganese: Low - Confirm status with plant tissue analysis. The availability of manganese fluctuates depending on soil temperature and moisture. Therefore a single soil test may not indicate the highest level of available Mn that is like to occur during the year. A further sample taken towards the end of summer may provide a better guide. Consider a test strip of 8kg/ha manganese sulfate.

Iron: Low - Plant tissue test to confirm status. Consider a test strip of iron sulfate at 10 - 15 kg/ha incorporated prior to planting.

Boron: Low - Boron is a highly mobile nutrient. Surface samples which indicate deficiency may be misleading and sub-surface soil testing and local knowledge should be used along with plant tissue analysis to confirm any deficiency. Boron is more likely to be deficient in old pasture areas. Crinkling and discolouration of young unfolding leaves and bud "dieback" in Eucalyptus may be controlled with an application of 30-100gms/tree of Sodium Borate. Leader dieback in P. Radiata can be controlled with an application of 50-150kg/ha (7-35gms/tree) Sodium Borate. This application can aid uptake of N, P & K. Slower release forms of boron eg Ulexite, will act over a longer period.

Molybdenum: Not Tested



Nutrient Strategy Report

Trading Name	Mineral Resources Tas.	Field Name	Endurance 1
Location	Telita	Section of Field	ALL
Contact Name:	Revel Munro	GPS Latitude	
Work Phone:		Sample Type	Soil
Adviser:	Leonard Youd	Lab Report No:	g0153247
Phone:		Crop:	TREES
Interpretation:	09-Aug-2001	Growth Stage:	
Chart:	FORESTRY MAINTENANCE-DRYLAND- i1780M	Planting:	
		Target Yield (t/ha)	0
		Soil Textures: All soils- Tasmania.	

The following information and recommendations are suggested for your consideration and are the opinion of the interpreter.

Fertilizer Nutrient Application (kg/ha)

Stage	%	N	P	K	S	Ca	Mg	Cu	Zn	Mn	Fe	B	Mo
Top Dressing 1	100.		25.9	12.5	1.9	18.4							
Totals		0.	25.9	12.5	1.9	18.4	0.						

Note: Interpretations and recommendations given here are a guide only, and depend on representative samples being analysed, additionally environmental and managerial factors influence production, therefore Incitec Limited and Dealers do not accept any liability whatsoever arising out of these interpretations and recommendations for any damage, loss or injury of any nature and the user takes these interpretations and recommendations on these terms. This recommendation is made in good faith, based on the best technical information available.

Chart Use: Occasionally Interpretations/Recommendations will be compiled using, as a basis only, a Chart referenced to a different crop or situation. This is necessary only if there is no Chart defined in the system for your crop or situation.



NUTRIENT ADVANTAGE

Recommendation & Status Report

Trading Name	Mineral Resources Tas.	Field Name	Endurance 2
Location	Telita	Section of Field	ALL
Contact Name:	Revel Munro	GPS Latitude	
Work Phone:		Sample Type	Soil
Adviser:	Leonard Youd	Lab Report No:	g0153216
Phone:		Crop:	TREES
Interpretation:	09-Aug-2001	Growth Stage:	
Chart:	FORESTRY MAINTENANCE-DRYLAND- i1780M	Planting:	
		Target Yield (t/ha)	0
		Soil Textures: All soils- Tasmania.	

The following information and recommendations are suggested for your consideration and are the opinion of the interpreter.

Analyte	Value	Def Plant Tests only	Low	< Opt/Norm or Mod	Generally Satisfactory	> Opt/ Norm	High	Excess or Toxic
pH (1:5 Water)	5.00							
pH (1:5 CaCl2)	4.10							
Organic Carbon %C	0.30							
Nitrate Nitrogen mg/kg	1.20							
Sulfate Sulfur (MCP) mg/kg	4.00							
Phosphorus (Colwell) mg/kg	6.00							
Phosphorus (Olsen) mg/kg	2.00							
Potassium (Amm-acet.) meq/100g	0.02							
Calcium (Amm-acet.) meq/100g	0.07							
Magnesium(Amm-acet.) meq/100g	0.09							
Aluminium (KCl) meq/100g	0.36							
Sodium (Amm-acet.) meq/100g	0.04							
Elect. Conductivity dS/m	0.01							
Copper (DTPA) mg/kg	0.10							
Zinc (DTPA) mg/kg	0.20							
Manganese (DTPA) mg/kg	1.00							
Iron (DTPA) mg/kg	63.00							
Boron	0.10							
Molybdenum								
Cation Exch. Cap. meq/100g	0.58							
Calcium/Magnesium ratio	0.76							
Aluminium Saturation %	61.70							
Sodium % of cations (ESP)	7.05							

Amendment/ Recommendation

pH (1:5 Water) 5 Value - Optimum - Strongly acidic. Liming not advisable.

Organic Carbon %C 0.3 % C w/w - Low

Calcium (Amm-acet.) meq/100g 0.07 meq/100g - Low

Magnesium(Amm-acet.) meq/100g 0.09 meq/100g - Low

Calcium/Magnesium ratio 0.76 Ratio - Low

Sodium % of cations (ESP) 7.05 % - High - Where ESP is > 5%, soil crusting occurs or germination is reduced, apply lime (pH below 7) or gypsum (pH above 7) at 2.5 to 3.75 t/ha. An extra 1 t/ha of lime or gypsum should be applied for every 2% sodium over the ESP threshold of 5%. Lime or gypsum is best applied 3 months pre-plant soil incorporated. On light textured soils reduce rate by up to 50%. Check that EC_{se} is not so high that adding gypsum could increase EC_{se} beyond the satisfactory range. If EC_{se} > 1.5 dS/m, do not apply gypsum. Seek further information.



NUTRIENT ADVANTAGE

Recommendation & Status Report

Trading Name	Mineral Resources Tas.	Field Name	Endurance 2
Location	Telita	Section of Field	ALL
Contact Name:	Revel Munro	GPS Latitude	
Work Phone:		Sample Type	Soil
Adviser:	Leonard Youd	Lab Report No:	g0153216
Phone:		Crop:	TREES
Interpretation:	09-Aug-2001	Growth Stage:	
Chart:	FORESTRY MAINTENANCE-DRYLAND- i1780M	Planting:	
		Target Yield (t/ha)	0
		Soil Textures:	All soils- Tasmania.

The following information and recommendations are suggested for your consideration and are the opinion of the interpreter.

Top Dressing 1

150.0 kg/ha Impact CSM 0 - 17 - 8 - 1
Phosphorus: Low
Potassium: Low
Sulfur: Low
Copper: Low
Zinc: < Optimum
Manganese: Low
Boron: Low
Molybdenum: Not Tested

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NUTRIENT ADVANTAGE

Nutrient Strategy Report

Trading Name	Mineral Resources Tas.	Field Name	Endurance 2
Location	Telita	Section of Field	ALL
Contact Name:	Revel Munro	GPS Latitude	
Work Phone:		Sample Type	Soil
Adviser:	Leonard Youd	Lab Report No:	g0153216
Phone:		Crop:	TREES
Interpretation:	09-Aug-2001	Growth Stage:	
Chart:	FORESTRY MAINTENANCE-DRYLAND- i1780M	Planting:	
		Longitude:	
		Depth:	0 - 7.5 cm
		Sample:	17-Jul-2001
		Target Yield (t/ha)	0

The following information and recommendations are suggested for your consideration and are the opinion of the interpreter.

Fertilizer Nutrient Application (kg/ha)

Stage	%	N	P	K	S	Ca	Mg	Cu	Zn	Mn	Fe	B	Mo
Top Dressing 1	100.		25.9	12.5	1.9	18.4							
Totals		0.	25.9	12.5	1.9	18.4	0.						

Note: Interpretations and recommendations given here are a guide only, and depend on representative samples being analysed, additionally environmental and managerial factors influence production, therefore Incitec Limited and Dealers do not accept any liability whatsoever arising out of these interpretations and recommendations for any damage, loss or injury of any nature and the user takes these interpretations and recommendations on these terms. This recommendation is made in good faith, based on the best technical information available.

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Recommendation & Status Report

Trading Name	Mineral Resources Tas.	Field Name	Endurance 3
Location	Telita	Section of Field	ALL
Contact Name:	Revel Munro	GPS Latitude	
Work Phone:		Sample Type	Soil
Adviser:	Leonard Youd	Lab Report No:	g0153217
Phone:		Crop:	TREES
Interpretation:	09-Aug-2001	Growth Stage:	
Chart:	FORESTRY MAINTENANCE-DRYLAND- i1780M	Planting:	
		Longitude:	
		Depth:	0 - 7.5 cm
		Sample:	17-Jul-2001
		Target Yield (t/ha)	0

The following information and recommendations are suggested for your consideration and are the opinion of the interpreter.

Analyte	Value	Def	Low	< Opt/Norm	Generally	> Opt/	High	Excess or
		Plant Tests only		or Mod	Satisfactory	Norm		Toxic
pH (1:5 Water)	4.60		■					
pH (1:5 CaCl2)	4.00				■			
Organic Carbon %C	1.00		■					
Nitrate Nitrogen mg/kg	1.00							
Sulfate Sulfur (MCP) mg/kg	18.00			■				
Phosphorus (Colwell) mg/kg	2.00							
Phosphorus (Olsen) mg/kg	2.00		■					
Potassium (Amm-acet.) meq/100g	0.04		■					
Calcium (Amm-acet.) meq/100g	0.07		■					
Magnesium(Amm-acet.) meq/100g	0.13		■					
Aluminium (KCl) meq/100g	2.16						■	
Sodium (Amm-acet.) meq/100g	0.11							
Elect. Conductivity dS/m	0.03							
Copper (DTPA) mg/kg	0.10		■					
Zinc (DTPA) mg/kg	0.30			■				
Manganese (DTPA) mg/kg	1.00		■					
Iron (DTPA) mg/kg	701.0						■	
Boron	0.10		■					
Molybdenum								
Cation Exch. Cap. meq/100g	2.50							
Calcium/Magnesium ratio	0.58		■					
Aluminium Saturation %	86.10							
Sodium % of cations (ESP)	4.29				■			

Amendment/ Recommendation

pH (1:5 Water) 4.6 Value - Low - Very strongly acidic. Check subsoil pH. Liming may be advisable for some species especially conifers, pines or deciduous trees. The acidifying effect of eucalyptus/acacia forestry may be overcome with the addition of 0.5ton/ha lime every 10 yrs.

Organic Carbon %C 1 % C w/w - Low

Calcium (Amm-acet.) meq/100g 0.07 meq/100g - Low

Magnesium(Amm-acet.) meq/100g 0.13 meq/100g - Low

Aluminium (KCl) meq/100g 2.16 meq/100g - High - Lime to pH(w) 5.5.

Calcium/Magnesium ratio 0.58 Ratio - Low

Top Dressing 1

150.0 kg/ha Impact CSM 0 - 17 - 8 - 1
Phosphorus: Low



NUTRIENT ADVANTAGE

Nutrient Strategy Report

Trading Name	Mineral Resources Tas.	Field Name	Endurance 3	Longitude:	
Location	Telita	Section of Field	ALL	Depth:	0 - 7.5 cm
Contact Name:	Revel Munro	GPS Latitude		Sample:	17-Jul-2001
Work Phone:		Sample Type	Soil		
Adviser:	Leonard Youd	Lab Report No:	g0153217		
Phone:		Crop:	TREES		
		Growth Stage:			
Interpretation:	09-Aug-2001	Planting:		Target Yield (t/ha)	0
Chart:	FORESTRY MAINTENANCE-DRYLAND- i1780M	Soil Textures:	All soils- Tasmania.		

The following information and recommendations are suggested for your consideration and are the opinion of the interpreter.

Fertilizer Nutrient Application (kg/ha)

Stage	%	N	P	K	S	Ca	Mg	Cu	Zn	Mn	Fe	B	Mo
Top Dressing 1	100.		25.9	12.5	1.9	18.4							
Totals		0.	25.9	12.5	1.9	18.4	0.						

Note: Interpretations and recommendations given here are a guide only, and depend on representative samples being analysed, additionally environmental and managerial factors influence production, therefore Incitec Limited and Dealers do not accept any liability whatsoever arising out of these interpretations and recommendations for any damage, loss or injury of any nature and the user takes these interpretations and recommendations on these terms. This recommendation is made in good faith, based on the best technical information available.

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NUTRIENT ADVANTAGE

Recommendation & Status Report

Trading Name	Mineral Resources Tas.	Field Name	Endurance 3		
Location	Telita	Section of Field	ALL		
Contact Name:	Revel Munro	GPS Latitude		Longitude:	
Work Phone:		Sample Type	Soil	Depth:	0 - 7.5 cm
Adviser:	Leonard Youd	Lab Report No:	g0153217	Sample:	17-Jul-2001
Phone:		Crop:	TREES		
Interpretation:	09-Aug-2001	Growth Stage:		Target Yield (t/ha)	0
Chart:	FORESTRY MAINTENANCE-DRYLAND- i1780M	Planting:		Soil Textures:	All soils- Tasmania.

The following information and recommendations are suggested for your consideration and are the opinion of the interpreter.

Potassium: Low
Copper: Low
Zinc: < Optimum
Manganese: Low
Iron: High
Boron: Low
Molybdenum: Not Tested

Note: Interpretations and recommendations given here are a guide only, and depend on representative samples being analysed, additionally environmental and managerial factors influence production, therefore Incitec Limited and Dealers do not accept any liability whatsoever arising out of these interpretations and recommendations for any damage, loss or injury of any nature and the user takes these interpretations and recommendations on these terms. This recommendation is made in good faith, based on the best technical information available.

Chart Use: Occasionally Interpretations/Recommendations will be compiled using, as a basis only, a Chart referenced to a different crop or situation. This is necessary only if there is no Chart defined in the system for your crop or situation.