

**NEWHAM EXPLORATION & MINING SERVICES**



**MICROFILMED**  
FICHE No 015526-27

**INTEGRATED DEVELOPMENT OF:**

- MAIN CREEK MAGNESITE
- LONG PLAINS MAGNETITE
- PIGMENTS

**A PRELIMINARY EVALUATION**

MINERAL RESOURCES		
FILE REF:		
27 MAR 2001		
DOC. REF:		
OFFICER	FOR ACTION	FOR INFO
RL 8802 FT 4		
See folio 12		
2M/99 PT1		
See folio 73		
RESUBMIT TO	DATE	

Prepared For:

Golden Triangle Resources  
Level 3  
71 Queens Road  
Melbourne, 3004

By:

L A Newham, B.Sc., F.A.I.M.M.  
PO Box 132  
Riverside, Tas 7250

Ph: (03) 6394 3434  
Fax: (03) 6394 3435

*A. L. Newham*

12 August, 1998

01\_4535

Integrated Development of: - Main Creek Magnesite,  
Long Plains Magnetite and Pigments - A Preliminary  
Golden Triangle Resources NL\*; Newham Exploration  
Newham, L.A. 2M/1998; RL2/1988

**CONTENTS**

- 1. SUMMARY**
- 2. INTRODUCTION**
- 3. MAGNESITE DEPOSITS**
- 4. LONG PLAINS MAGNETITE**
- 5. PIGMENT DEVELOPMENT**
- 6. INTEGRATED DEVELOPMENT PROPOSAL**
- 7. POTENTIAL PROBLEMS with OTHER DEVELOPERS**  
(Not with Report)

**Figures:**

- Fig 1: Location Plan**
- Fig 2: District Plan** (1:5,000)
- Fig 3: Section Through Long Plains  
and Magnesite**
- Fig 4: Section Through Umber  
and Magnesite**

## 1. SUMMARY

- (a) This report reviews various development options with reference to the Main Creek magnesite deposits, the adjacent Long Plains magnetite deposit and the pigment deposits.

**To avoid confusion, Long Plains magnetite is hereafter referred to as "iron-ore".**

- (b) Open-cut iron-ore mining will not physically affect magnesite mining, provided the "magnetite lease" is defined as per the attached Fig 2.

- (c) UMBER mining will affect any proposal to open-cut mine the Bowry Creek magnesite deposit, but will not affect underground mining of that deposit, which is the recommended option.

This potential problem could be overcome by GTR agreeing to give the umber operator two years notice of intent to open-cut mine the magnesite.

- (d) The **magnesite project** would derive some infrastructure capital cost savings if GTR also developed the iron-ore and pigment projects.

However, these benefits are neither large nor critical to the magnesite project.

- (e) The **iron-ore project** is totally dependant on securing a sales agreement with ABM for the delivery of 500,000 tpa of superior quality crushed iron-ore for approximately \$18-20/t.

- (f) The **pigment project** would benefit substantially from, and may be dependant upon, simultaneous development of the iron-ore project.

These benefits include "free" supply of magnetite fines for black pigment production and shared infrastructure costs.

- (g) There are six (6) realistic development options available to GTR. "Ball-park" cost estimates for each are tabulated below:

	Pre-develop (\$'M)	Dev.Cap (\$'M)	Operating (\$/t)
Magnesite only	16.0	18.0	41.00
Iron-ore only	1.3	7.0	14.00
Magnesite and Iron	17.0	21.0	40.00 (Mg) 13.00 (Fe)
Magnesite and Pigments	16.6	22.0	41.00 (Mg) 450 (Black) 437 (Brown)
Iron-ore and Pigments	1.8	11.0	13.00 (Fe) 390 (Black) 419 (Brown)
Magnesite and Iron and Pigments	17.5	25.0	40.00 (Mg) 13.00 (Fe) 390 (Black) 419 (Brown)

- (h) The option recommended for more detailed evaluation by GTR is the concurrent development of all 3 projects: magnesite and iron-ore and pigments.

This option depends critically upon:

- negotiating a sales agreement for iron-ore with ABM
- developing pigment markets
- confirmation of resources
- dealing successfully with environmental issues

- (i) The principal benefit in GTR developing all three projects is in infrastructure cost savings; eg, power, roads, water supply.

These infrastructure items between Savage River and the operations total approximately \$6M, which could be spread between three projects.

Minor savings in pre-development and operating costs would be achieved by concurrent projects.

(j) Scope exists to expand markets for both iron-ore and pigment output, once these operations were established.

(k) Operating profits from the iron-ore project based on \$18/t would be approximately \$2M pa.

Savage Resources estimated a pre-tax profit for the pigment project of \$36.8M over a 20-year period, with the first profit in Year 2 of \$363,000.

(l) **Environmental issues** associated with water quality are likely to be substantial for both the pigment and iron-ore projects.

With the pigments, the problem will be coloration and siltation associated with mining the umber deposits close to Bowry Creek.

With the iron-ore, the problem will be acid mine drainage associated with the open-cut and waste dumps.

These issues would represent a significant cost to any GTR operation and would have to be professionally managed.

(m) If another Company was to develop the iron-ore and/or pigment projects, management of these environmental issues could become of major concern to GTR's magnesite project in terms of liability determination and public relations/image factors.

Savage Resources is currently talking to at least one other potential developer (Brambles).

(n) GTR should negotiate continued access rights along easement 4W/94 to the magnesite deposits, at least in the short term, prior to development of a new production road.

## 2. INTRODUCTION

Savage Resources Limited are the holders of Consolidated Mining Lease 46M/90, the contiguous Retention Licence 8802 and access easement licences 4W/94 and 3W/94.

These tenements lie several kilometres south-west of Savage River township on the west coast of Tasmania, and cover three styles of drill inferred mineral deposits:

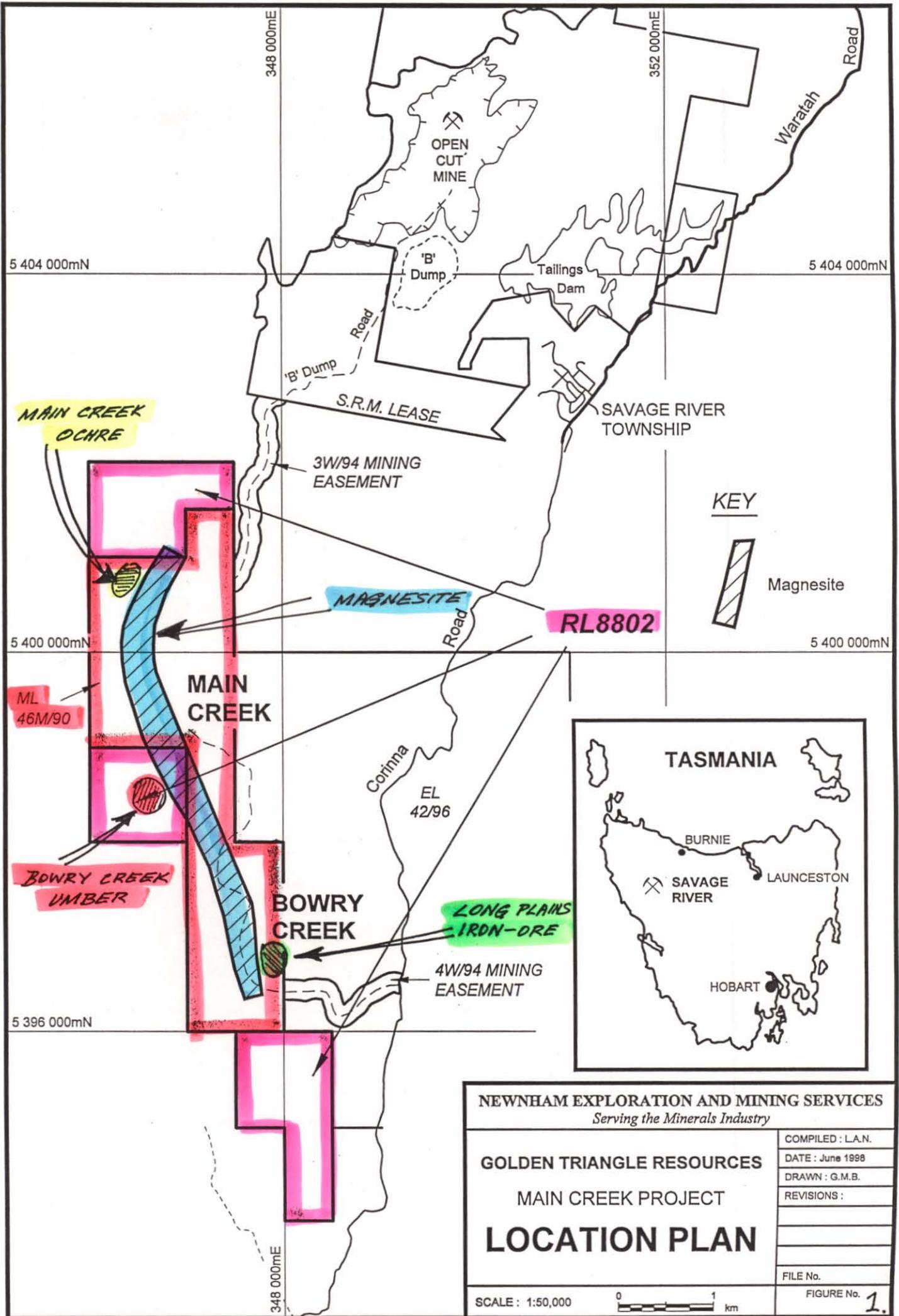
- magnesite
- magnetite
- pigments

The magnesite deposits are currently under option to purchase to Golden Triangle Resources NL (GTR).

The magnetite and pigment deposits are under offer to GTR, and other Companies.

This report reviews the inter-relationship of these three deposit styles in terms of both development factors and commercial factors.

Because the words "magnesite" and "magnetite" are readily confused, Long Plains magnetite is hereafter referred to as iron-ore.



**NEWNHAM EXPLORATION AND MINING SERVICES**  
*Serving the Minerals Industry*

<b>GOLDEN TRIANGLE RESOURCES</b> MAIN CREEK PROJECT <b>LOCATION PLAN</b>	COMPILED : L.A.N.
	DATE : June 1998
	DRAWN : G.M.B.
	REVISIONS :
SCALE : 1:50,000	FILE No.
	FIGURE No. <b>1.</b>

### 3. MAGNESITE

#### 3.1 Geology and Resource Potential:

The magnesite deposits occur as major units in a 200-400 m wide zone of carbonate rich rocks (Carbonate Sequence) within the Precambrian Arthur Metamorphic Zone of western Tasmania. In the lease area, the Carbonate Sequence strikes NNW and dips 70-80° E.

The magnesite is a primary sedimentary unit, variably altered and dolomitised during strong regional metamorphism.

Wide spaced core drilling has identified the following inferred resource occurring at Main Creek in the north and Bowry Creek in the south:

	Mt	%MgO	%CaO	%SiO <sub>2</sub>	%Fe <sub>2</sub> O <sub>3</sub>
Main Creek	24.3	44.03	2.17	2.41	1.22
Bowry Creek	23.1	42.64	2.24	2.93	2.32
<b>TOTALS</b>	<b>47.4</b>	<b>43.36</b>	<b>2.20</b>	<b>2.66</b>	<b>1.75</b>

The resources in each area occur in multiple lenses, defined by assay, within a broader sequence of calcareous rocks. Further drilling may show that the two areas are end members of a continuous zone.

The magnesite lenses appear to be diminishing to the north of Main Creek and south of Bowry Creek, but this remains to be confirmed by drilling.

Indications are the magnesite lenses extend down dip below the current drilling pattern, and substantial resource extensions may exist in that direction.

The Carbonate Sequence is flanked to the east on the hangingwall and the west on the footwall by pyritic schists. Exposure of these schists by mining has significant environmental implications.

Chemically and visually, the Bowry Creek and Main Creek deposits appear very similar. It remains to be determined if they are metallurgically similar.

### **3.2 Development Proposal: (Figs 2, 3)**

GTR is evaluating these deposits as a potential feedstock to a magnesium metal refinery, producing 60,000-100,000 tpa magnesium metal.

Allowing for cumulative process losses, it is estimated that 5 tonnes magnesite are required to produce 1 tonne magnesium metal. Thus, an 80,000 tpa Mg metal refinery will require 400,000 tpa of high grade magnesite feedstock.

Because of the high capital expenditure required for the refinery, the project must be regarded as very long-term, say minimum 25-30 years. This equates to a guaranteed magnesite feedstock of 12 Mt.

Allowing for mine and stringent grade control recoveries, this would translate into a minimum resource requirement of 20 Mt.

**Either of the Bowry Creek or Main Creek deposits has this potential.**

Conceptual mine studies by BFP Consultants Pty Limited recommend an underground cut and fill operation at Bowry Creek as the preferred mining option, subject to confirmation of the resource suitability.

The decline access location is shown on Fig 2. If subsequent metallurgical testing or drilling showed Bowry Creek to be unsuitable, a similar underground operation could be established at Main Creek. Costs associated with water control and access may be higher at Main Creek.

Open-cut options at either Main Creek or Bowry Creek would be short life operations if significant environmental problems and costs were to be avoided.

NSR Environmental Consultants Pty Limited identified acid mine drainage associated with the open-cut mining and development of waste dumps of pyritic hangingwall and footwall schists as a significant environmental issue.

This issue could be avoided if open-cuts were restricted to the Carbonate Sequence. Such pits at both Bowry Creek and Main Creek would have lives of approximately 5 years. They would not represent a significant cost advantage (if any) over underground mining.

The 400,000 tpa magnesite from an underground mine would be trucked to an adjacent crusher for single stage crushing. Crushed magnesite would be trucked along a new access road to the Corinna road which would require rebuilding for the six kilometres to Savage River, then along the upgraded existing highway to a rail head at Whyte Hill.

Figures 2 and 3 illustrate that the development described above would not conflict with either the open-cut mining of the Bowry Creek umber deposit or the Long Plains iron-ore deposit.

However, if it was decided to open-cut Bowry Creek, there would be a direct conflict with an umber open-cut operation. This is viewed as a low probability scenario but is commented upon further in Section 7.

### 3.3 Costs:

Indicative costs associated with the above magnesite development proposal have been detailed elsewhere and can be summarised as:

Pre-development studies	\$16M
Development capital	\$18M
Operating costs	\$41/t (Tas refinery) \$69/t (non-Tas refinery)

Pre-development costs would not be affected by an involvement with the iron-ore and pigment projects.

Development capital associated with provision of power (\$2M) and rebuilding the Corinna road (\$3M) could be shared by the three projects, thus reducing development capital on the magnesite by \$1.5M or approximately 10%.

Operating costs would be only marginally lower in the early stages and unaffected in the longer term.

**In summary:**

**Costs associated with the magnesite project are not significantly affected by any decision to develop either the iron-ore or pigment projects.**

**A 10% reduction in development capital may be achieved.**

## **4. LONG PLAINS IRON-ORE**

### **4.1 Background:**

The Long Plains iron-ore deposit lies approximately 12 road kilometres south of the ABM processing plant at Savage River.

The mineralisation is considered similar to the ABM mill feed. An opportunity therefore exists to mine the Long Plains deposit as a feedstock to the ABM mill. This would involve negotiating a sales agreement with ABM.

ABM would only be interested in such an agreement if:

- the Long Plains product was of superior quality to their own
- it could be delivered to the mill at the same or lower cost to delivery of their own product
- ABM was experiencing difficulty optimising their own production tonnage

The project is currently on offer to GTR and possibly two other Companies.

The section reviews:

- the commercial attractiveness of the deposit to GTR
- the general impact of mining Long Plains on the magnesite and pigment projects
- the impact of another Company mining Long Plains

### **4.2 Geology:**

The Long Plains iron-ore deposit occurs as a series, or stack, of steeply east dipping lenses of pyritic magnetite in the immediate hangingwall of the Carbonate Sequence east of the Bowry Creek magnesite deposits.

Widely spaced drilling and magnetic data suggest the deposit extends over a strike length of three kilometres, but it is only the northern 600 m which is of real economic interest.

In this northern area, lenses of magnetite are separated by weakly mineralised amphibolites and cut by a barren dyke rock.

On the basis of seven drill holes, consultant Mick McKeown estimated an inferred resource of 9.4 Mt 45% DTR within an area 600 m x 300 m to a vertical depth of 170 m. (DTR stands for "Davis Tube Recovery" which is a device for determining the likely mill recovery of magnetite from samples. The ABM mill feed averages about 40-45% DTR.)

The deposit is oxidised to approximately 15 m. Assaying of cores suggests the mineralogy of the deposit is very similar to the Savage River deposits.

A substantial amount of additional drilling would be required to confirm the existence and mineability of the inferred resource.

### **4.3 Mining and Processing:**

The Long Plains iron-ore deposit would be amenable to open-cut mining. Savage Resources designed two pits on the resource (Figs 2, 4). The first was a small pit designed to extract limited tonnages of magnetite for coal washery applications and black pigment production. The second was a larger pit designed to extract 6.5 Mt ore to be sold to ABM.

It is this second, larger, pit design which should be the basis of any involvement by GTR.

A reasonable development plan would be to mine 650,000 tpa of ore over a 10-year period.

This material would be crushed to, say, 100 mm and upgraded on site by magnetic methods to produce approximately 500,000 tpa of 50-55% DTR for delivery to ABM.

The average stripping ratio would be approximately 1:1, meaning an average 0.65 Mtpa overburden removal over a 10-year mine life.

Waste dumps would be established to the south and east of the mine.

Access to the mine would be via a rebuilt Corinna road from Savage River, and an upgraded road along the existing track from the Corinna road.

Power would be obtained by construction of a new feeder from Savage River to a mine substation.

#### **4.4 Environmental Issues:**

Acid mine drainage would be a major factor to be addressed in this mine. The host rocks and waste rocks are pyritic and reactive.

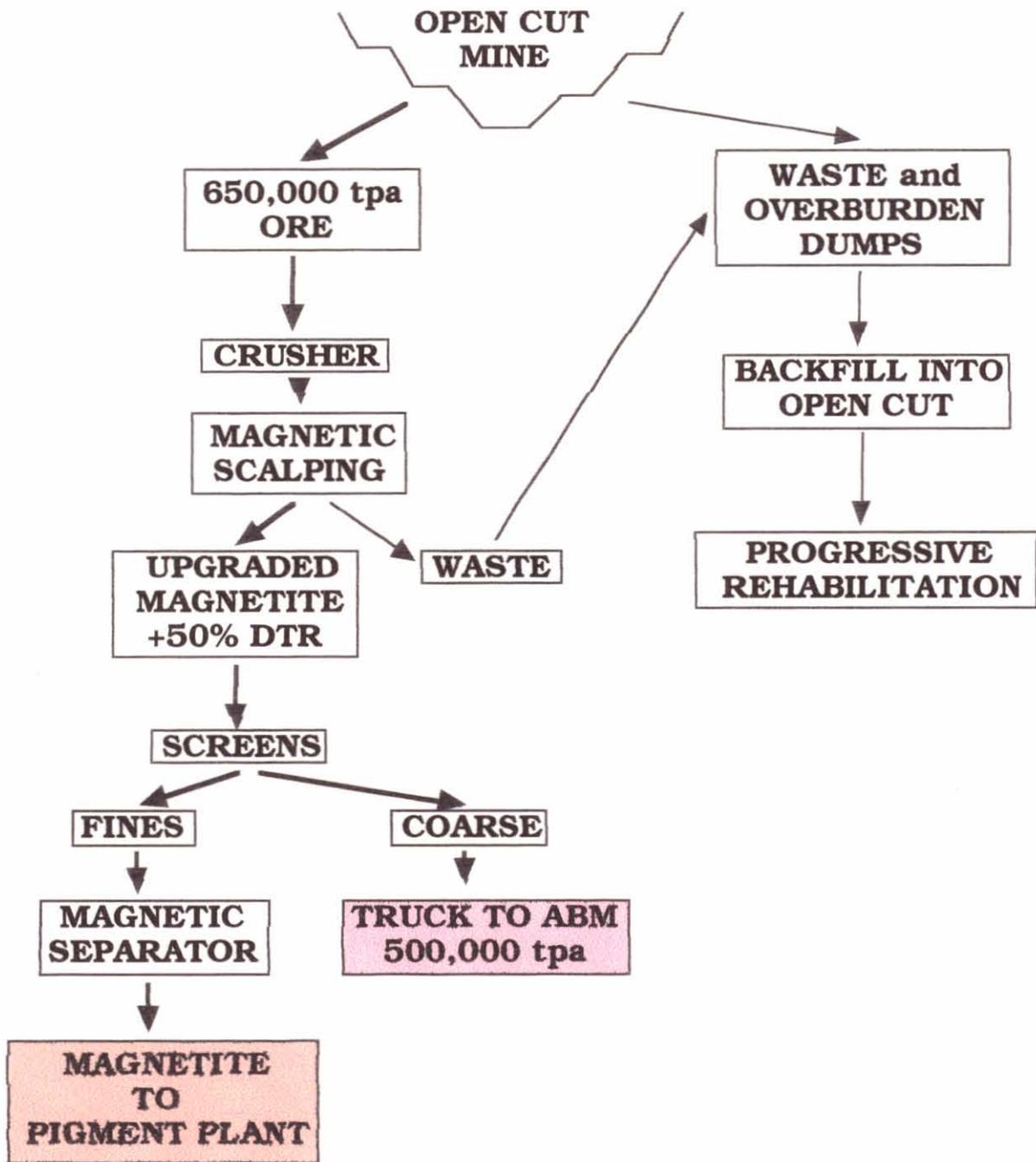
ABM is confronted with similar problems at Savage River where waste must be "encapsulated" in thick clay lined dump areas.

One way of tackling this problem at Long Plains might be to design the open pit and waste dumps in such a way that all waste can be back filled into the pit on completion of mining.

This issue was dealt with at some length in NSR's recent environment issues report on the magnesite project and must be taken into account. NSR are fully conversant with the problem because of their current involvement with ABM.

The proposed development plan is schematically presented in the following chart. Three key factors are:

- crushing to a size attractive to ABM
- upgrading above 50% DTR by magnetic scalping on the conveyor
- removal of fines for black pigment production



**LONG PLAINS IRON ORE DEVELOPMENT PLAN**

#### **4.5 Costs:**

Indicative "ball-park" costs are estimated on the basis of all mining, crushing, processing would be contracted.

For conformity purposes with the other projects they have been divided into:

- pre-development
- development capital
- operating costs

##### **4.5.1 Pre-Development Costs:**

###### **Resource Definition: \$550,000**

To drill define the deposit on 50 m centres would require approximately 50 cored holes, totalling 4,000 m (\$400,000).

This core would be logged, (\$20,000), assayed in detail (\$30,000), subjected to metallurgical and geotechnical testing (\$100,000).

###### **Mine Planning: \$100,000**

Using the above drilling data, resource modelling and pit optimisation studies would be completed.

###### **Process Planning: \$50,000**

Design and costing of the processing flow sheet.

###### **Environmental Studies: \$500,000**

Because of the potential impacts of an open-pit mine and AMD, a substantial effort would be required over a 12-month period gathering base line data, preparing an EMP and progressing this through the approval process.

The allocation may appear substantial but so are the issues to be addressed.

**Project Management: \$50,000**

General management of the above tasks, preparation of a co-ordinated development plan and EMP for government approval, discussions with contractors, etc, will require an experienced manager for 25% of their time.

**Estimated total pre-development costs:  
\$1.25M**

**4.5.2 Development Capital:**

Indicative development capital is estimated in this section on the basis of a largely contract stand alone operation; ie, no benefits from adjacent pigment or magnesite operations has been factored in. These benefits are commented upon further below.

**Road Construction: \$4.8M**

- 8 km of Corinna Road rebuilt \$4M
- 2 km of mine access road \$0.8M

**Power and Site Facilities: \$2M**

- supply 1-2 MW from Savage River \$1M
- develop site, establish office, facilities \$1M

**Waste Dump Site Preparation: \$0.2M**

- Clearing, access and drainage development

**Estimated total development capital:  
\$7M**

**4.5.3 Operating Costs:**

	<b>\$'M</b>
- overburden removal 2 Mm <sup>3</sup> @ \$2/m <sup>3</sup>	4
- waste drill & blast 0.25 Mm <sup>3</sup> @ \$2.50/m <sup>3</sup>	0.625

-	waste removal 0.25 Mm <sup>3</sup> @ \$1.50 m <sup>3</sup>	0.375
-	ore drill & blast 0.25 Mm <sup>3</sup> @ \$2.50/m <sup>3</sup>	0.625
-	ore removal 0.25 Mm <sup>3</sup> @ \$1.50/m <sup>3</sup>	0.375
-	crushing, loading, 0.65 Mt @ \$2.50/m <sup>3</sup>	1.625
-	road freight 0.5 Mt @ \$1.20/t	0.600
-	environmental control 0.65 Mt @ \$1/t	0.650
-	rehabilitation provision 0.65 Mt @ \$0.5/t	0.325
-	management, survey, geology	<u>0.500</u>
	<b>TOTAL operating Year 1</b>	<b>= \$9.7M</b>
		<b>= \$19.4/t</b>
		<b>(delivered to ABM)</b>
	<b>Subsequent Years</b>	<b>= \$11.4/t</b>
		<b>(no overburden removal)</b>

If the overburden removal costs were spread over the life-of-mine, the average operating costs would be \$12/t. To this must be added government royalty (\$1/t) and Savage Resources royalty (say, \$1/t).

**Estimated operating costs over life-of-mine: \$14/t**

#### **4.6 Relationship to Magnesite:**

The spatial relationship of the iron-ore open-cut to the Bowry Creek magnesite deposits is shown on Figs 2, 3, along with the proposed definition of the iron-ore lease (Fig 2).

##### **4.6.1 Physical Factors:**

In terms of **physical relationship** of the two possible operations, there are three issues to consider:

- (a) magnesite mining method
- (b) iron-ore waste and overburden dumps
- (c) access

(a) **Magnesite Mining:**

If the Bowry Creek magnesite was to be mined underground, as recommended, there would be little interference between the two operations.

If, however, it was decided to open-cut the Bowry Creek magnesite, the two open-cuts would possibly join (Fig 3). This would only happen if the Bowry open-cut was very large and extended through Bowry Creek towards drill hole MC 29.

The probability of this development is related as low.

It can, therefore, be reasonably concluded that there should be minimal (if any) interference between the two mining operations.

(b) **Waste and Overburden Dumps:**

Provided the iron-ore operation waste and overburden dumps were confined to the iron-ore lease as proposed, ie, to the east and south of the open-cut, these dumps would not **physically** impact on the magnesite operation.

(c) **Access:**

Access to the Bowry Creek magnesite is proposed along a new road north of Bowry Creek.

Access to Long Plains iron-ore would probably be along the existing track south of Bowry Creek.

In such circumstances, there would be no interference between the two operations.

However, until such time as a decision to mine Bowry Creek magnesite is made, and the new access road is agreed and developed, access will remain along the existing access track.

**Therefore, it is important that GTR secures a long-term right-of-way along the existing access track in the event of another party securing access to the Long Plains iron-ore deposit.**

#### 4.6.2 Environmental Factors:

In planning development of the magnesite deposits, both NSR and BFP have emphasised the importance, from an environmental point of view, of avoiding disturbance of the reactive pyritic hangingwall schists.

The Long Plains iron-ore open-cut would be in those very same schists. The environmental implications are obvious.

The above costings make considerable allowance for the proper management of these pyritic rocks by way of appropriate waste dump management and open-cut back filling rehabilitation.

Of major concern would be the negative impacts on the GTR magnesite operation if the Long Plains deposit was developed by another party who failed to manage the environmental issues appropriately. These negative impacts would be in the form of actual environmental impacts and public image.

**The negative environmental impacts on GTR's magnesite mine from a Long Plains iron-ore mine poorly managed by another Company could be very substantial.**

#### 4.6.3 Cost Benefits:

If GTR was to develop both the Long Plains iron-ore mine and the magnesite mine, there would be cost benefits, principally in the area of development capital.

With respect to **pre-development costs**, there would be only minor cost benefits, confined to environmental studies and general project management. These may represent a saving of \$100,000 to each project.

With respect to **development capital**, cost benefits would occur in the following areas:

- rebuilding the Corinna/Savage River road
- provision of power
- site development

For both projects, approximately \$4M was allocated to rebuilding the Corinna road. This would largely be shared if both the magnesite and

iron-ore deposits were developed by GTR, except for the two kilometre stretch between the two site access routes. The saving on combined capital would be around \$3M.

Provision of power transmission from Savage River would be shared. However, because two sites would be needed, there would still be two substations. The saving on combined capital would be around \$1M.

Some saving on site development costs would be effected. However, two sites and two crushing facilities would still be required because mixing iron-ore with magnesite would be very much to the detriment of the magnesite quality. Site benefits might arise through development of common water supply, head tanks, offices, workshops, etc. Savings on combined site capital would be around \$0.25M.

**Total development capital savings would thus be approximately \$4M-5M.**

With respect to operating costs, the benefits would be quite minor, and largely restricted to general and technical management; say, approximately \$100,000 pa to each operation, which represents a saving of \$0.25/t to each project. This is worth having, but not a major consideration.

#### **4.7 Relationship to Pigments:**

There is no physical relationship between the Bowry Creek umber deposits and the Long Plains iron-ore deposit (Fig 2). Either could be mined independently without affecting the other.

However, there is a close relationship between the black pigment and the Long Plains deposit, in that the Long Plains operation as proposed would produce magnetite fines which are the pigment feedstock.

Development of Long Plains iron-ore, therefore, directly benefits any pigment operation but the converse does not apply; ie, development of the pigment operation does not benefit the Long Plains iron-ore operation, because the cost of delivering iron-ore to ABM would not be lowered by development of the pigment operation.

This relationship is commented upon in greater detail in the pigment section below.

#### **4.8 Summary:**

The Long Plains iron-ore deposit may have the potential to produce 0.5 Mtpa crushed and upgraded product to ABM for a 10-year period.

The resource potential has to be confirmed by drilling.

Costs associated with such a development would be:

	<b>Long Plains only</b>	<b>Long Plains (if shared with magnesite)</b>
<b>Pre-development and Development capital (\$'M)</b>	<b>8.3</b>	<b>6.0</b>
<b>Operating Costs (\$/t iron-ore delivered to ABM)</b>	<b>14.0</b>	<b>13.5</b>

It is unknown at this stage if such a price (say, \$18/t) would be attractive to ABM.

Development of Long Plains does not have a substantial cost benefit to the magnesite project, but it would have a major benefit to a black pigment operation.

There are potentially serious environmental outcomes for the magnesite project if another company develops Long Plains.

## **5. PIGMENT DEVELOPMENT**

### **5.1 Background:**

Prior to 1995, Savage Resources undertook extensive technical and market studies on the production of a range of pigment products to supply Australian and overseas markets.

Production was to be phased in gradually over a number of years as markets were identified and developed.

Black pigment was to be produced initially, closely followed by brown, then later by yellow.

The black pigment feedstock was finely ground magnetite, initially to be supplied from the Savage River mine and later by a purpose developed open-cut mine at Long Plains.

The brown pigment was to be produced by mining an umber clay deposit near Bowry Creek.

The yellow pigment was to be produced from ochre deposits north of Main Creek.

The processing plant was to be built at Savage River, by agreement with the then owners of Savage River Mines. The process design was developed by Savage Resources, and remains substantially confidential to them.

Since 1995, several factors affecting this plan have changed:

- Savage Resources' priorities have changed and they no longer wish to develop the pigment operation themselves
- control of the Savage River mine has changed hands and there is no indication that the new operators, ABM, will want the pigment plant on their site
- GTR has defined large, high grade magnesite deposits in close proximity to the pigment feedstocks
- ABM has emerged as a potential buyer of Long Plains iron-ore which would impact on supply of black pigment feedstock

This section reviews the pigment project in terms of:

- its possible impacts on mining of the magnesite, and Long Plains iron-ore
- commercial potential to GTR

## 5.2 Geology:

The feedstock for **black pigment** production is fine, clean magnetite. This can be sourced from one of several places:

- Savage River mine
- Long Plains mine, if developed
- any other magnetite mine; eg, Kara

Because there is nothing too special about the feedstock the selection of supply comes down to economics.

The feedstock for the **brown pigment** was an umber deposit near Bowry Creek (see Fig 2).

Umbur is essentially a goethite rich clay developed by weathering of underlying magnesite. It occurs in narrow seams and pockets in the weathering profile, to a depth of approximately 20 m.

The deposit has been defined by shallow auger drilling and trenching. The resource so defined has been divided into:

low iron - 10,000 t (35-48% Fe)

high iron - 11,000 t (48-55% Fe)

At an envisaged mining rate of 2,000 tpa, the current resource should be sufficient for a 10-year operation.

Potential exists to locate further resources in the area.

The feedstock for the **yellow pigment** is extensive deposits of yellow ochre north of the Main Creek magnesite deposits.

The ochre also develops as a weathering product of magnesite.

These resources have been defined by trenching. Because of their lower value, it was envisaged that they be mined at a later date as markets were identified.

### 5.3 Mining:

Savage Resources envisaged initially purchasing magnetite fines from the Savage River mine operation for \$70/t, for black pigment production. Upon closure of that mine (Year 2), they would produce these fines from a purpose built open-cut operation at Long Plains, and carting the product to the pigment plant at Savage River.

There is now no certainty that ABM will either supply the magnetite fines or permit construction of the plant on their lease.

Supply of the magnetite fines from the Long Plains deposit thus becomes the most likely feedstock. This can be produced in one of two ways:

- (a) as a small open cut designed just to produce 10,000 tpa magnetite fines
- (b) as a byproduct from a larger open cut developed to supply 0.5 Mtpa iron-ore to ABM

The outlines of these two open-cuts is shown on Figs 2, 3.

In both cases, the weathered overburden would have to be stripped and dumped in carefully managed stockpiles. Waste would similarly have to be drilled, blasted and placed in stockpiles.

The **umber** would be mined as a small open-cut following removal of vegetation and overburden. Because of the nature of the umber, it would have to be mined very selectively by small scale means; eg, mini-excavators, under strict pit-control supervision.

Savage Resources envisaged trucking this material to a Savage River mine processing plant. However, if the plant was built at Long Plains, the haul distance is only 2-3 km.

An umber mining rate of 2,000 tpa is only 40 tpw. There would probably be substantial cost and environmental advantages in mining the annual production in one annual campaign between January-March and stockpiling at the processing plant.

The **ochre** deposits would be mined in a fashion similar to the umber; ie, a small open-cut with one annual mining campaign.

The main problem with the ochre is its location on the western side of Main Creek. To deliver it to a processing plant at Long Plains would require development of either a road to Savage River or a new road through Main Creek to Long Plains. These alternatives would be substantially influenced by the magnesite development decisions.

#### 5.4 Processing:

The actual pigment processing procedure is currently confidential to Savage Resources. Because input and output is small (10,000 tpa), location is not critical.

However, if the black pigment feedstock was from a Long Plains iron-ore mine feeding ABM, there would be advantages in developing the plant there. The fines would be scalped from the crushing plant as shown in Fig 4, at minimal cost.

If the black pigment feedstock was from ABM or elsewhere, then a range of processing plant site options emerge.

Because of the small tonnages involved, the processing plant location would not be significantly affected by the umber or ochre deposit locations.

#### 5.5 Environmental Issues:

Environmental issues associated with the pigment operation can be considered in terms of:

- the mines
- the processing plant

##### 5.5.1 The Mines:

If the **magnetite fines** for the black pigment were sourced from Long Plains, the size (but not the nature of the impact) of the open-cut would depend on whether the open-cut was developed just for pigment feedstock or for iron-ore and pigment. The environmental issues for such a pit were outlined in section 4.6.2 above.

The **umber** open-cut would be small and shallow. Issues which would need to be addressed are:

- Proximity to Bowry Creek.
- Behaviour of exposed clays and pigments in the pit in a high rainfall area. The pit area could become a "sea of brown mud", with resultant impacts on adjacent water courses. A series of special settling ponds may be required.

The **ochre** open-cuts would be developed in rain forest areas. Rain forest clearing is always subject to special scrutiny. As

with the umber, there may be special and significant problems with water discoloration associated with ochre mining in high rainfall areas. The ability of ochre to spectacularly discolor streams is well known. Special settling dams and water management procedures will undoubtedly be required. Summer campaign mining would certainly assist with this issue.

### **5.5.2 The Processing Plant:**

Because the nature of the plant procedures and waste products are unknown, it is difficult to comment on potential environmental impacts. However, because the procedure basically involves purifying products of very fine grain size it can be anticipated that most concerns will be associated with waste water chemistry and coloration.

By proposing to build the plant at Savage River mine, Savage Resources planned to address water management issues by discharging into Savage River tailings dams.

However, ABM may not be in favour of this option because of the very sensitive allocation of impacts and indemnity issues which currently apply to their new operation.

Further, if the processing plant was built at Long Plains, special dams and water management procedures would be required.

## **5.6 Costs and Profitability:**

Because of the postponed nature of the ochre development, this section confines itself to the shorter term production of pigments from umber and magnetite fines.

Costs are considered in terms of:

- (i) pre-development costs
- (ii) development capital
- (iii) operating costs

### **5.6.1 Pre-Development Costs:**

These costs would be incurred in the following studies:

- resource confirmation and mine design
- process design and engineering

- environmental
- marketing
- definitive feasibility

**Resource Confirmation: (\$0.1M)**

The costs of proving up the magnetite fines resource are essentially absorbed in the Long Plains iron-ore project.

Some additional work would be required on the umber resource.

Similarly, mine planning would be restricted to the umber.

**Process Design and Engineering (\$0.1M)**

It would seem that most of this work has been completed by Savage Resources.

If that is the case, there may only be a requirement to independently check their work, and maybe tidy up a few loose ends.

**Environmental Studies: (\$0.2M)**

These studies would be confined to the umber mine and the processing plant, and would largely address water management issues.

**Marketing Studies: (\$0.1M)**

Whilst Savage Resources undertook considerable studies several years ago, these may need to be up-dated. Being a niche market industrial mineral, the development of markets is fundamental to success. Savage was correct in adopting a staged approach to market development.

**Feasibility Studies: (\$0.1M)**

Following completion of the above studies, a final definitive feasibility study would be required.

**Total estimated pre-development:  
costs \$0.6M.**

### 5.6.2 Development Capital

This estimate assumes:

- (a) umber mining would be by contractor
- (b) magnetite fines were obtained as a by-product of a Long Plains iron-ore mine
- (c) the processing plant was built at Long Plains

If the Long Plains iron-ore mine was not developed, it would probably be better to source the magnetite fines from a current producer and build the processing plant wherever was cheapest; eg, Burnie area.

Thus, development capital would be limited to:

- magnetite extraction from iron-ore processing plant
- pigment processing plant
- waste product management

#### **Magnetite Extraction: (\$0.20)**

Fig 4 shows the magnetite being acquired from the Long Plains iron-ore crushing plant by screening and magnetic separation.

This would be a very straightforward add-on to the plant.

#### **Pigment Processing Plant: (\$3.8M)**

This figure was developed by Savage Resources in their 1995 study. It allows for the initial production of 5,500 tpa pigment product.

At this stage, that figure must be accepted.

#### **Waste Management: (\$0.5M)**

Allowance is made to develop a series of small dams and pumping facilities to handle waste water. The exact nature of such a system is not known, but such an allowance seems prudent.

**Total development capital estimate:  
\$4.5M**

### 5.6.3 Operating Costs:

Again, this section assumes magnetite fines produced as a by-product of a Long Plains iron-ore operation.

Operating costs are confined to:

- lumber mining
- processing plant
- environmental control

#### Umbur Mining:

	<b>\$/m<sup>3</sup></b>
Overburden removal	3.50
Mining	3.50
Cartage	1.00
Mining Sub-total	\$8/m <sup>3</sup>
	= \$6/t (dry)

#### Processing Plant:

Savage Resources estimated the following, after subtracting raw materials cost:

- black pigment	\$380/t
- brown pigment	\$403/t

#### Environmental Control:

'Guesstimate' only \$10/t

**Operating costs summary:**

<b>black pigment</b>	<b>\$390/t</b>
<b>brown pigment</b>	<b>\$419/t</b>

#### 5.6.4 Cost Summary:

<b>Pre-development &amp; Development Capital:</b>		<b>\$5.1M</b>
<b>Operating Costs:</b>	<b>black</b>	<b>\$390/t</b>
	<b>brown</b>	<b>\$419/t</b>
<b>Revenue:</b>	<b>black</b>	<b>\$1,200/t</b>
	<b>brown</b>	<b>\$1,000/t</b>
<b>Volume:</b>	<b>4,500 tpa initially, rising to 8,000 tpa as markets develop</b>	
<b>Life of Mine:</b>	<b>Minimum 10 years</b>	

This suggests that if markets were developed, the pigment project could be quite profitable.

### 5.7 Pigment Relationship to Magnesite:

#### 5.7.1 Mining:

Mining of umber would interfere with any open-cut mining of the Bowry magnesite deposit. This is illustrated in Fig 4.

Umbur mining would not interfere with any underground mining of magnesite.

**If** open-cut mining of magnesite at Bowry remains a possibility, and if GTR is not involved in the pigment project, this potential mine conflict situation must be resolved.

Requiring GTR to specifically stockpile umber during any stripping operation on the magnesite would represent an additional cost to GTR and, undoubtedly, present situations of potential conflict.

One means of resolving this would be for GTR to be required to give Savage Resources (or the pigment processor) two years' notice of its intention to open-cut mine the Bowry Creek magnesite. During this period, the pigment processor would be entitled to remove all affected umber.

### 5.7.2 Environment:

Unless very professionally managed, both the umber mine and the pigment processing plant (if developed at Long Plains) have the potential to impact on water quality of streams in the general vicinity of the Bowry Creek magnesite mine. Any such impact would probably also reflect on the adjacent GTR magnesite operation, through simple confusion and geographic association.

### 5.7.3 Financial Impacts:

Development of an umber mine and a pigment processing plant would have only minor impacts on the pre-development and operating costs of magnesite.

These would be some development capital benefits to both projects in terms of cost sharing of infrastructure, principally power supply and road improvements.

These benefits would be greatest for the pigment project in the event that the iron-ore mine was not developed.

## 5.8 Pigment Relationship to Long Plains Iron-ore:

There are substantial financial benefits in developing both the Long Plains iron-ore mine and the pigment processing plant together.

The Long Plains iron-ore project **may** be viable on its own.

The pigment plant **may not** be viable on its own. The pigment plant would benefit substantially from co-development with the iron-ore mine in the following ways:

- essentially free black pigment feedstock (magnetite fines)
- shared infrastructure costs; such costs would essentially be free to the pigment operation if they were carried solely by the iron-ore development
- shared waste management costs

### 5.9 Summary:

Mining of umber at Bowry Creek has the potential to disrupt open-cut mining of Bowry Creek magnesite. The possibility of this occurring is rated low and the situation could be negotiated by agreement.

A pigment plant does not benefit greatly from the adjacent development of magnesite, but does benefit substantially from co-development of Long Plains iron-ore.

**The concept of GTR operating an iron-ore mine at Long Plains supplying both ABM with an upgraded magnetite product and an adjacent pigment plant with magnetite fines for black pigment production has substantial financial appeal.**

Negotiations with both ABM and Savage Resources to pursue this opportunity are strongly recommended.

## 6. INTEGRATED DEVELOPMENT PROPOSAL

The relationship between the magnesite, iron-ore and pigment operations can be viewed in terms of:

- physical relationships
- financial relationships

The physical relationships are relatively straightforward. The financial relationships are potentially more complex..

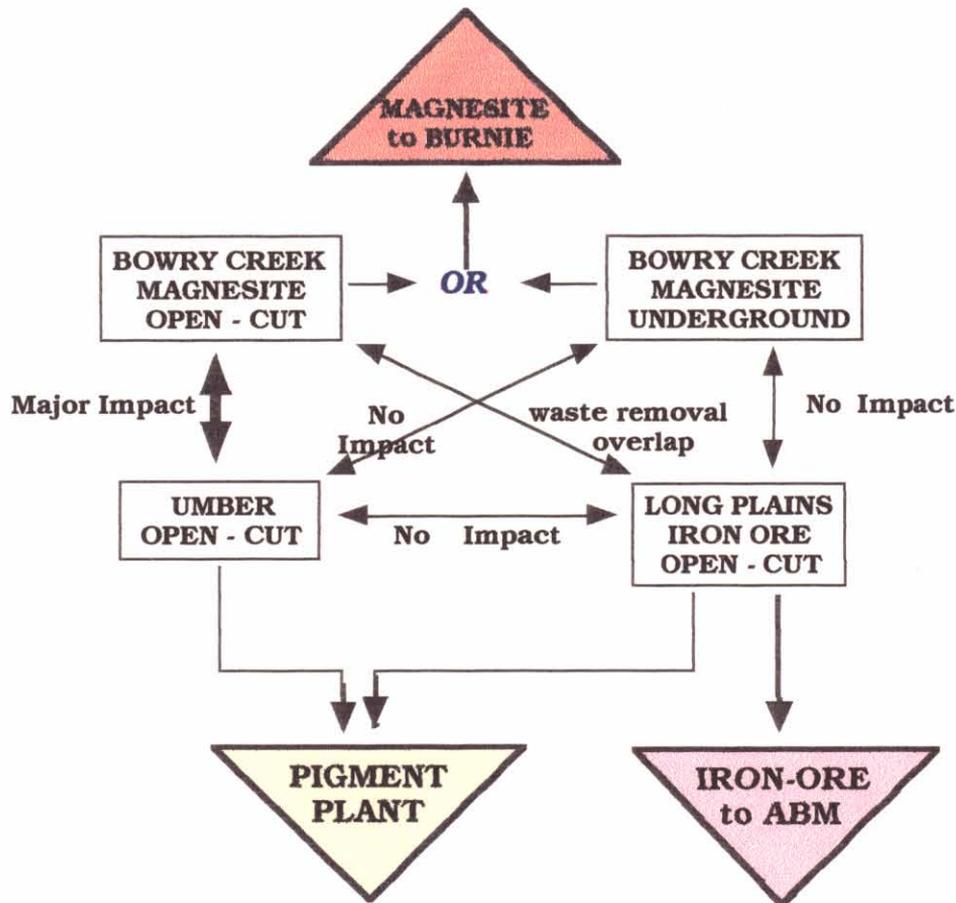
Both financial and physical relationships are simplified if GTR controls all three projects.

### 6.1 Physical Relationships:

As described previously, potential physical problems only occur if a decision is made to open-cut mine the Bowry Creek magnesite deposit. This is rated as of low probability. However, in the event, such a decision would have two impacts:

- The western side of the Long Plains open cut may overlap with the eastern wall of the magnesite open-cut. In effect, such a situation could **benefit** both operations because of shared waste removal costs.
- Overburden stripping of the magnesite open-cut would remove the umber deposit. This problem could be solved by GTR agreeing to provide notice of "intent to mine".

The various physical relationships are schematically shown below:



## PHYSICAL RELATIONSHIP OF INTEGRATED OPERATION

### 6.2 Financial Relationships:

The **magnesite project** is very long-term and capital intensive (overall). It would benefit slightly by sharing infrastructure capital development with both the iron-ore and, to a lesser extent, the pigment projects. Pre-development and operating costs would only benefit marginally.

**The magnesite project is not financially sensitive to development of the iron-ore or pigment projects.**

The **iron-ore project** would benefit substantially from infrastructure capital sharing with the magnesite project, principally in road and transmission line costs. It would not benefit greatly in terms of pre-development or operating costs.

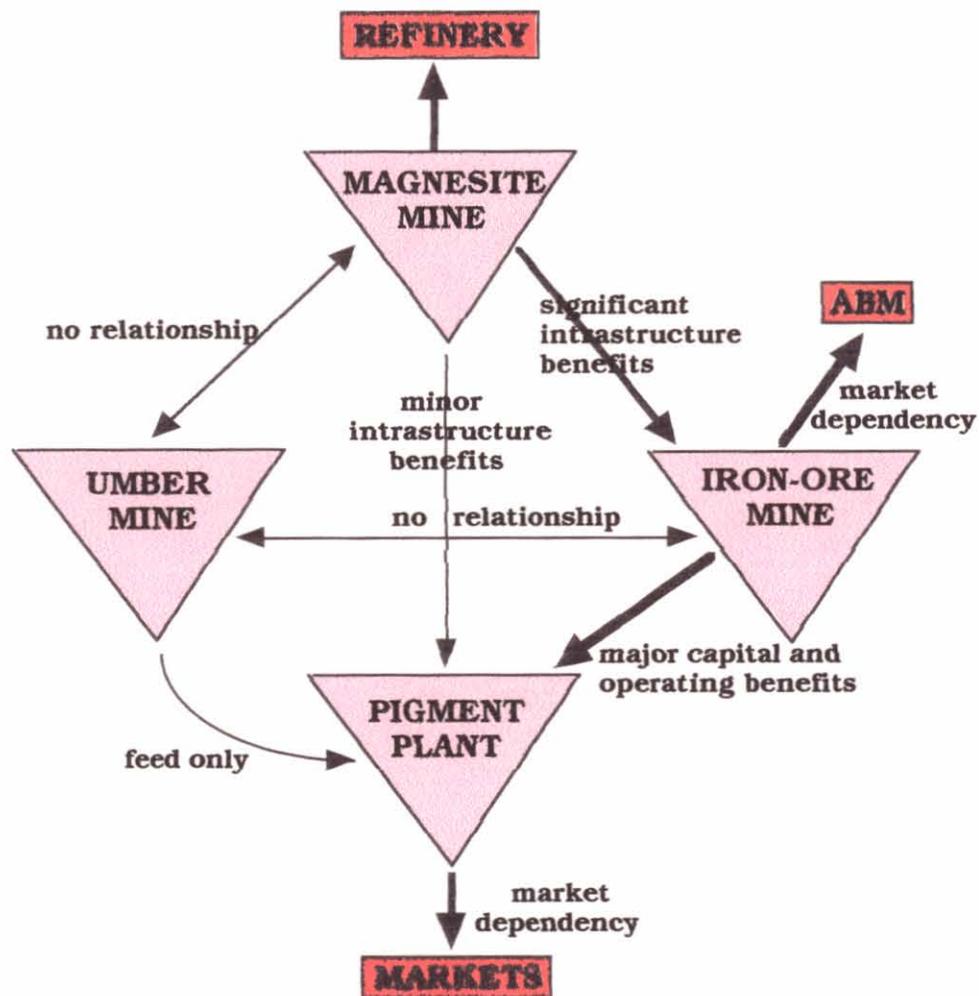
The iron-ore project would derive significant, but not crucial, capital and operating benefits from co-development of the pigment plant.

**The viability of the iron-ore project depends entirely upon ABM agreeing to purchase Long Plains material for approximately \$18/t delivered.** Such a sales contract is only likely if the product is viewed as superior to their own mill feed.

The **pigment operation** would benefit substantially in terms of operating and capital costs from co-development with the iron-ore mine at Long Plains. **Without development of the iron-ore mine, the pigment plant may not be viable** because it would have to bear all capital and operating costs.

The pigment operation benefits only in a minor way from co-development of the magnesite project.

The various financial relationships are schematically shown below:

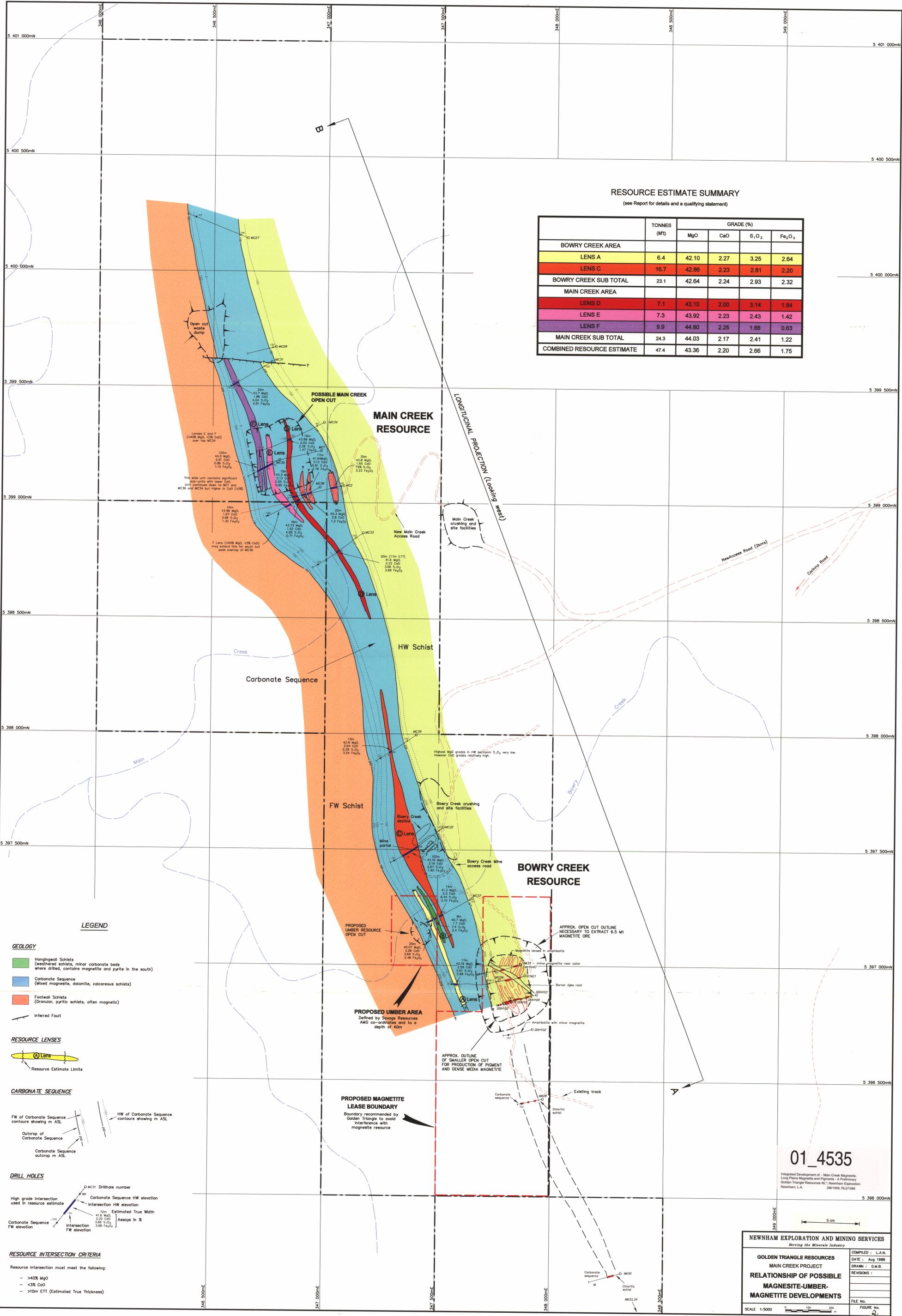


## FINANCIAL RELATIONSHIPS BETWEEN OPERATIONS

**RESOURCE ESTIMATE SUMMARY**

(see Report for details and a qualifying statement)

	TONNES (MT)	GRADE (%)			
		MgO	CaO	SiO <sub>2</sub>	Fe <sub>2</sub> O <sub>3</sub>
<b>BOWRY CREEK AREA</b>					
LENS A	6.4	42.10	2.27	3.25	2.64
LENS C	16.7	42.86	2.23	2.81	2.20
<b>BOWRY CREEK SUB TOTAL</b>	<b>23.1</b>	<b>42.64</b>	<b>2.24</b>	<b>2.93</b>	<b>2.32</b>
<b>MAIN CREEK AREA</b>					
LENS D	7.1	43.10	2.00	3.14	1.84
LENS E	7.3	43.92	2.23	2.43	1.42
LENS F	9.9	44.80	2.25	1.88	0.63
<b>MAIN CREEK SUB TOTAL</b>	<b>24.3</b>	<b>44.03</b>	<b>2.17</b>	<b>2.41</b>	<b>1.22</b>
<b>COMBINED RESOURCE ESTIMATE</b>	<b>47.4</b>	<b>43.36</b>	<b>2.20</b>	<b>2.66</b>	<b>1.75</b>



**LEGEND**

- GEOLOGY**
- Hangwall Schists (weathered schists, minor carbonate beds where drilled, contains magnetite and pyrite in the south)
  - Carbonate Sequence (Mixed magnesite, dolomite, calcareous schists)
  - Footwall Schists (granular, pyritic schists, often magnetic)
  - Inferred Fault
- RESOURCE LENSES**
- Resource Estimate Limits
- CARBONATE SEQUENCE**
- FW of Carbonate Sequence contours showing in ASL
  - Outcrop of Carbonate Sequence
  - Carbonate Sequence outcrop in ASL
- DRILL HOLES**
- Drillhole number
  - High grade intersection used in resource estimate
  - Carbonate Sequence HW elevation
  - Intersection HW elevation
  - Estimated True Width
  - Assays in %
  - Carbonate Sequence FW elevation
  - Intersection FW elevation
- RESOURCE INTERSECTION CRITERIA**
- Resource intersection must meet the following:
- >40% MgO
  - <3% CaO
  - >10m ETT (Estimated True Thickness)

01\_4535

Integrated Development of Main Creek Magnesite, Long Plains Magnesite and Pigments - A Preliminary Golden Triangle Resources NL, Newham Exploration Newham, L.A. 2M1996, RL21988

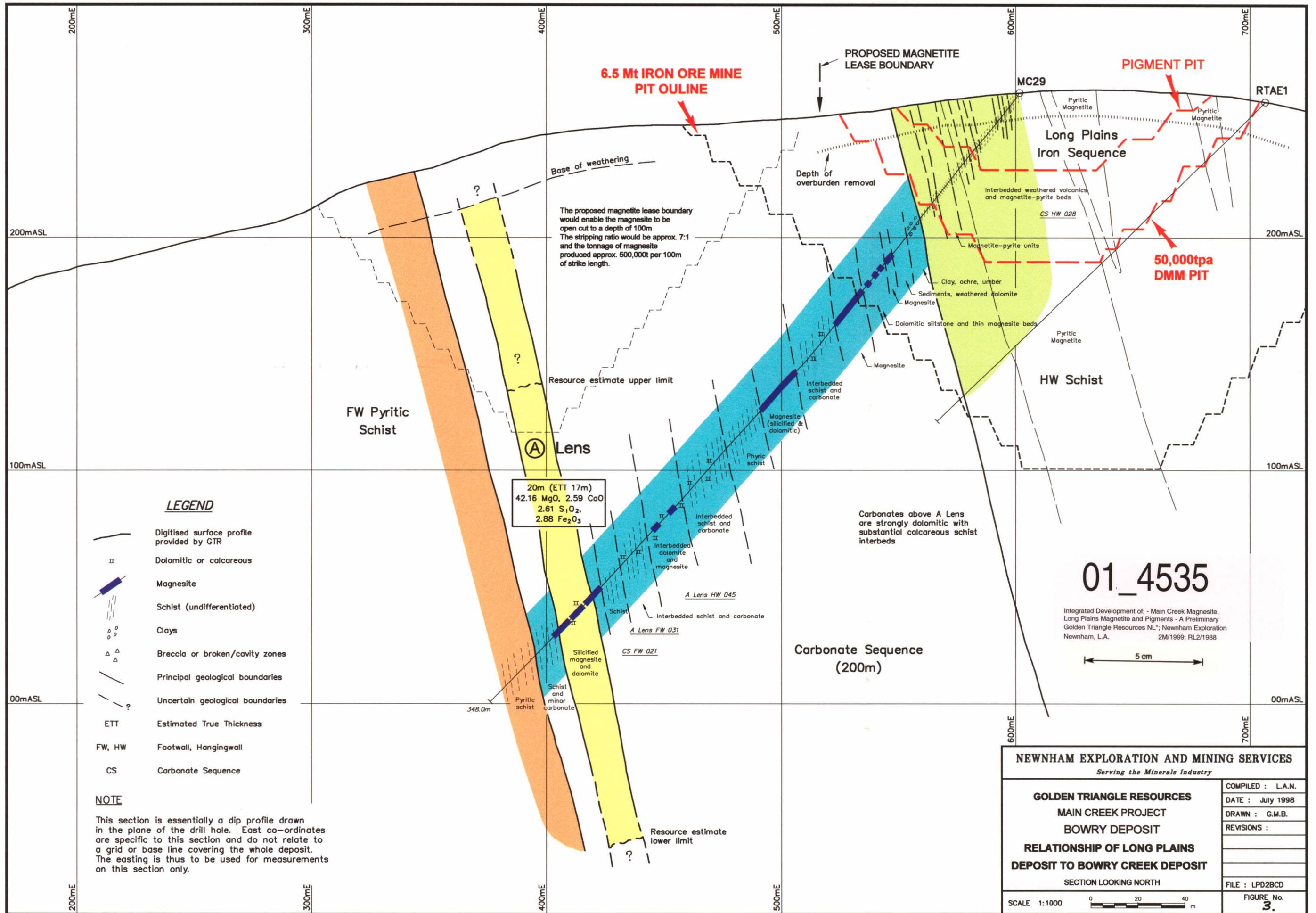
**NEWHAM EXPLORATION AND MINING SERVICES**  
Serving the Minerals Industry

**GOLDEN TRIANGLE RESOURCES**  
MAIN CREEK PROJECT

**RELATIONSHIP OF POSSIBLE MAGNESITE-UMBER-MAGNETITE DEVELOPMENTS**

COMPILED: L.A.N.  
DATE: Aug 1988  
DRAWN: G.M.B.  
REVISIONS:  
FILE No.  
FIGURE No. 4

SCALE 1:5000



**LEGEND**

- Digitised surface profile provided by GTR
- Dolomitic or calcareous
- Magnesite
- Schist (undifferentiated)
- Clays
- Breccia or broken/cavity zones
- Principal geological boundaries
- Uncertain geological boundaries
- Estimated True Thickness
- Footwall, Hangingwall
- Carbonate Sequence

**NOTE**

This section is essentially a dip profile drawn in the plane of the drill hole. East co-ordinates are specific to this section and do not relate to a grid or base line covering the whole deposit. The easting is thus to be used for measurements on this section only.

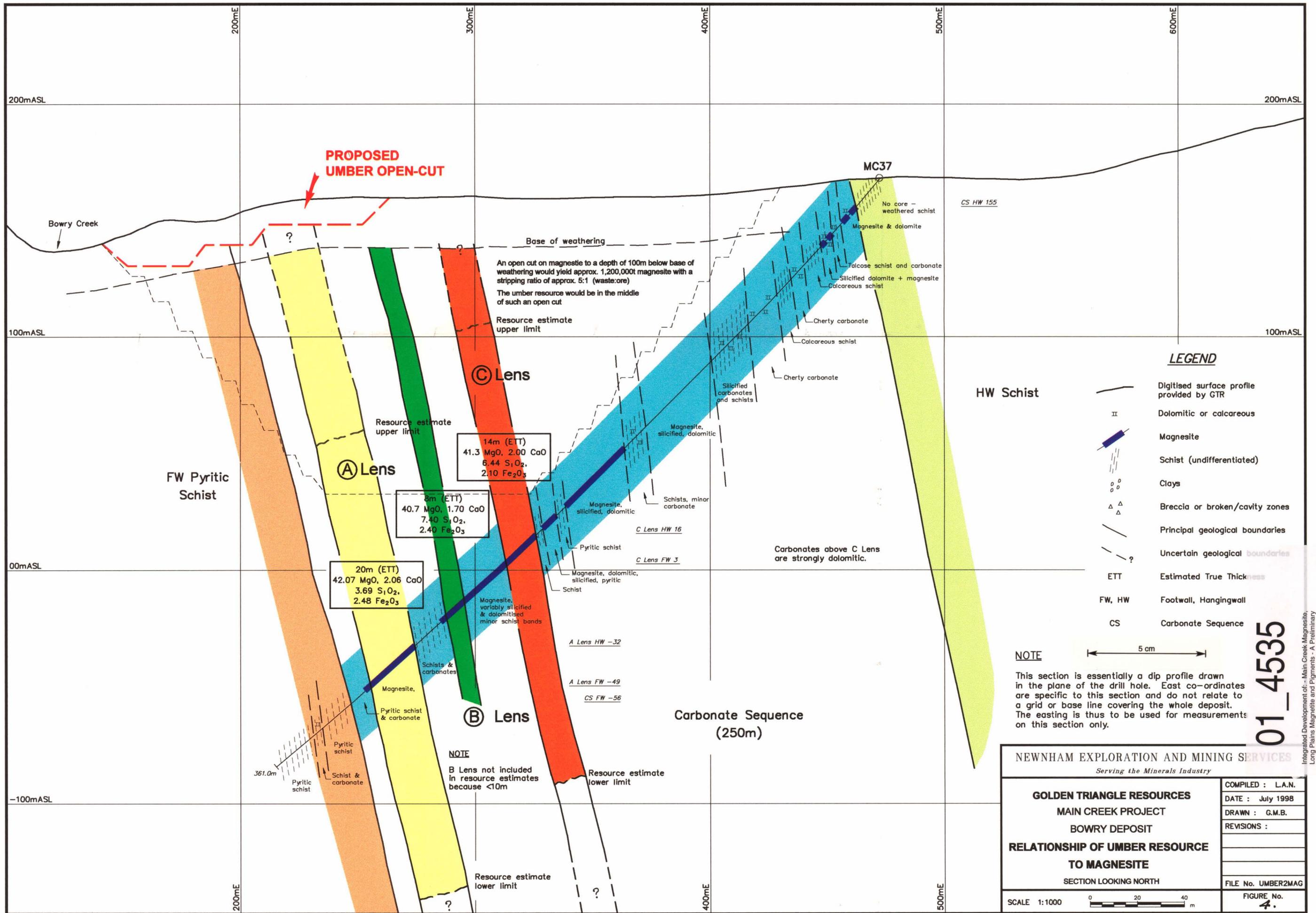
20m (ETT 17m)  
 42.16 MgO, 2.59 CaO  
 2.61 SiO<sub>2</sub>,  
 2.88 Fe<sub>2</sub>O<sub>3</sub>

**01\_4535**

Integrated Development of: - Main Creek Magnesite, Long Plains Magnetite and Pigments - A Preliminary Golden Triangle Resources NL; Newham Exploration Newham, L.A. 2M/1999; RL2/1988

5 cm

<b>NEWHAM EXPLORATION AND MINING SERVICES</b> <i>Serving the Minerals Industry</i>	
<b>GOLDEN TRIANGLE RESOURCES</b> MAIN CREEK PROJECT BOWRY DEPOSIT <b>RELATIONSHIP OF LONG PLAINS DEPOSIT TO BOWRY CREEK DEPOSIT</b> SECTION LOOKING NORTH	COMPILED : L.A.N. DATE : July 1998 DRAWN : G.M.B. REVISIONS :  FILE : LPD2BCD FIGURE No. <b>3.</b>
SCALE 1:1000	



**LEGEND**

- Digitised surface profile provided by GTR
- Dolomitic or calcareous
- Magnesite
- Schist (undifferentiated)
- Clays
- Breccia or broken/cavity zones
- Principal geological boundaries
- Uncertain geological boundaries
- ETT Estimated True Thickness
- FW, HW Footwall, Hangingwall
- CS Carbonate Sequence

**NOTE**

This section is essentially a dip profile drawn in the plane of the drill hole. East co-ordinates are specific to this section and do not relate to a grid or base line covering the whole deposit. The easting is thus to be used for measurements on this section only.

<b>NEWNHAM EXPLORATION AND MINING SERVICES</b> <i>Serving the Minerals Industry</i>	
<b>GOLDEN TRIANGLE RESOURCES</b> <b>MAIN CREEK PROJECT</b> <b>BOWRY DEPOSIT</b> <b>RELATIONSHIP OF UMBER RESOURCE TO MAGNESITE</b> SECTION LOOKING NORTH	COMPILED : L.A.N. DATE : July 1998 DRAWN : G.M.B. REVISIONS : FILE No. UMBER2MAG FIGURE No. 4
SCALE 1:1000	

01\_4535

Integrated Development of - Main Creek Magnesite, Long Plains Magnesite and Pigments - A Preliminary Golden Triangle Resources NL; Newnham Exploration 2M/1989; RL2/1988 Newnham, L.A.