

Northern Orion Explorations Ltd.

**TECHNICAL REPORT ON THE MINING
AND PROCESSING ASSETS OF
MINERA ALUMBRERA LTD.,
IN ARGENTINA**

JUNE, 2003

TABLE OF CONTENTS

	Page
1.0 SUMMARY AND CONCLUSIONS.....	1
1.1 BAJO DE LA ALUMBRERA PROJECT	1
1.2 REGIONAL GEOLOGY AND MINERALIZATION.....	3
1.3 MINERAL RESOURCES AND RESERVES.....	3
1.4 MINING OPERATIONS	5
1.5 MINERAL PROCESSING	5
1.6 PRODUCTION	6
1.7 ENVIRONMENTAL CONSIDERATIONS.....	6
1.8 CAPITAL COSTS	7
1.9 OPERATING COSTS.....	8
1.10 ECONOMIC ANALYSIS.....	10
2.0 INTRODUCTION AND TERMS OF REFERENCE.....	12
3.0 DISCLAIMER.....	14
4.0 PROPERTY DESCRIPTION AND LOCATION.....	15
4.1 INTRODUCTION.....	15
4.2 OWNERSHIP.....	15
4.3 ROYALTIES.....	17
4.4 DEBT AND FINANCING.....	17
4.5 ALUMBRERA PROJECT FACILITIES.....	17
4.5.1 Mine	17
4.5.2 Processing Plant	19
4.5.3 Mine Site Infrastructure	19
4.5.4 Mine Site Utilities	19
4.5.5 Concentrate Pipeline	20
4.5.6 Filter Plant.....	20
4.5.7 Railroad	20
4.5.8 Port	20
4.5.9 Environmental Liabilities.....	21
5.0 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY	22
6.0 HISTORY	23
6.1 RECENT OWNERSHIP HISTORY.....	24
7.0 GEOLOGICAL SETTING	25
7.1 REGIONAL GEOLOGY	25
7.2 DEPOSIT GEOLOGY	25

8.0	DEPOSIT TYPE AND ALTERATION	30
9.0	MINERALIZATION	31
10.0	EXPLORATION	32
11.0	DRILLING.....	34
11.1	DRILLING CAMPAIGNS	34
11.2	DRILL HOLE LOGGING	35
11.2.1	Geological Core Logging and Interpretation	35
11.2.2	Structural and Geotechnical Core Logging.....	36
11.2.3	RC Drill Hole Logging.....	36
11.2.4	Blast Hole Logging	36
12.0	SAMPLING METHOD AND APPROACH.....	37
12.1.1	Drill Core.....	37
12.1.2	RC Samples	37
12.1.3	Blast Hole Sampling.....	37
13.0	SAMPLE PREPARATION, ANALYSES AND SECURITY	38
13.1	SAMPLE SHIPMENT AND SECURITY	38
13.2	SAMPLE PREPARATION.....	38
13.3	SAMPLE ANALYSES	39
13.4	QA/QC PROGRAMS	39
13.4.1	Laboratory Standards	40
13.4.2	MAA Standards.....	40
13.4.3	Laboratory Duplicates	40
13.4.4	MAA Selected Reassays	41
13.4.5	External Laboratory Reassays	41
13.4.6	Duplicate Quarter Core Samples.....	42
13.5	LABORATORY CERTIFICATION	42
14.0	DATA VERIFICATION.....	44
14.1	DATABASE VALIDATION.....	44
14.2	INDEPENDENT REVIEWS	44
14.3	MICON'S REVIEW	44
15.0	ADJACENT PROPERTIES	46
16.0	MINERAL PROCESSING AND METALLURGICAL TESTING.....	47
16.1	INTRODUCTION.....	47
16.2	FEASIBILITY STUDIES AND PROCESS DESIGN.....	47
16.2.1	Phase 1.....	47
16.2.2	Phase 2.....	48
16.2.3	Phase 3.....	48
16.2.4	Phase 4.....	48

16.3 PROCESS OPTIMIZATION	48
16.4 STRATEGIC PLANNING AND DEVELOPMENT	48
16.5 SUMMARY	49
17.0 MINERAL RESOURCE AND MINERAL RESERVE ESTIMATES	50
17.1 MINERAL RESOURCE ESTIMATION METHODOLOGY	51
17.1.1 ALUF Reserve Block Model.....	51
17.1.2 ALUG Reserve Block Model.....	61
17.1.3 Treatment of High Grade Assays	65
17.1.4 Bulk Density.....	66
17.1.5 Grade Control Model	66
17.1.6 Throughput Model.....	66
17.1.7 Software	68
17.1.8 External Audits.....	68
17.2 MINERAL RESERVE ESTIMATION METHODOLOGY	69
17.3 MINERAL RESOURCES AND MINERAL RESERVES.....	71
17.3.1 Mineral Resources.....	71
17.3.2 Mineral Reserves.....	72
17.3.3 Responsibility For Estimation.....	73
17.3.4 Production Reconciliation.....	73
17.3.5 Reconciliation to CIM Standards	75
17.3.6 Issues Affecting Mineral Resource and Mineral Reserve Estimates	76
18.0 OTHER RELEVANT DATA AND INFORMATION	77
19.0 ADDITIONAL REQUIREMENTS FOR TECHNICAL REPORTS ON DEVELOPMENT PROPERTIES AND PRODUCTION PROPERTIES	78
19.1 MINING OPERATIONS	78
19.1.1 Production Operations.....	78
19.1.2 Mine Planning	80
19.1.3 Mine Fleet Requirements	83
19.1.4 Maintenance	84
19.1.5 Summary	85
19.2 MILLING OPERATIONS AND RECOVERABILITY	85
19.2.1 Process Description.....	85
19.2.2 Performance	88
19.3 MARKETS.....	90
19.4 CONTRACTS	90
19.4.1 Mining	90
19.4.2 Power.....	91
19.4.3 Concentrate Sales	91
19.4.4 Concentrate Logistics	91
19.5 ENVIRONMENTAL CONSIDERATIONS.....	92
19.5.1 Permitting.....	92
19.5.2 Compliance.....	92
19.5.3 Reclamation and Closure	93

19.5.4	Bond-Posting.....	93
19.6	TAXES.....	94
19.7	CAPITAL AND OPERATING COST ESTIMATES	95
19.7.1	Capital Costs	95
19.7.2	Operating Costs	97
19.7.3	Mine Operating Costs.....	97
19.7.4	Processing Costs.....	99
19.7.5	Other Costs.....	99
19.8	ECONOMIC ANALYSIS.....	99
19.8.1	Method of Evaluation.....	99
19.8.2	Resources and Reserves	100
19.8.3	Production Estimates.....	100
19.8.4	Revenue Projections.....	101
19.8.5	Debt Service	102
19.8.6	Overall Cash Flow Projection	103
19.8.7	Sensitivity Analyses	107
19.8.8	Payback	107
19.8.9	Mine Life.....	107
20.0	INTERPRETATION AND CONCLUSIONS	108
21.0	RECOMMENDATIONS.....	109
22.0	REFERENCES.....	110
23.0	CERTIFICATES.....	112

List of Tables

	Page
Table 1.1	Alumbrera Ore Reserves as of December 31, 2002 4
Table 1.2	Total Scheduled Ore To Be Mined And Processed..... 6
Table 1.3	MAA Capital Expenditure 2004 To 2013 8
Table 1.4	Actual Operating Costs For FY 2003 Compared With LOM Estimates..... 9
Table 1.5	Sensitivity to Metal Price 11
Table 11.1	Alumbrera Project Drilling Summary 34
Table 11.2	MAA Drill Core Size Used, Summary to 1998..... 34
Table 13.1	Population Statistics Comparison with Referee Laboratory, Gold Analyses... 41
Table 13.2	Population Statistics Comparison with Referee Laboratory, Copper Analyses 42
Table 17.1	Alumbrera Geological Codes 53
Table 17.2	Assay Record Variables 54
Table 17.3	Assay Composite Variables..... 55
Table 17.4	Block Model Extents 55
Table 17.5	Block Model Variables..... 56
Table 17.6	Search Parameters 57
Table 17.7	Variogram Parameters 58
Table 17.8	Andesite Kriging Zones, Search Azimuths 58
Table 17.9	Block Classification Criteria 61
Table 17.10	Specific Gravity by Rock Type 66
Table 17.11	NSR Calculation..... 70
Table 17.12	Alumbrera Ore Reserves as of December 31, 2002, Using the ALUG Model 72
Table 17.13	Comparison, In-Pit Reserves, ALUF vs. ALUG Models Using Pit 806 and December, 2002 Surfaces..... 73
Table 17.14a	ALUF Block Model Reconciliation, July, 1999 to June, 2002 74
Table 17.14b	ALUG Block Model Reconciliation, July, 2002 to December, 2002 74
Table 17.15	Mill Feed Reconciliation 75
Table 19.1	LOM Mining Equipment Requirements..... 84
Table 19.2	Major Equipment Availability..... 84
Table 19.3	Process Performance 89
Table 19.4	MAA Capital Expenditure, 2003 to 2012 95
Table 19.5	Actual Operating Costs for Fiscal Year 2003 Compared with LOM Estimates 98
Table 19.6	Recent Project Performance Compared With Fiscal Year 2003 and LOM plan Average Projections 101
Table 19.7	MAA's Current Gold Hedging Cover 102
Table 19.8	Shareholder Subordinated Debt Repayment Schedule..... 103
Table 19.9	Bajo de la Alumbrera Base Case Cash Flow..... 104
Table 19.10	Sensitivity to Metal Price 107

List of Figures

	Page
Figure 1.1	Location Map, Bajo de la Alumbrera 2
Figure 4.1	Location Map, Bajo de la Alumbrera 16
Figure 4.2	Mine Infrastructure and Surface Leases 18
Figure 7.1	Bajo de la Alumbrera Geology Map 26
Figure 7.2	Stage 1 Pit Geology Map 28
Figure 7.3	Cross Section 49 N 29
Figure 10.1	MAA Contract Area and Final Pit Outline 33
Figure 13.1	MAA Sample Preparation Flowsheet 38
Figure 17.1	Alumbrera Kriging Zones 57
Figure 17.2	Example ALUF Block Model Section 59
Figure 17.3	Rock Domain (Composites Influence) 60
Figure 17.4	Grade Domain (Composites Influence) 60
Figure 17.5	Alteration Domain (Composites Influence) 60
Figure 17.6	Faults Domain (Composites Influence) 61
Figure 17.7	Example ALUG Block Model Section Showing Kriged Copper Grades 64
Figure 17.8	Example ALUG Block Model Section Showing Calculated Equivalent Copper Grades 65
Figure 17.9	Quartz Magnetite Porphyry and Rubble Andesite Photographs 67
Figure 17.10	Grindability Domains in ALUF Block Model, 20 x 20 m Blocks - Bench 2373 68
Figure 19.1	Bajo De La Alumbrera Open-Pit (Looking at Phase 4 North) 79
Figure 19.2	2002 - Final Pit Design 80
Figure 19.3	2001 - Pit Phase Designs 81
Figure 19.4	2002 - Pit Phase Designs 81
Figure 19.5	Material Movement 82
Figure 19.6	Process Flowsheets 87

APPENDICES

APPENDIX I	Minera Alumbrera Limited - Taxes
------------	---------------------------------------

LIST OF ABBREVIATIONS	
Abbreviation	Unit or Term
'	minutes of longitude or latitude
~	Approximately
ARG\$	Argentine peso(s)
US\$	United States dollar(s)
US\$/oz	United States dollars per ounce
US\$/t	United States dollars per tonne
%	Percent
<	less than
>	greater than
°	degrees of longitude, latitude, compass bearing or gradient
°C	degrees Celsius
2D	two-dimensional
3D	three-dimensional
µm	microns, micrometres
AAS	atomic absorption spectroscopy
AARL	Anglo American Research Laboratory
Ag	Silver
ARD	acid rock drainage
As	Arsenic
Au	Gold
BCM	bank cubic metre(s)
Bi	Bismuth
BOD	biological oxygen demand
c.	circa, approximately
cm	centimetre(s)
Co	cobalt
Cu	copper
d	day
D	density
DD	diamond drill(ing)
DC	diamond core
dm	dry metric tonnes
DPO	data processing order
DWT	dead weight tonnes
EIR	Environmental Impact Assessment Report
EqCu	Payable equivalent copper grade
et al.	and others
FA	fire assay
Fe	iron
ft	foot, feet
FY	Financial Year for MAA, in each case 1 July to 30 June
g/t	grams per tonne
g/t Au	grams per tonne of gold
GPS	global positioning system
GW	gigawatt(s)
GWh	gigawatt hour(s)
h	hour(s)
ha	hectare(s)
h/d	hours per day
HP	horsepower
HQ	H-sized core, Longyear Q-series drilling system
ICP	inductively coupled plasma
ICP-OES	inductively coupled plasma-optical emission spectrometry
IMCP	Interim Mine Closure Plan
in	inch(es)
JORC	Code of the Joint Ore Reserves Committee of the Australasian Institute of Mining and Metallurgy (1999)
kg	kilogram(s)
kg/d	kilograms per day
km	kilometre(s)
km ²	square kilometre(s)
kV	kilovolt(s)
L	litre(s)
lb	pound(s)

Li	lithium
LIMS	laboratory information management system
LOM	MAA's life-of-mine plan
LTIFR	lost time injury frequency rate
m	metre(s)
m ³	cubic metre(s)
m/s	metres per second
M	million(s)
Ma	million years
MAA	Minera Alumbrera Ltd.
masl	metres above sea level
MEB	Musto Explorations (Bermuda) Limited
MIL	Mining Investment Law of Argentina
MIM	MIM Holdings Limited
MIP	Mount Isa Pacific Pty. Ltd.
mm	millimetre(s)
Mn	manganese
Mo	molybdenum
MPD	mean percentage difference
Mt	million tonnes
Mt/y	million tonnes per year
MW	megawatt(s)
N	North
n.a.	not applicable, not available
Na	sodium
NCA	Nuevo Central Argentino railway
NOE	Northern Orion Explorations Ltd
NPV	net present value
oz	troy ounce(s)
oz/t	troy ounces per tonne
Pb	lead
PD	percussion drilling
pH	concentration of hydrogen ion
PIMA	portable infrared mineral analyser
ppb	parts per billion
ppm	parts per million
QA/QC	quality assurance/quality control
RC	reverse circulation
ROM	run-of-mine
RQD	rock quality designation (data)
RTP	Rio Tinto plc
s	second
S	south
SAG mill	semi-autogenous grinding mill
Sb	antimony
SD	standard deviation
SEM	scanning electron microscope/microscopy
SFA	screen fire assay
SG	specific gravity
SI	International System of Units
SPG	strategic mine planning group
t	tonne(s) (metric)
t/h	tonnes per hour
t/y	tonnes per year
UN	United Nations
US	United States
UTE	Union Transitoria de Empresas, between YMAD and MAA
V	volts
W	west or watt
WMT	wet metric tonnes
wt %	percent by weight
y	year
YMAD	Yacimientos Mineros de Agua de Dionisio, a statutory entity which owns the Alumbrera mining concession.
Zn	zinc

1.0 SUMMARY AND CONCLUSIONS

Micon International Limited (Micon) has been retained by Northern Orion Explorations Ltd. (NOE) to provide an independent technical review of the mineral resources and reserves and operational facilities of Minera Alumbrera Ltd. (MAA), in Argentina. This review was requested by NOE, in connection with its potential purchase of 50 % of BHP Billiton (BHPB)'s 25 % ownership of MAA. This report is in compliance with the requirements of National Instrument 43-101 and may be used in support of financing.

While conducting an earlier due diligence in support of an F1 Technical Report, Micon visited the MAA operations during the period October 22 through 23, 2002, where discussions were held with management and other responsible technical and financial staff. During this previous due diligence of the MAA operations, Micon had reviewed technical data, including historic operational records, in Rio Tinto plc's (RTP) offices in Melbourne from October 14 to 17, 2002.

1.1 BAJO DE LA ALUMBRERA PROJECT

The Bajo de la Alumbrera Project is Argentina's first world-scale mining enterprise, and is operated by Minera Alumbrera Ltd. (MAA) from an administrative centre at the mine site in Catamarca. MAA is indirectly held by M.I.M. Holdings Limited (MIM) (50 %), Wheaton River Minerals (WRM) (25 %) and BHP-Billiton (25 %). All mining prospects in the Farallón Negro district, the region including Alumbrera, are enclosed by a 344 km² national mineral reserve owned and administrated by Yacimientos Mineros de Aqua de Dionisio (YMAD), a statutory entity and quasi-government mining company. The project is subject to a royalty of 20 % of net proceeds, after capital recovery, to YMAD and a royalty of 3 % "*Boca Mina*" (mine mouth) to the provincial government of Catamarca.

The Bajo de la Alumbrera Project (Alumbrera) consists of five facilities spanning three Argentine Provinces with:

- the open-pit mine, processing facilities and central administration offices at Alumbrera, Catamarca.
- a 316 km concentrate slurry pipeline through Catamarca and Tucumán Provinces.
- a 202 km, 220kV, power line from the project's substation at El Bracho, Tucumán.
- the filter plant and rail loading facilities at Cruz del Norte, Tucumán.
- the port, handling facilities and train maintenance facilities at San Martín near Rosario, Santa Fé.

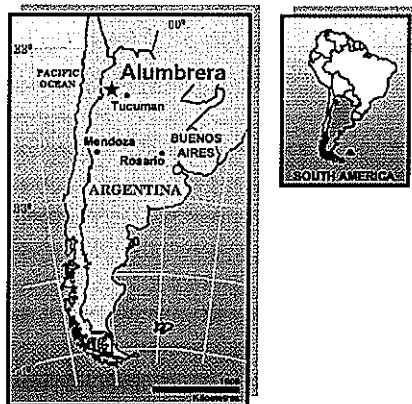
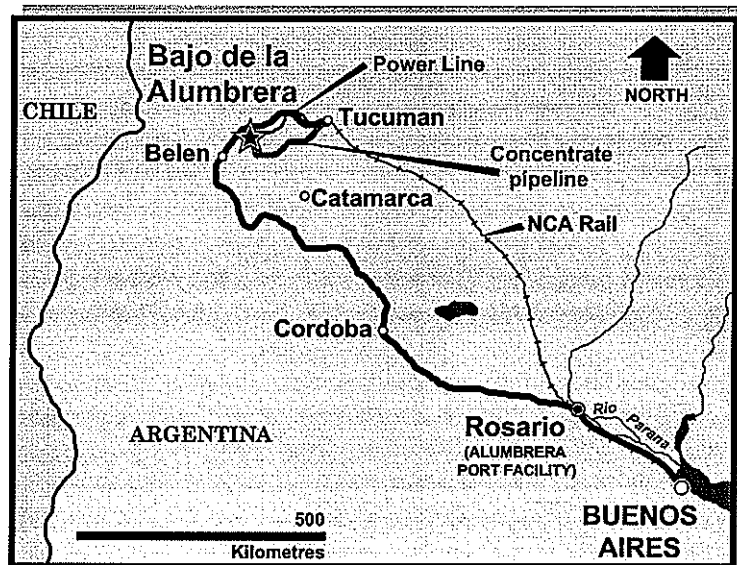
Support offices are located in Tucumán, Catamarca City, Rosario and Buenos Aires.

Bajo de la Alumbrera is located 1,100 km northwest of Buenos Aires and 6 hours by paved and dirt roads from the airport at San Miguel de Tucumán. Located in Hualfin District, Belén

Department, Catamarca Province, the deposit is 95 km northeast of the town of Belen and approximately 50 road-kilometres northwest of Andalga, Figure 1.1. The project is serviced by air and all-weather roads. MAA has daily flight schedules to and from Tucumán, and the mine site, and bus transport to and from both Catamarca and Tucumán.

The open-pit mine is situated on a 600 ha 20-year Mining Lease, known as the Contract Area, at Alumbrera, located in a valley west of the easternmost range of the Andes at an altitude of 2,600 m above sea level. Immediate mine infrastructure and other mine facilities cover an additional area of 5,200 ha. The climate is arid to semi-arid, with average mean temperatures of 17 to 18°C and average minimum and maximum temperatures range between 8 to 10 °C and 22 to 27 °C. Average mean rainfall is 160 mm, occurring as rain predominantly during the months of December through March.

Figure 1.1
Location Map, Bajo de la Alumbrera



Bajo de la Alumbrera
LOCATION

The project was developed during 1995 to 1997, with project capital expenditures totalling approximately \$US1.2 billion. All project financing is non-recourse to the owners.

Mining activities will continue until 2011, based on established (proved and probable) ore reserves, with processing of stockpiles continuing until 2013.

For MAA, the fiscal reporting year runs from July 1 to June 30.

1.2 REGIONAL GEOLOGY AND MINERALIZATION

Alumbrera is a classic porphyry copper-gold deposit. Mineralization is associated with hydrothermal alteration zones in andesitic volcanics and dacitic plutons. Host rocks are high-potassic calc-alkaline andesites of the late Miocene Farallón Negro volcanic complex, and the copper-gold deposit is intrusion-centred, in and around a subcylindrical complex of dacite porphyry stocks. Early magnetite-silica flooding occurs at the core of a 2 km-broad potassium feldspar-biotite potassic zone that hosts most of the chalcopyrite and gold mineralization. The area of extensive potassic alteration is ringed by peripheral propylitization and subsequently was overprinted by phyllic alteration. The only hypogene copper mineral is chalcopyrite. Gold occurs as 10- to 50-micron sized particles of native gold in chalcopyrite and to a lesser extent in magnetite, quartz and orthoclase. Veinlet and disseminated mineralization is integral to alteration and the intrusive units. Mineralization occurs as a dome-like carapace over a deep central low-grade core.

1.3 MINERAL RESOURCES AND RESERVES

The identified mineral resources at Alumbrera were estimated using a database comprising approximately 53,000 m of diamond drilling and 14,000 m of reverse circulation drilling, which has been adjusted to remove known biased results from earlier drill programs. Grade estimation was performed on a geologically constrained block model using ordinary kriging methods and parameters proposed and/or reviewed by Gary F. Raymond, Consulting Mining Engineer, Applied Mining Geostatistics. A complex system of hard and soft domain boundaries has been used to control interpolation.

The procedures utilised by MAA for converting mineral resources to mineral reserves are standard in the industry for resources recoverable by open-pit techniques. An ultimate pit shell is applied to the resource block model in order to extract ore, which has recoverable grades of metal capable of covering mining, processing and all down stream costs. This process employs Whittle software. The ultimate pit shell also includes waste removal necessary to release ore. At the pit rim a cut-off grade necessary to cover the cost of haulage from stockpile, processing and all downstream costs then determines which material is sent as waste for permanent storage and which is mineral reserve for processing or stockpiling.

MAA believes that there is little likelihood that the remaining known mineralization outside of the optimized pit shell will be recoverable and no longer reports Mineral Resources for

Alumbrera. In the past it has been MAA's practice to report mineralization outside of the ultimate pit shell in its Mineral Resource statement. MAA's current projections indicate that "reasonable prospects for mining to extend outside the LOM ultimate pit are not considered to exist." As a result, and in order to remain in compliance with the JORC Code, this mineralization is no longer reported. MAA also does not estimate inferred resources during grade interpolation for Alumbrera and, therefore, no inferred resources, within the ultimate pit shell, are available to be reported. As a consequence there currently are no Mineral Resources to be reported at Alumbrera.

MAA's fiscal year end is in mid-year and it re-estimates its Ore Reserves at that time. However, it also reports them at year end for use by its joint venture partners. MAA's Ore Reserves as of December 31, 2002, the most recent data available, are set out in Table 1.1 below.

Table 1.1
Alumbrera Ore Reserves as of December 31, 2002

Material	Cutoff	Confidence Category	Tonnes (million)	Au (g/t)	Cu (%)	Contained Metal	
						Gold (oz)	Copper (Mt)
In Situ	0.32% EqCu*	Proved	234	0.68	0.58	5,081,000	1.360
		Probable	23	0.49	0.47	362,000	0.108
		Total	257	0.65	0.57	5,443,000	1.468
Stockpiles	Various**	Proved	111	0.41	0.36	1,463,000	0.400
		Probable	0	0.00	0.00	0	0.000
		Total	111	0.41	0.36	1,463,000	0.400
Total		Proved	345	0.59	0.51	6,544,000	1.760
		Probable	23	0.49	0.47	362,000	0.108
		Total	368	0.58	0.51	6,906,000	1.868

* Payable equivalent Copper, @ \$295 oz Au & \$0.80 lb Cu. The pit has been optimized with the Whittle software package. The cutoff grade is used at the pit rim for stockpiling decisions.

** In its past the mine has operated using different cutoff criteria.

It is Micon's opinion that the Measured and Indicated Mineral Resources, estimated at Alumbrera, are individually the equivalent of the Measured and Indicated Mineral Resource categories as presented in the CIM Standards on Mineral Resources and Reserves, Definitions and Guidelines adopted by CIM Council on August 20, 2000. MAA does not estimate Inferred Resources. Micon is also of the opinion that the Proved and Probable Ore Reserves prepared by MAA staff and presented above are the equivalent of Proven and Probable Mineral Reserves under the same CIM standards.

The Proved and Probable Ore Reserves prepared by MAA staff are also the equivalent of Proven and Probable Reserves used in The United States Securities and Exchange Commission's Guide 7, Description of Property by Issuers Engaged or to Be Engaged in Significant Mining Operations. The Guide 7 definitions are taken from USBM Circular 831, Principles of a Resource Reserve Classification System for Minerals.

1.4 MINING OPERATIONS

MAA operates a large open-pit, where standard truck and shovel mining techniques operations are employed. Mining is carried out on 17 m benches, which suit the 42 m³ shovels and 220 tonne haul trucks necessary for the design production rate.

Current mineral reserves have a low waste to ore ratio, of an average of 1.77:1, for the 2002 LOM Plan. Operation of the mine is carried out at an elevated cut-off grade, which is reduced over the mine life to the economic cut-off grade. This practice requires that some ore be temporarily stockpiled for later processing. The average reserve grade is 0.51 % Cu and 0.58 g/t Au.

The mining rate in FY (2001/2002) slightly exceeded 300,000 tpd for a total of approximately 112 million tonnes of material mined, comprised of some 39 million tonnes of ore and 73 million tonnes of waste. At the end of April, 2003 (10 months) the MAA forecast for FY (2002/2003) is approximately 113 million tonnes. The total material mined is planned to increase to an average of 355,000 tpd, approximately 130 million tonnes per annum, for the FY's 2004 to 2007, after which time waste stripping reduces significantly.

Based on visual inspection and review of performance data, it is Micon's opinion that the operation is being conducted in a satisfactory manner. The open pit has been developed and operated over several years and, with attendant improvement, is reaching on-going steady state routine processes. While it is evident, from discussions with responsible MAA personnel, that several challenges exist, which require attention, no major impediments were identified which, in Micon's opinion, would prevent the achievement of MAA's mining production and cost targets.

1.5 MINERAL PROCESSING

The original plant uses a conventional porphyry copper flotation circuit with proven, large scale equipment. The plant produces two products, a copper flotation concentrate containing the major gold credit and doré bullion from gravity recovery of coarser free gold. The original design capacity was 80,000 tonnes/day with a utilisation of 94 %, equivalent to 29.2 Mt/a. Provision was made for expansion to 100,000 tonnes/day by the addition of a third grinding line, in order to maintain metal production as the ore grade decreases. The third line has been constructed and is in operation.

Final concentrate is thickened before being pumped via a 316 km long, 175 mm diameter pipeline to MAA's filter plant near Tucumán. The filters discharge to a storage building, where a front-end loader reclaims the filter cake for rail transport 830 km to the port near Rosario. MAA owns the locomotives and wagons used for rail transport, but the rail system operator runs them under contract. MAA owns and operates the ship loading facility, on the Rio Parana, at Rosario.

During its inspection of the concentrator and associated facilities, Micon observed that equipment condition and housekeeping were generally excellent and gave every indication of a

well managed operation. Based on information provided by and discussions with MAA, it appears that manning levels; operating, maintenance and metallurgical accounting procedures; and the range and quantity of consumables, operating spares and insurance spares retained on site and on consignment are appropriate for the nature of the operation.

Based on the results of the reported metallurgical testing, reported plant performance on Alumberrera ores, Micon considers that the process metallurgical and cost inputs to the ore reserve calculations and the LOM plan are valid. Annual variations in the LOM plan inputs reflect the metallurgical testing conducted on various ore types, plant performance to date and the proportions of each ore type to be processed.

Micon considers that the processing plant is capable of treating the projected tonnage throughputs and achieving the forecast metal recoveries.

1.6 PRODUCTION

The total scheduled ore to be processed, and the gold and copper output, are presented below in Table 1.2.

Table 1.2
Total Scheduled Ore To Be Mined And Processed

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Ore Milled (Mt)	36.71	36.62	36.80	36.97	37.23	37.33	37.19	37.23	37.23	17.61	350.92
Gold Grade (g/t)	0.76	0.63	0.58	0.64	0.54	0.60	0.77	0.59	0.29	0.29	0.58
Copper Grade (%)	0.60	0.54	0.50	0.55	0.48	0.60	0.65	0.54	0.28	0.29	0.51
Gold Prod'n ('000oz)	649	529	483	529	442	511	684	507	203	96	4,633
Copper in Conc ('000t)	195	175	161	177	156	198	216	178	85	42	1,581

1.7 ENVIRONMENTAL CONSIDERATIONS

Ongoing rehabilitation is recognised as part of routine operations and associated costs are included in the project's financial plan. Testing is being completed in order to generate information regarding the potential for acid generation from waste materials, and initial testing of capping materials has been completed. Progressive rehabilitation commenced in 2002, with the placement of barren core material on final batters of the northwest waste dump. Micon considers that MAA has an appropriate acid rock drainage management plan.

The main environmental permit is the original Environmental Impact Report (EIR), which was prepared to 1988 World Bank guidelines and was approved in 1997 as part of the project approval process. Under the terms of the Union Transitoria de Empresas (UTE) agreement, MAA is responsible for compliance with the commitments made in the EIR and the cost of reclamation and closure. Micon understands that currently there are no significant areas of non-compliance. Environmental considerations are discussed in more detail in Section 19.5.

Minera Alumbrera acknowledges its responsibility to provide a safe working environment for both employees and contractors and works to create and sustain an injury free, healthy work environment for all employees and contractors. MAA maintains high levels of leadership, education and training, effective supervision and safety audits in its' approach to safety and environmental issues.

MAA have developed an environmental policy which commits MAA to high standards of environmental management and MAA conducts its' environment affairs in a manner transparent to the Government and other stakeholders. MAA is licensed through a series of Provincial and National Laws. The mine site and concentrate pipeline are regulated by 2 yearly Environment Impact Review Reports submitted to the Provincial Authorities in Tucumán and Catamarca. Discharge from the filter plant in Tucumán is regulated by a Provincial discharge license that has discharge standards consistent with World Bank Guidelines. Both Provincial and National laws require full manifest tracking and approval of hazardous waste disposal and regulate industrial waste disposal. MAA operates under a UTE agreement with YMAD. The long-term environment program and closure plans are development in consultation with YMAD and MAA is committed to carry out progressive rehabilitation using technologies designed to prevent ongoing post mining liabilities.

1.8 CAPITAL COSTS

The Alumbrera project was commissioned in 1998 after the expenditure of some US\$1.233 billion of project development capital. After additional capital expenditure of some US\$79 million in 1999, on-going annual sustaining and project capital has been expended since that time at a rate of approximately US\$26 million per fiscal year.

Some US\$29 million was expended in FY 2000, followed by US\$18 million and US\$30 million, in FY's 2001 and 2002, respectively, and with a further US\$29 million forecast to be spent in FY 2003. As at the end of March, 2003, some US\$12.3 million, of the total for FY 2003, had been expended.

Micon has accepted the MAA 2002 LOM Plan estimates of future capital expenditure as input to its cash flow model. The capital estimates included in the Micon estimates of future annual cash flows are presented below in Table 1.3.

Table 1.3
MAA Capital Expenditure 2004 To 2013
(US\$ million)

Item	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Mining	13.6	10.3	4.8	4.8	4.2	5.1	1.7	2.1			46.6
Tailings Dam	2.8	2.8	2.4	2.4	2.4	2.3	2.3	2.2	2.2	0.1	21.9
Concentrator	3.3	2.6	1.8	1.8	1.6	2.1	1.3	1.4	2.1	1.8	19.8
Administration	0.29	0.28	0.32	0.32	0.14	0.3	0.13	0.15	0.05		2.0
Filter Plant, Rail, Port	0.69	0.22	0.19	0.19	0.15	0.08	0.81	0.35	0.16	0.05	2.9
Closure Cost										23.5	23.5
Total	20.6	16.2	9.5	9.5	8.4	9.9	6.3	6.3	4.5	25.5	116.7

N.B. MAA 2002 LOM Plan Capital adjusted by Micon for one additional year of reserve. Totals may not add due to rounding

Based on its observations and discussion with MAA management, Micon believes that the capital provisions for the mining, process and other facilities in the LOM Plan and, as used in Micon's LOM cash flow analysis, are adequate.

1.9 OPERATING COSTS

The current on-site operating costs were compared with estimates included in the MAA 2002 LOM Plan cash flow estimates, which have been used as a basis for estimating the cost estimates in the Micon cash flow projections, included in the economic evaluation section of this report. These costs are included in the projections of cash flow under the functional headings of mining, concentrator and pipeline, filter plant and administration.

Operating costs have been significantly influenced by the depreciation of the Argentine Peso, in January 2002, and the significance of this is still being realised. Prior to that date for ten years, the Peso had been fixed at 1:1 to the US Dollar. Since floating against other currencies, the Peso to the US Dollar currently is at a rate of approximately 2.9:1. In its cost estimates, included in the 2002 LOM Plan, MAA has assumed 100 % inflation of the Peso, in the FY 2003, with constant Peso rates, thereafter. Actual inflation in Argentina, since MAA's preparation of the 2002 LOM Plan, has been significantly less than the projected annual rate.

The MAA Monthly Performance Report for April, 2002, recorded a monthly inflation of minus 3.19 % and a year-to-date total for the period July, 2002 to April, 2003 of 9.07 %. As a result, the actual costs in US Dollars for on-site, concentrate pipeline and rail, port and marketing costs, up to on-board ship (FOB), were US\$4.26/ t milled, some 22 % below the budget estimate of US\$5.45/t milled.

Table 1.4 below, compares actual operating costs for the FY 2002 with the average LOM estimates used in Micon's economic analysis, included in Section 19.8 of this report.

Table 1.4
Actual Operating Costs For FY 2003 Compared With LOM Estimates

		2003 1st Half	2003 2nd Half	LOM 2004	LOM Average
Mine Unit Costs	US\$/t moved	0.62	0.69	0.69	0.72
Mine Costs	US\$ '000s	36,202	38,990	89,617	627,655
Concentrator & Pipeline Unit Costs	US\$/t milled	1.53	1.49	2.47	2.46
Concentrator & Pipeline Costs	US\$ '000s	25,649	26,010	90,570	863,768
Filter Plant Unit Cost	US\$/t milled	0.04	0.04	0.05	0.05
Filter Plant Cost	US\$ '000s	600	747	1,943	16,514
Administration Unit Cost	US\$/t milled	0.40	0.43	0.55	0.54
Administration Cost	US\$ '000s	6,637	7,543	20,222	190,932
Total FOR Unit Cost	US\$/t milled	4.13	4.19	5.51	4.84
Total FOR Cost	US\$ '000s	69,091	73,288	202,351	1,698,868
Rail, Port & Marketing Unit Cost	US\$/t milled	0.18	0.23	0.33	0.29
Rail, Port & Marketing Cost	US\$ '000s	2,946	3,938	12,020	102,308
Total FOB Unit Cost	US\$/t milled	4.30	4.42	5.84	5.13
Total FOB Cost	US\$ '000s	72,037	77,226	214,371	1,801,176
Sea Freight Unit Cost	US\$/dmt Sold	31.80	29.71	31.07	31.07
Sea Freight Cost	US\$ '000s	11,863	10,607	22,709	183,984
Total Unit Cost, incl. Sea Freight	US\$/t milled	5.01	5.02	6.46	5.66
Total Cost, incl. Sea Freight	US\$ '000s	83,897	87,835	237,081	1,985,160

Other off-site costs are incurred for transport of concentrate. The MAA forecast costs, of US\$11.63/t of dry concentrate, for rail transport to, and ship-loading at, Rosario, with sea freight costs averaging US\$31.07 per tonne of dry concentrate.

Provincial and YMAD royalties are also imposed in addition to site and off-site costs. The Provincial royalty currently paid is some 2 % of net revenue after deduction of off-site smelter and refining charges. The YMAD royalty is 20 % of cash flows after all costs, debt service and recovery of initial productive capital expenditure. The projected base case cash flows do not trigger any payments of this royalty. However, MAA agreed to pay to YMAD, to assist the local community, an advance payment of US\$10 million, to be deducted from future royalty payments. A final US\$2 million of this amount is scheduled to be paid in FY 2003.

The smelter terms and treatment and refining charges used in the estimates of cash flows are those included in the MAA 2002 LOM Plan estimates, which are based on historical experience. Concentrate smelting is estimated at US\$66/t of dry concentrate, while refining charges are US\$0.066/lb of payable copper and US\$5.00/oz of payable gold in concentrate.

Micon considers that the process used by MAA for estimating future operating costs is sound. The operation has reached a relatively steady state condition, which facilitates reliable cost forecasting, when the economic parameters outside the control of operating management remain stable. Accordingly, based on actual financial year 2001/2002 and 2002/2003 to April 2003 costs, and allowing for MAA's assumed inflation and exchange rates, Micon considers that the budgeted costs are reasonable, if somewhat conservative.

1.10 ECONOMIC ANALYSIS

The overall economic potential of the MAA operation has been evaluated using conventional discounted cash flow techniques. This procedure has been used for the purpose of estimating the financial returns expected to accrue to NOE as the owner of 12.5 % of the MAA mining, processing and concentrate transportation operations.

The overall base case cash flow projections for the MAA operation, based on the input estimates and assumptions discussed herein, are presented in Table 19.8, Section 19.8.6. These projections incorporate the currently reported mineral reserves of MAA. The projections are in constant US Dollars, of mid-2003 value. It can be seen that:

- Over its projected operating life of 10 years, at exchange and inflation rates projected by MAA, the operation is expected to generate a total undiscounted net cash flow, after senior debt service and available for distribution to shareholders, of some US\$1.12 billion, of which 50 % of BHPB's 25 % share would equate to approximately US\$140 million.
- The net present value of 50 % of BHPB's 25 % share of the projected future cash flows for the operation, at a discount rate of 10 % per year, is estimated at some US\$86 million. At a discount rate of 15 % per year, the net present value is reduced to US\$73 million.
- The effects on operating cost and hence cash flows of the foreign exchange rate and the escalation of the Argentine Peso are significant. However, the absolute levels of the base case cash flows are so large that even significant changes in operating cost render less material changes in the current value of the Alumbrera property. As discussed in Section 19.7 of this report, the MAA projections of operating cost, which Micon has used as a basis for its projections of cash flow, assume a 100 % inflation of the Argentine Peso in the FY 2003 and a constant Peso/US Dollar exchange rate of 3.5:1. At the end of April, 2003, an annualized rate of Peso inflation of some 22 % was forecast for the year by MAA, with a Peso/US Dollar exchange rate of 2.85:1 reported. In its base case cash flow projections Micon has incorporated both these latter rates.

The above base case estimates of cash flow are based on assumed metal prices of copper at a constant US\$0.80/lb and gold at a constant US\$320/oz.

Net present values, for the 50 % of BHPB 25 % share of cash flows available to shareholders after full debt service, have been estimated for metal prices 10 % higher and lower than the base case prices.

The results of these analyses are summarized in Table 1.5.

Table 1.5
Sensitivity to Metal Price

Input Parameter	Total NPV (50 % of BHPB 25 %)		
	(US\$ million)		
Discount Rate, %	0	10	15
Base Case Prices	140	89	73
Base Case Prices +10 %	173	110	91
Base Case Prices -10 %	106	66	54

2.0 INTRODUCTION AND TERMS OF REFERENCE

Micon International Limited (Micon) has been retained by Northern Orion Explorations Ltd. (NOE) to provide an independent technical review of the mineral resources and reserves and operational facilities of Minera Alumbrera Ltd. (MAA), in Argentina. This review was requested by NOE, in connection with its potential purchase of 50 % of BHP Billiton's 25 % ownership of MAA.

MAA owns and operates the Bajo de la Alumbrera (Alumbrera) facilities. MAA, in turn, is indirectly owned by Mount Isa Mines Ltd. (MIM) (50 %), BHP Billiton (BHPB) (25 %) and Wheaton River Minerals (WRM) (25 %). Alumbrera is located in the Catamarca Province of north-west Argentina. The facilities consist of an open pit mine and concentrator, at Alumbrera, a concentrate slurry pipeline, a filter plant and rail loading facilities, in Tucumán, and ship loading at San Martín near Rosario, Santa Fé. A copper and gold concentrate is produced at Alumbrera for shipment and sale to international smelters. A gold doré also is produced at site for sale to international refineries.

During an earlier due diligence, a visit to the MAA facilities was carried out by Messrs. Burgess and Hennessey on October 22 and 23, 2002. Prior to the site visits, the Micon team reviewed data in Rio Tinto plc's (RTP) office in Melbourne from October 14 to 17. RTP was a prior owner of 25 % of the Alumbrera property. Mr. David Wells reviewed data, relating to processing and environmental matters in RTP's office in Melbourne. Each of the individuals who carried out the site visits is a Qualified Person under National Instrument 43-101 (NI 43-101).

Presentations describing the operations were made to the Micon team and other interested parties by management at site, and subsequent discussions were held with responsible staff at the operation. Micon was also provided with all pertinent financial information and operating details for the property.

The principal documents referred to in this report are the following:

MAA

- Project Technical Briefing, January 1998.
- Confidential Information Memorandum, Minera Alumbrera Ltd., Cutfield, Freeman and Co. Ltd., February 19, 2001.
- Project Technical Briefing, Updated December 2001.
- Geology, Mineralization and Genesis of the Bajo de la Alumbrera Deposit, Catamarca Province, Argentina: John M. Guilbert, Arizona Geological Society, Digest 20 Porphyry Copper Deposits of the American Cordillera, edited by F.W. Pierce and J.G. Bolm 656p., 43 papers, hardbound, 1995.

- Descriptions of sampling, resource estimation and other procedures have been taken from other MAA reports and memos enumerated in the References Section.
- Other sections of this report have been compiled and quote from the MAA May 2002 Life-of-Mine (LOM) Plan.

The review of the assets of MAA is provided in subsequent sections of this report.

Metric units of measurement are used in this report, with quantities expressed in metric tonnes (t) except for Troy ounces (oz) of gold and silver. References to currency are expressed in United States dollars (US\$), and in Argentine pesos (ARG\$).

This report is based primarily on information provided by MAA via BHPB, and earlier by RTP, supported by personal observation by Micon. Micon did not drill any holes on the properties nor take any independent samples, as part of its technical review.

The descriptions of the properties and ownership thereof provided in this report is for general information only. Micon did not perform any legal investigation, nor did it review the relevant agreements between the parties, and makes no assertions as to title of the various parties.

3.0 DISCLAIMER

Micon has reviewed and analysed data provided by BHPB, and MAA and previously by RTP, their consultants and previous operators/explorers of the mine properties, and has drawn its own conclusions therefrom, augmented by its direct field examination. Micon has not carried out any independent exploration work, drilled any holes nor carried out any sampling and assaying. However, the presence of gold and copper in the local rocks is substantiated by the established mining history by MAA. Micon has not performed any estimation of resources and reserves at MAA, but has reviewed the estimates performed by previous mine personnel, examined the procedures used and reviewed in house and independent reserve and resource audits.

While exercising all reasonable diligence in checking, confirming and testing it, Micon has relied upon the data presented by BHPB, RTP and MAA in formulating its opinion.

The various agreements under which MAA hold title to the mineral lands for these projects have not been investigated or confirmed by Micon and Micon offers no opinion as to the validity of the mineral title claimed by MAA. The description of the property, and ownership thereof, as set out in this report, is provided for general information purposes only.

The metallurgical, geological, mineralization, exploration technique and certain procedural descriptions, figures and tables used in this report are taken from reports prepared by MAA and its consultants. The name Alumbrera refers to the deposit being mined by MAA, the joint venture corporation which holds a contract to mine the deposit

MAA estimate and report its mineral resources and mineral reserves using the current (1999) version of the Australasian Code for Reporting of Mineral Resources and Ore Reserves (JORC Code), the Australian, MAA and BHPB standards. For this reason, and because of the use of extracts from MAA reports, Micon will generally use JORC terminology throughout the report and provide a reconciliation to the CIM code in Section 17.3.5, Mineral Resources and Mineral Reserves.

Micon is pleased to acknowledge the helpful cooperation of BHPB and previously RTP's managements as well as the mine staff at MAA, all of whom made any and all data requested available and responded openly and helpfully to all questions, queries and requests for material.

4.0 PROPERTY DESCRIPTION AND LOCATION

4.1 INTRODUCTION

The Bajo de la Alumbrera Project (Alumbrera) consists of five separate facilities spanning three Argentine Provinces:

- The open pit mine, processing facilities and central administration offices at Alumbrera, Catamarca.
- A 316-km concentrate slurry pipeline through Catamarca and Tucumán Provinces.
- A 202-km, 220-kV power line from the project's substation at El Bracho, Tucumán.
- The filter plant and rail loading facilities at Cruz del Norte, Tucumán.
- The port, handling facilities and train maintenance facilities at San Martín near Rosario, Santa Fé.

Support offices are located in Tucumán, Catamarca City, Rosario and Buenos Aires.

The Alumbrera project is Argentina's first world-scale mining enterprise and is operated by Minera Alumbrera Ltd. (MAA) from the company's administrative centre at the mine site in Catamarca. The open-pit is located on a 600 ha Mining Lease, or "Contract Area", at Alumbrera, near Belen in northwestern Argentina, Figure 4.1. It is not known whether the Contract Area has been surveyed in and monuments erected. Immediate mine infrastructure and other mine facilities cover an additional permitted surface area of 5,200 ha. The mine is located in a valley west of the easternmost range of the Andes at an altitude of 2,600 m above sea level.

Alumbrera is a classic porphyry copper-gold deposit where mineralization is associated with hydrothermal alteration zones in andesitic volcanics and dacite plutons. The Mining Lease encompasses all mineralized areas of the deposit. The project was developed during 1995 to 1997 with Project Capital expenditures totalling approximately US\$1.2 billion. Mining activities will continue until 2010 based upon established (proven and probable) reserves and inferred resources, with processing of stockpiles continuing until 2012.

4.2 OWNERSHIP

All mining prospects in the Farallón Negro district, the region including Alumbrera, are enclosed by a 344 km² national mineral reserve and are owned and administrated by YMAD, a quasi-government mining company. YMAD was created in 1958 to exploit the mineral resources within its land concession. YMAD is managed by a board of five directors, three designated by the government of Catamarca Province and two by Tucumán University. The President of YMAD is appointed by the Federal Government of Argentina. YMAD also operates an underground manganese-gold-silver mine (Cordilleran vein-type deposit) at Farallón Negro, 7 km northwest of Alumbrera.

Figure 4.1
Location Map, Bajo de la Alumbrera



The 20-year Mining Lease that encloses the Alumbrera deposit was granted to MAA by agreement in April, 1994. The relationship, rights and obligations between YMAD and MAA are set out in an agreement between the parties (the UTE agreement). The agreement defines the working relationship between the parties including royalty obligations and requires that ownership of the facilities and infrastructure revert to YMAD after completion of operations.

The Alumbrera Project is owned and managed by MAA. MAA is owned 50 % by Mount Isa Pacific Pty. Ltd. and 50 % by Musto Explorations (Bermuda) Ltd. (MEB). Mount Isa Pacific Pty. Ltd. is wholly owned by M.I.M. Holdings Limited of Australia (MIM). MEB is indirectly owned 50 % by WRM and 50 % by BHPB.

4.3 ROYALTIES

MAA is required to pay a 3 % *Boca Mina* royalty to the provincial government of Catamarca. The royalty is calculated on the value of mineral substances at the mine mouth (*Boca Mina*) after certain allowable deductions. During the Micon site visit, MAA reported that its calculation of the *Boca Mina* Royalty in the LOM Plan cash flows is the equivalent of a 2 % charge against net revenue, i.e. revenue after deduction of offsite smelting and refining charges.

MAA is also obliged to pay a royalty to YMAD amounting to 20 % of net proceeds after capital recovery under the terms of the UTE agreement. To date, no payments have been due. However pursuant to an amendment to the UTE Agreement dated February 26 1997, MAA agreed to pay an advanced royalty of US\$10 million. The balance of US\$2.0 million will be paid in fiscal year 2003, ending June 30, 2003. MAA's 2002 LOM Plan does not project payment of the 20 % Net Proceeds Royalty during the Life of Mine production. Micon's estimates of annual cash flows for the same period, with Base Case metal prices increased by 10 %, indicate small payments commencing in 2011.

4.4 DEBT AND FINANCING

All project financing is non-recourse to owners. Project financing contains no financial cover ratios other than deposits into the Senior Debt Reserve Account. Senior Debt outstanding as of June, 2003 is forecast by MAA to be US\$206 million. Additional shareholder loans to the project, as of June, 2003, are forecast at US\$268 million.

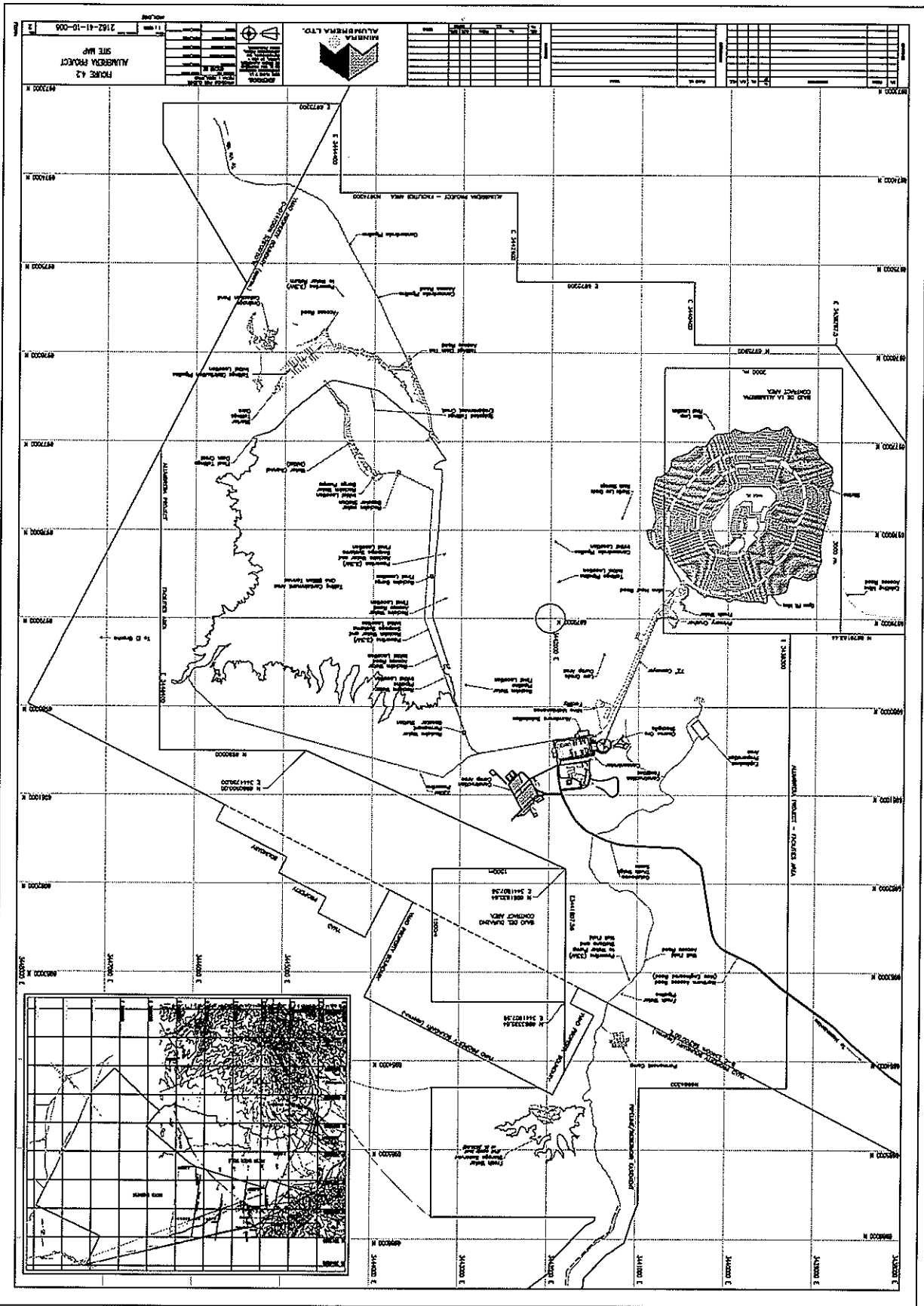
4.5 ALUMBRERA PROJECT FACILITIES

4.5.1 Mine

MAA operates a large-scale open pit located within the boundaries of the Alumbrera Mining Lease (see Figure 4.2). Standard truck and shovel mining techniques operations are employed, utilizing 42-m³ shovels and 220-t haul trucks to move both ore and waste. Mining is carried out on 17-m benches, which suit the size of the equipment necessary for the production rate.

The mining rate in fiscal year 2002 slightly exceeded 300,000 t/d for a total of approximately 112 million t of material mined, comprised of some 39 million t of ore and 73 million t of waste. The total material mined is planned to increase to an average of 355,000 t/d, or approximately 130 million t/y, for the fiscal years 2004 to 2007, after which time waste stripping reduces significantly.

MAA employs approximately 800 permanent staff and 400 contractors, of whom approximately 500 MAA employees and 200 contractors work in the mining department. Human resources and labour practices have been developed according to international best practice standards measured through productivity and efficiency. Approximately 40 expatriate staff are employed by MAA. This figure has been reduced from an expatriate workforce of around 90 when operations began.



It is envisaged that this number will decrease further as Argentine staff continue to be provided with the skills and opportunities required to develop relevant industry expertise.

Argentina is a highly unionized country with industry-based unions and very prescriptive Labour Agreements. MAA worked closely with the representative Union and Argentine Labour Ministry to negotiate an initial, one-union bargaining agreement. This was renegotiated in the second year resulting in the introduction of an innovative and flexible, four-year Labour Agreement. The agreement has been renewed, in 2003, for a further four-year period.

4.5.2 Processing Plant

Alumbrera processes ore through conventional crushing, grinding, sulphide flotation and gravity gold circuits. Originally designed for 80,000 t/d throughput, the mine produced 580,000 t copper concentrate (162,000 t contained copper) and 600,000 oz gold in fiscal year 2000. In 2001, expansion projects were commissioned which will increase throughput to 100,000 t/d (37 million t/y). With expansion of the concentrator, average annual production increased to 200,000 t of copper in concentrate and 700,000 oz of gold in concentrate and doré in fiscal 2002.

4.5.3 Mine Site Infrastructure

Mine site infrastructure includes offices, warehouse, laboratory, medical centre, permanent camp and workshops. The development of high quality mine site facilities has been a major focus of MAA in order to support the well being of employees while working a commute roster cycle. Site facilities include accommodation, catering, medical and indoor and open-air recreation facilities. There are two accommodation camps. The permanent camp (192 rooms) is located five km north of the central office and can accommodate 250 people in two shifts. Four additional three-story accommodation modules, consisting of 72 rooms per module, were under construction at the time of Micon's site visit in 2002.

A temporary construction camp is located 800 m east of the central office and retains 120 rooms for short-term contractors and temporary personnel.

4.5.4 Mine Site Utilities

Water

MAA obtains water from a bore field, Campo Arenal and this is supplied to the mine site through a 30-km long, 750-mm pipeline. The operation maintains a 1.7 million m³ water reservoir.

Power

A 202-km long 220-kV power line provides electrical power to the mine site from the project's substation at El Bracho, Tucumán. The power line, with 530 transmission towers, was constructed to provide access to the National Power grid.

4.5.5 Concentrate Pipeline

Concentrate slurry from the processing facilities is pumped a distance of 316 km to a filter plant at Cruz del Norte. The pipeline is 175 mm in diameter and has three pumping stations.

4.5.6 Filter Plant

Concentrates are processed through two parallel 2,000-m³ agitated storage tanks and three 120-m² filter presses; which lower the water content from 37 % to less than 8 % moisture, prior to loading into railcars.

4.5.7 Railroad

Concentrates from the filter plant are shipped 830 km by rail from Cruz del Norte, Tucumán, to Puerto Alumbra. Approximately one fully-loaded train of 2,240 WMT of concentrate is scheduled to depart from the filter plant for the port each day. Each train departs with approximately 40 wagons holding approximately 56 t of concentrate in each. The current rail equipment, with some minor modifications, has the ability to operate longer trains and haul approximately 85 t per wagon.

MAA purchased four 3,000-HP, GM GP.40 locomotives and 182 wagons (55-t capacity). Wagons are equipped with fibreglass covers to completely seal the wagon during transportation of concentrate. While MAA owns the locomotives and rail wagons, NCA (the railway concession owner) is contracted to operate the railroad and provide the engineers and crew for the operation of the trains between Tucumán and Rosario.

Maintenance of all rolling stock is performed at the port, which has a building that can house the locomotive and wagons during this time. All maintenance work is carried out through a service contract.

4.5.8 Port

The port is located in San Martín, Rosario in the Province of Santa Fé. Puerto Alumbra is the furthest upstream facility on the Río Paraná capable of handling Panamax-size vessels. The port can handle cargoes up to 60,000 DWT, but the depth of dredging in the river limits the size of cargo to approximately 40,000 t. The port operation and maintenance facilities are contained within a 12-ha lease which includes a rail-switching yard with approximately 8,200 m of rail. These facilities are adjacent to an existing facility, Terminal 6 (grain terminal). The depth of the Río Parana at the Terminal 6 berth is 11.89 m. Vessels are limited by the depth of the Mitre Channel at 9.75 m, about a third of the way down-river from Rosario.

Port facilities include a rail car unloading building and 50,000-t storage shed. Wagons are unloaded using a Cat 330L excavator, which transfers concentrate from each wagon to a conveyor system and into storage. Upon ship arrival, Cat 988F and 970F front-end loaders are used to transfer concentrate at 1,250 t/h from stockpile to the ship-loader feed conveyors.

Concentrate passes through an automatic sampling and static batch weighing station for product control, prior to reaching a radial ship-loader that loads the vessel alongside the pier.

The port operation and maintenance functions are undertaken through annually renewed service contract.

4.5.9 Environmental Liabilities

As discussed above, MAA operates under a UTE agreement with YMAD. The long-term environmental program and closure plans are developed in consultation with YMAD and MAA is committed to carry out progressive rehabilitation using technologies designed to prevent ongoing liabilities after closure.

The main environmental document is the original Environmental Impact Report (EIR), which was prepared to 1988 World Bank guidelines and was approved in 1997 as part of the project approval process. Under the terms of the UTE agreement, MAA is responsible for compliance with the commitments made in the EIR and the cost of reclamation and closure. Micon understands that there are no significant areas of non-compliance. Environmental considerations are discussed in more detail in Section 19.5.

5.0 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

Alumbrera is about 1,100 km northwest of Buenos Aires and six hours by paved and dirt roads from the airport at San Miguel de Tucumán. Located in Hualfin District, Belen Department, Catamarca Province, the deposit is 95 km northeast of the town of Belen and approximately 50 road-kilometres northwest of Andalgalá. The project is served by air and all-weather roads. MAA has scheduled flights to and from Tucumán and the mine site, and bus transport to and from both Catamarca and Tucumán. On average, more than 2,000 people are transported by road and more than 1,200 people are transported by air, either to or from the mine site, every month. An internal bus service runs on a continual schedule, transporting personnel to and from job sites, accommodation and recreation facilities within the mine site.

Topographically, (prior to commencement of mining) the Alumbrera deposit was a bowl-shaped, ellipsoidal depression oriented northeast-southwest (1,900 m by 1,200 m), surrounded by ridges formed mostly by andesitic breccia of the Farallón Negro volcanics. The floor of the bowl, at an altitude of 2,625 to 2,675 m, covers an area of 2.5 km². It is characterized by altered yellowish and reddish rocks that are the oxidized and weathered "surface rind" of hydrothermally altered and mineralized zones that were easily weathered in the recent geologic past, thereby forming the bowl. 'Bajo de la Alumbrera' translates to 'basin with alum' (low place, with magnesium sulphate), typical of altered copper deposits.

The deposit is located at latitude 27 °S and the climate is arid to semi-arid with topography and vegetation similar to the Arizona-Sonora desert. Alumbrera is near the boundary between the Sierras Pampeanas and Puna physiographic provinces and the area is sparsely populated. Average mean temperature is 17 to 18 °C and average minimum and maximum temperatures range between 8 to 10 °C and 22 to 27 °C. Temperatures of minus 10 °C in winter and 40 °C in summer can be reached. Average mean rainfall is 160 mm, occurring as rain predominantly during the months of December through March. Light snows can occur in July. Annual evaporation averages 1,585 mm.

6.0 HISTORY

The Alumbreira area has been known for its veins of copper and gold, and alum deposits since at least the 19th Century. Small-scale mining activity took place at the end of the 19th century and during the early 20th century at the southern sector of the edges of the present 'Bajo' area.

The most important periods in the discovery and development of the current project can be summarized chronologically as follows:

- 1938-45: Peirano maps mineralization associated with volcanism, arranging the works of Alto la Alumbreira in a regional geological map of the district, published by Tucumán National University (UNT).
- 1948-49: Cecione (Professor of Geology, Tucumán University) continues study of the area and identifies the central dacite intrusive during regional geological mapping.
- 1950: The Alto La Alumbreira veins are sampled by the government for copper and gold.
- 1959: Quartino and Zardino indicate the location of silicification in the present 'Bajo' area.
- 1961: Sister and La Iglesia cover the whole area with photo geology and publish the map on which 'Bajo de la Alumbreira' is mentioned for the first time.
- 1963: A.M. Mazzetti & R.G. Sister conduct a mapping and geochemical survey defining a deposit of disseminated/scattered copper.
- 1969: Romani (YMAD) carries out a thorough geological geochemical prospecting program and completes 4 short drill holes for a total depth of 226 m. Average grade of the samples was 0.38 % copper and 0.40 g/t gold.
- 1971: R.H. Sillitoe, working for the United Nations (UN), identifies the potassic alteration zone.
- 1973-76: YMAD requests the national government carry out more detailed studies. The government, through the NOA MINERO (Argentine Northwest Mining) Plan of the National Service of Mining and Geology, carry out a geophysical study (induced polarization and magnetics) and commences a drilling program on 100-m spacing. Drilling completed over several years: 5,000 m in 1974 and 1975 and 1,000 m in 1976. Bassi and Rochefort (YMAD) carry out resource mapping and evaluation from available drill holes (published in 1980 by the national government).
- 1978 Kaiser Engineers International Inc., in association with Latinoconsult S.A., produce a feasibility study for YMAD and the Dirección General de Investigación y Desarrollo (DIGID) of the Argentine Ministry of Defence.

- 1975-82: UN supervises the ongoing exploration program. Dr. John Guilbert, while under a UN services agreement, suggests deepening three existing holes to 600 m, thereby defining the mineralized flanks of the deposit and the barren core. Researchers under his supervision perform thorough geological mapping. YMAD and Fabricaciones Militares (military manufacturer) continue intermittent drilling to complete a total of 18,970 m and 71 drill holes for the period 1968-1981.
- 1981 Seltrust Engineering Limited (SEL) carried out a feasibility study validation to provide an independent review of the project and to support the preparation of a prospectus for international circulation.
- 1983-85 MS Thesis by A. Stults, University of Arizona, completed with UN-Fabricaciones Militares support.
- 1985-88 YMAD investigates open pit mining and heap leaching of ore from the central gold-rich oxidized zone. An additional 1,283 m of drilling, averaging 50 m per hole, is completed. Feasibility studies prepared by Dr. Otto - Gold Consulting Engineers (1986) and IDEMSA (1988).
- 1992-93 International Musto Explorations Limited initiates a feasibility study. Geological exploration activity included geotechnical investigations by Piteau Associates, a core relogging program and a diamond drilling program, including 24 holes, by Musto, mineralogical assessments by Lakefield Research and Cominco Exploration Services and a complete reinterpretation of the deposit geology by Musto. A geology and metal grade block model of the deposit was generated by MINTEC, Inc.
- 1994 Minera Alumbrera Limited completed a 20-hole, 8,000-m DDH program in October 1994. Drilling was concentrated in the southern flank of the orebody, and within the area to be mined during the first five years of the open pit life.
- 1995 MAA commences mining activities in the Bajo.
- 1997 Project commissioning commences in August with the processing of the first ore from the mine.
- 1999 Project achieves production and performance tests under terms of project financing in December, 1999.

6.1 RECENT OWNERSHIP HISTORY

MEB negotiated an interest in the project from YMAD in 1990, establishing MAA as the entity to exploit the deposit in 1993. MIM purchased a 50 % interest in MAA in 1994 and MEB, with its 50 % remaining interest in MAA, was subsequently acquired by Rio Algom Ltd. and North Ltd. in 1995. RTP acquired North in August, 2000. Billiton acquired Rio Algom in October, 2000. BHP and Billiton merged during 2001. WRM purchased RTP's 25 % share in March, 2003.

7.0 GEOLOGICAL SETTING

7.1 REGIONAL GEOLOGY

Alumbrera, along with a dozen or so nearby porphyry copper-gold targets, was emplaced in the late Miocene Farallón Negro - Capillitas volcanic flow and breccia complex, situated in the Sierra de Capillitas. This high-potassium calc-alkaline shoshonitic to banakitic volcanism is the easternmost expression of subduction related volcanism which appears to have developed in block-faulted areas on Palaeozoic crystalline basement along the Andean Cordillera in the late Miocene at 10.4 Ma. The Farallón Negro complex lies near the boundary of nearly flat and 30-°E dipping segments of the subducting Nazca Plate, a discontinuity expressed by the east-west boundary between the Puna and Sierras Pampeanas provinces, by a 50-km right-lateral offset in the Andes crest and by the east-west trend of Neogene volcanoes of the Ojos de Salado chain west of Alumbrera and the Farallón Negro centre.

Alumbrera and its host stratovolcano lie between two northeast-trending lineaments, the Hualfin and Aconquija, which may have localized volcanism and mineralization in tension fractures between them. The volcanism was controlled by sinistral pull-apart tectonics along a major northwest-trending lineament. The Farallón Negro volcanic and intrusive complex was a stratovolcano formerly up to 6 km high and some 16 km in diameter, which evolved from more mafic pyroxene andesites to more hornblende- and biotite-bearing andesites and dacites. Volcanism was followed by the emplacement of the mineralization-related dacite porphyries. The location of the dacite porphyries coincides with the eruptive centres of the former andesite-dacite stratovolcano, whose roots they intruded.

Other localities with porphyry-type mineralization in the Farallón Negro area are Bajo el Durazno, Bajo de San Lucas, Las Pampitas, Agua Tapada, Mi Vida and Los Jejenes. In addition, the porphyry copper prospects of Cerro Atajo and Agua Rica are located nearby, and are related to the same Tertiary volcanic activity as the other prospects in the Alumbrera district.

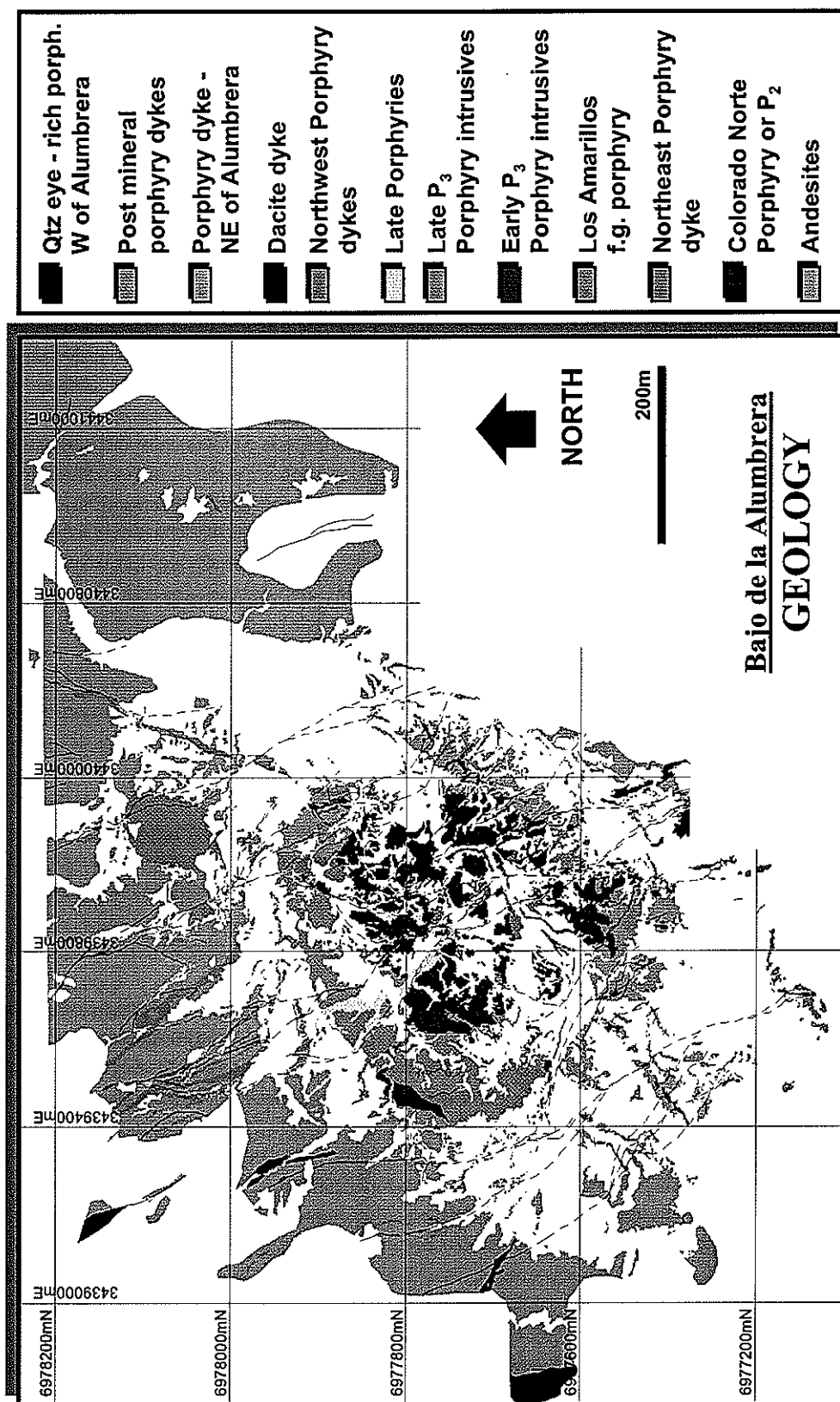
7.2 DEPOSIT GEOLOGY

The Alumbrera alkalic dacite porphyries were intruded some 8 million years ago into the roots of the Farallón Negro volcano. The intrusion-generated, large-scale hydrothermal circulation resulted in alteration and mineralization of the porphyry itself and its volcanic host rocks. Subsequent erosion has exposed the upper part of the volcano and its porphyry system at a level that is favourable to mining. Rocks exposed at surface were originally at depths of approximately 2.8 km and at 0.6 to 0.8 kilobars lithostatic pressure. See Figure 7.1.

The Farallón Negro host rocks are about 90 % autobrecciated flows in a thick-bedded sequence of fragment-poor to fragment-crowded, weakly to strongly porphyritic potassic andesite. Lithic and non-porphyritic flow units comprise the other 10 %.

The primary mineralized rocks of Alumbrera, consist of a series of porphyritic intrusions. A total of seven distinctive porphyritic intrusions have been recognised, which form stocks (earliest

Figure 7.1
Bajo de la Alumbreira Geology Map



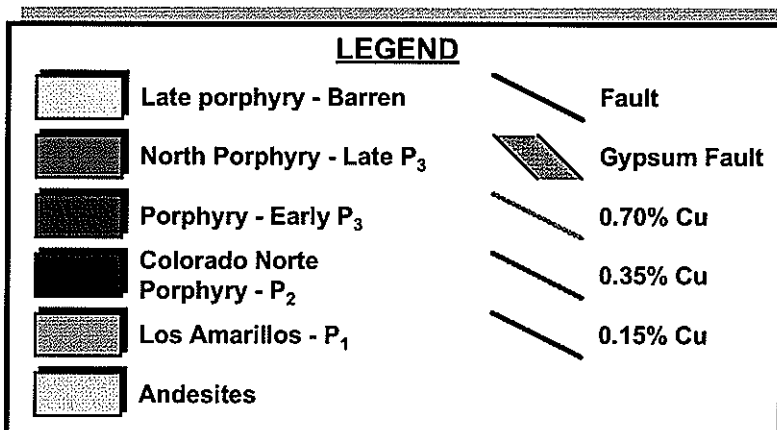
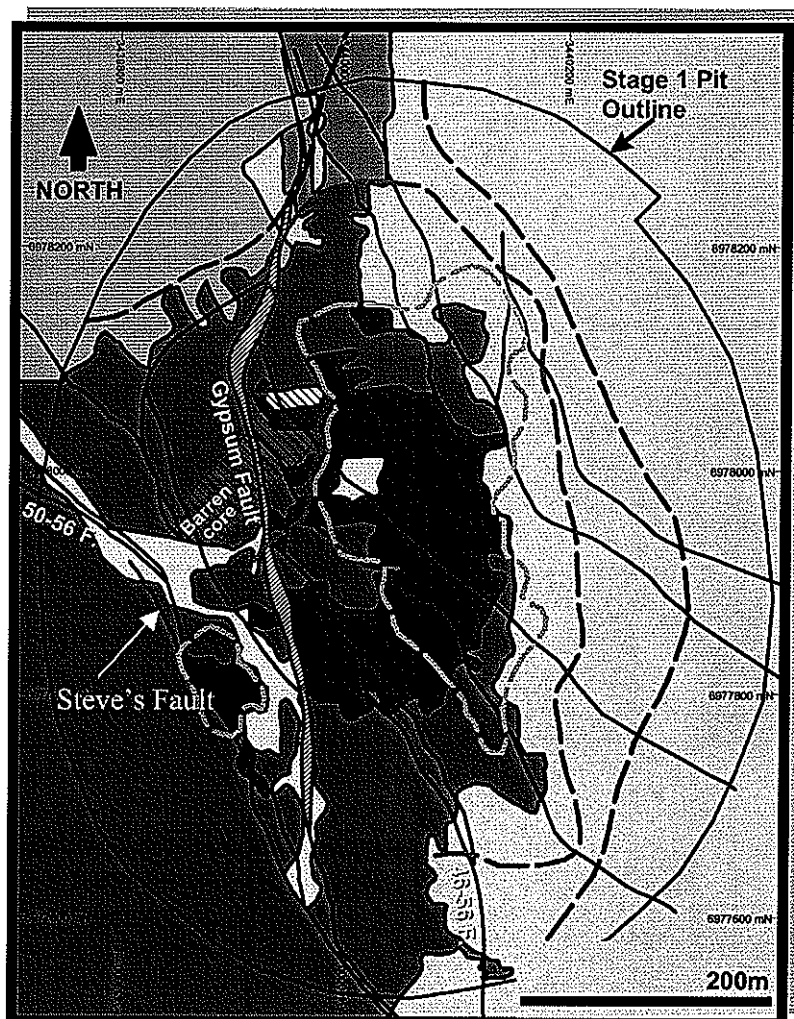
units) and dyke-like bodies (youngest units) that extend to the outer edge of the deposit with some of the dykes forming a radial pattern around the central stocks, (see Figure 7.1). The individual porphyry units can be distinguished by their phenocryst content, but primarily are classified by their cross cutting intrusive relationships. Geochemically the dacites are typical for subduction-related potassic igneous rocks (shoshonites) from mature continental arc settings. The most important intrusives are subdivided into P1 to P4 and are recognised as pre-, syn- or post-mineralization. See Figures 7.2 and 7.3.

Most of the P1 - Pre-Main Stage Porphyry rings the potassic core of the deposit. Its peripheral position having predestined it for later phyllic overprinting, reflected in obliteration of textures by silicification, sericitization, pyritization and then supergene oxidation. The P1 dacite porphyry is studded with plagioclase, and quartz phenocrysts while biotite is rare. The unit is largely pre-mineralization in age, possibly co-magmatic and it was a receptor of later alteration and mineralization, rather than a progenitor-carrier.

P2 and P3 - Main Stage Porphyries may represent the same unit, the former being almost totally replaced and recrystallized by silica-magnetite flooding and potassic alteration-mineralization and representing the highest-grade zone in the initial pit design. P2 porphyry consists of massive subparallel mosaic veinlets or dense fine to coarse stockworks of quartz with pyrite, chalcopyrite, magnetite and hematite with sparse shapeless inclusions of altered porphyry. These altered fragments display the distinctive biotite-phenocryst texture of P3. The Main Stage P3 quartz dacite porphyry is easily distinguished by distinctive plagioclase, quartz and pseudo-hexagonal biotite phenocrysts. The P3 porphyry occupies the central portion of the bajo and the deposit symmetry, Figure 7.2, and extends to the southwest and to depth, Figure 7.3. The Main Stage P3 unit appears to be the progenitor of the deposit.

The deposit is cut by late, barren P4 - Late Dacite Porphyry and by late northwest-trending faults, the most significant of which are Steve's Fault and Gypsum Fault.

Figure 7.2
Stage 1 Pit Geology Map



8.0 DEPOSIT TYPE AND ALTERATION

Bajo de la Alumbreira is a classic porphyry copper-gold deposit. Mineralization is associated with hydrothermal alteration zones in andesitic volcanics and dacite plutons. The deposit is reported to display the most typical "Lowell and Guilbert" zoning pattern of all porphyry copper-gold deposits world-wide. The hydrothermal alteration zones are arranged in a classic concentric pattern, with at least two distinctive events occurring.

The alteration pattern of the first event consists of a potassic core that is surrounded by propylitic alteration (chlorite-epidote). The most intense potassic alteration temporally overlaps with and is genetically related to two of the early mineralized porphyritic intrusions, P2 and P3. Within the potassic alteration zone, areas of intense silicification occur (quartz-magnetite alteration), the extreme form of potassic alteration. Younger porphyry intrusions show only weak to moderate potassic alteration, and a post-mineralization porphyry cuts both the potassic and propylitic alteration zones. As per the classic model for porphyry systems, a "barren core" occurs in the centre of the potassic alteration to show the classic inverted bowl form. The hydrothermal alteration in this barren core is weak to intense potassic (quartz-magnetite) alteration without any significant copper-gold mineralization. The barren core apexes at the 2,900 masl level, some 300 m below the topographic.

Phyllic-argillic alteration (feldspar destruction) overprints all the porphyry types and potassic and propylitic alteration. It is most intense in a zone between the potassic core and the propylitic halo.

9.0 MINERALIZATION

The mineralogy of the primary (unweathered) ore consists of chalcopyrite ($\pm$ bornite), native gold and pyrite. Gold occurs mainly in chalcopyrite. Gold values correlate closely with copper values in primary mineralization and ratios are very consistent through the deposit.

Ore grades correlate with lithology. The highest copper-gold grades are associated with intense potassic (quartz-magnetite) alteration of two of the earliest mineralized porphyritic intrusions, P2 and P3, and in adjacent biotized or potassium feldspar altered andesites. Younger porphyries are less mineralized or barren. The majority of the copper is primary and occurs as chalcopyrite in disseminated grains and in veinlets. Gold occurs in association with early pyrite-chalcopyrite-magnetite as free gold grains in the 10 to 50 μ m range.

The occurrence of gold within chalcopyrite, together with magnetite and pyrite, suggests that the gold was transported by the same fluids as the other metals and that this fluid was oxidized. Near-surface oxidation and supergene enrichment appear limited at Alumbreira. Consequently, the economic-grade sulphide mineralization extends upward almost to surface.

The upper portion of the orebody has been subject to weathering and can be sub-divided into two distinct zones, an upper, thin, leached zone, and a lower sulphide enriched zone. The leached zone contains oxide and carbonate copper minerals, including soluble species. Gold values appear largely unaffected by leaching. The sulphide-enriched zone is complex and contains chalcocite, covellite, native copper and chalcopyrite in varying proportions. The intensity of chalcocite decreases with depth and is absent in fresh (primary) ore. Leaching and oxidation near the surface generally does not extend to deeper than 30 m. Rare and erratic deeper oxidation is attributed to enhanced permeability caused by local fracturing and faulting. The corresponding underlying zone of supergene enrichment is erratic in its development, occurring at depths to 150 m in some places and being barely recognizable at all in others.

10.0 EXPLORATION

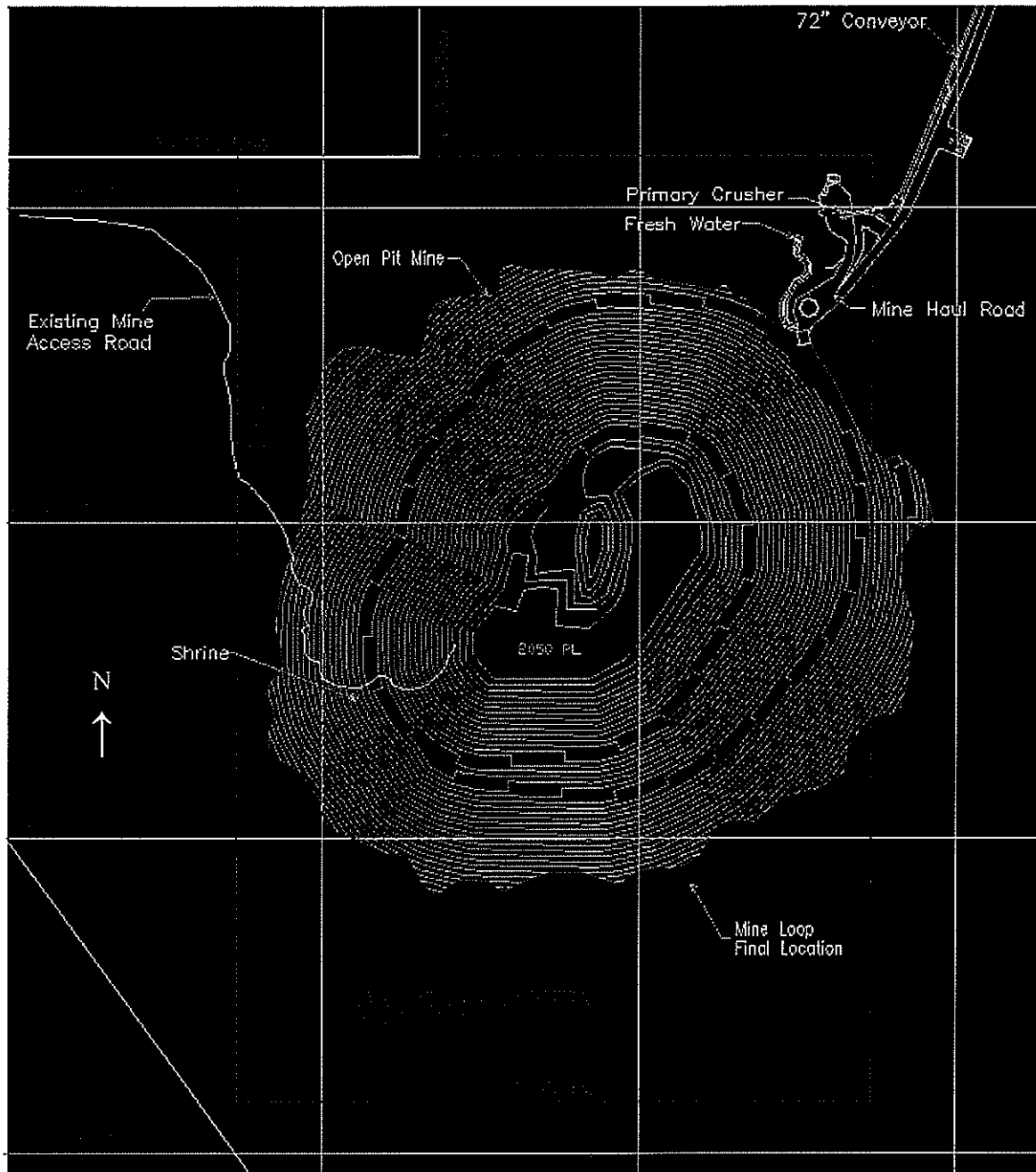
The mining rights to Alumbrera held by MAA are limited to a 2,000 m by 3,000 m rectangle (600 ha in size) approximately centred on the open pit. This area, referred to as the contract area, is just slightly larger than the ultimate pit rim dimensions. (The ultimate push back actually exceeds this area in one location but no ore is to be mined there, see Figure 10.1 below.) No exploration is conducted by MAA outside of the contract area.

Known mineralization in the pit has been fully delineated to the northwest and southeast. However, to the northeast, towards the crusher, and to the southwest mineralization is cut off by faults parallel to the dominant faulting direction seen in Figures 7.1 and 7.2. It is possible that a small amount of mineralization remains to be discovered in these areas if it can be shown that they have been down-faulted.

Since 1999, exploration efforts have been limited. In 2002 a small geophysical survey consisting of a limited amount of Induced Polarization surveying was conducted to look for disseminated sulphides in these areas. Results were not available at the time of Micon's visit although it is anticipated that a certain amount of diamond drilling will be required in the future to test this potential. It is not anticipated that any significant discoveries, with material impact upon the project, will be made here.

Because of the very limited area of mineral rights involved in the project and the dominance of that area by the Alumbrera pit, it is not anticipated that any other exploration will occur. Any exploration by MAA outside of the contract area would require a new agreement with YMAD.

Figure 10.1
MAA Contract Area and Final Pit Outline



Scale: Mine grid in 1,000 m squares (in blue)

11.0 DRILLING

11.1 DRILLING CAMPAIGNS

The Alumbrera project has been worked by at least four different companies and with numerous drilling campaigns since YMAD commenced work in 1969. Both RC and diamond drilling has been performed. The database is composed dominantly of diamond core data, however. The drilling campaigns are summarized in Table 11.1, below.

Table 11.1
Alumbrera Project Drilling Summary

Campaign	Type	Number of Holes	Assayed Metres
YMAD	DDH	71	18,970
IDEMSA*	DDH	28	1,295
Musto	DDH	20	7,311
MAA – 1995	DDH	35	11,967
MAA – 1998-1999	DDH	17	11,146
Total DDH (without IDEMSA)		143	49,394
MAA – 2002*	DDH	14	6,390
MAA – 1995	RC	17	1,126
MAA – 1997-1998	RC	110	11,613
MAA Metallurgical – 1998-1999	RC	5	962
Total RC		127	13,701
Grand Total for ALUF Model **		270	63,095

* 2002 drilling not available for June 30, 2002 Ore Reserves. Used as basis for the new ALUG model.

** Total for ALUF model does not include 2002 diamond drilling

The MAA diamond drill programs were completed using both NQ- and HQ-sized core (47.6 mm and 63.5 mm core diameter, respectively). The drilled lengths of each size of core used by MAA are set out by drill campaign in Table 11.2, below. Drill core sizes for the earlier programs are not known with certainty as no records exist. Verbal communication with ex-Musto geologists indicates that standard HQ and NQ core sizes were used. MAA's RC holes were drilled with a 9 inch diameter bit.

Table 11.2
MAA Drill Core Size Used, Summary to 1998

Campaign	Length HQ (m)	Length NQ (m)
MAA – 1995	3,500	8,467
MAA – 1998	5,100	6,046

The 270 holes listed above are drilled on a nominal 50 m by 50 m pattern over the entire deposit. However, due to shorter lengths of some holes, this density decreases somewhat at the deepest pit elevations. All holes were drilled on sections oriented N75°/N255°, with dips varying between vertical and minus 60°. This orientation was chosen so as to best outline faults in the

dominant fault strike direction, many of which have material post-mineralization movement or control the intrusion of the host porphyry and mineralizing fluids.

Since the 1998/99 Resource Definition Drilling Program, it became apparent that a few more holes would be necessary in order to increase data density at the deeper elevations of the pit. This was required in order to improve geological controls on the model and to upgrade some of the indicated resources to the measured category based on the ALUF model and kriging variances seen during grade interpolation. It was decided that 14 additional holes, a combination of 200-m long HQ and 400-m long NQ holes, would be drilled to fill in areas of low confidence. These had been completed at the time of Micon's visit (the MAA 2002 program) but were not included in the June, 2002 ore reserve estimate. Due to constraints placed on drilling locations by pit bench development eight of the MAA 2002 holes were drilled at -45° , some of which flattened to -30° at depth.

The MAA 2002 drill holes form the basis of the new ALUG geological model, which was used for the December 31, 2003 ore reserves and the grade control model after September, 2002. There is no known requirement for further drilling of the existing resource. A minor amount of exploration drilling may still required near the edges of the pit as discussed in Section 10.0 above.

Core recovery was generally very good except in the Rubble Zone geotechnical domain, where the core is badly broken up. The Rubble Zone is best illustrated in the photographs in Figure 17.9b in Section 17.1.6 below where a grindability model for the deposit is discussed.

11.2 DRILL HOLE LOGGING

11.2.1 Geological Core Logging and Interpretation

Drill core was logged in order to collect sufficiently detailed data to allow immediate definition of the mineral resources and, also, to collect data that would be useful in guiding any future geological studies of the Alumbrera orebody. In addition to descriptive records, photographic records of all core were kept.

The drill core was logged at the core logging and storage facility at the Alumbrera mine, a metal roofed, open-sided structure protected by a weather-proof semi-transparent fabric hanging from the sides of the building. All logging was completed in digital format, with data entry directly onto Hewlett Packard HP 360LX palmtop computers. Logging was completed on either sawn or un-sawn core, depending on the logging and sampling priorities at the time.

Log descriptions were made on 3-m lengths of core corresponding to the sampled intervals using a set of standard codes to describe the lithological, textural and mineralogical characteristics. Within each 3-m length, the location of specific geological features such as veins, faults or intrusive contacts was noted.

Since a large number of geologists have worked at Alumbrera during the Musto, MIM and MAA exploration programs, there has been an evolution of geological models as more data have become available. As a consequence, a wide variety of geological interpretation is represented in the written drill logs.

As part of the 1998/99 exploration program conducted in preparation for the then new ALUF geological model (described below), a significant effort was placed on a program of careful reinterpretation of the drill hole database. This effort paid particular care to ensuring that lithology and alteration were well defined and that lithologic continuity between drill holes of differing campaigns was maintained, if such continuity existed.

Magnetic susceptibility measurements were also taken on all sampled intervals of core. Measurements were taken every metre using a hand-held Geoinstruments susceptibility meter. Measurements were taken by holding the core in the operator's hand, away from any potential magnetic interference.

11.2.2 Structural and Geotechnical Core Logging

In addition to the geological core logging, structural observations and geotechnical features of the rock mass were also recorded. Structural information was initially collected using oriented drill core in order to determine the exact orientation of the main faults, veins and joint sets. However, the use of oriented drill core was abandoned after three holes due to repeated poor results. Geotechnical information collection concentrated on the description of general rock mass characteristics rather than the carefully defined structural data.

11.2.3 RC Drill Hole Logging

All RC holes are geologically logged. When sampled for assay a small subsample of chips from each 3-m sample run was retained in small plastic "chip boxes" designed for the purpose and logged for rock and alteration type using similar criteria as for core logging.

11.2.4 Blast Hole Logging

During sampling of each blast hole, described below, drill hole cuttings are sampled and bagged by the sampling crew for later geological description by a geologist. Blast hole data are used for the grade control block model but are not used to estimate in situ reserves. The grade control model is used to estimate grade for the stockpile reserves.

12.0 SAMPLING METHOD AND APPROACH

12.1 DRILL CORE

During logging, the MAA geologist selects the portions of each hole to be sampled based primarily on mineralization. Using visual inspection, the location of the 0.15 % copper boundary would be estimated and sampling would commence approximately 50 m before this estimated position. This procedure was deemed to be a reasonable compromise between minimizing analysis costs for the unnecessary assaying of essentially barren core and providing enough information upon which to estimate the low-grade halo around the deposit.

Samples were selected on 3-m intervals regardless of lithologic contacts and geological variation in the core. Once selected, the core to be sampled was sawn in half with a diamond saw and one half of the core retained for future reference. All sampling and core storage took place at the core logging facility.

12.2 RC SAMPLES

RC samples were collected in the field, at the drill rig, over 3-m intervals. 20 kg samples are collected after being split in the ratio 3:1. The samples were collected with a MetalCraft sampler employing an automated splitter. MetalCraft samplers use either conventional riffle splitters or a newly designed cone splitter, developed in conjunction with sampling expert Francis Pitard. Micon is familiar with Pitard's reputation and work and feels that either device is likely an acceptable sample reduction tool.

The smaller sample was sent for analysis and the larger fraction retained on site for the duration of the drill program in order to provide additional samples for check analyses or for bench-scale flotation testwork. The larger fraction was discarded after the completion of each program.

12.3 BLAST HOLE SAMPLING

MAA samples all blast holes in the open pit except when the geological supervisor considers it unnecessary (because of duplicate holes or close-spacing, for example).

One sample per hole is collected from the cone of cuttings surrounding the collar. Sampling is performed by cutting two opposing channels into the cone and through its full depth to the bench floor. A sample of approximately 15 to 20 kg is collected from one wall of each of the two channels. Samples are split in a Gilson splitter to ¼ of their original size (5 kg) and sent to the mine laboratory. For one in every five samples collected from the Phase 4 South and Phase 3 areas of the Alumbreira pit, a second sample split is collected from the Gilson splitter and sent to ALS Chemex in Mendoza for check analysis.

13.0 SAMPLE PREPARATION, ANALYSES AND SECURITY

13.1 SAMPLE SHIPMENT AND SECURITY

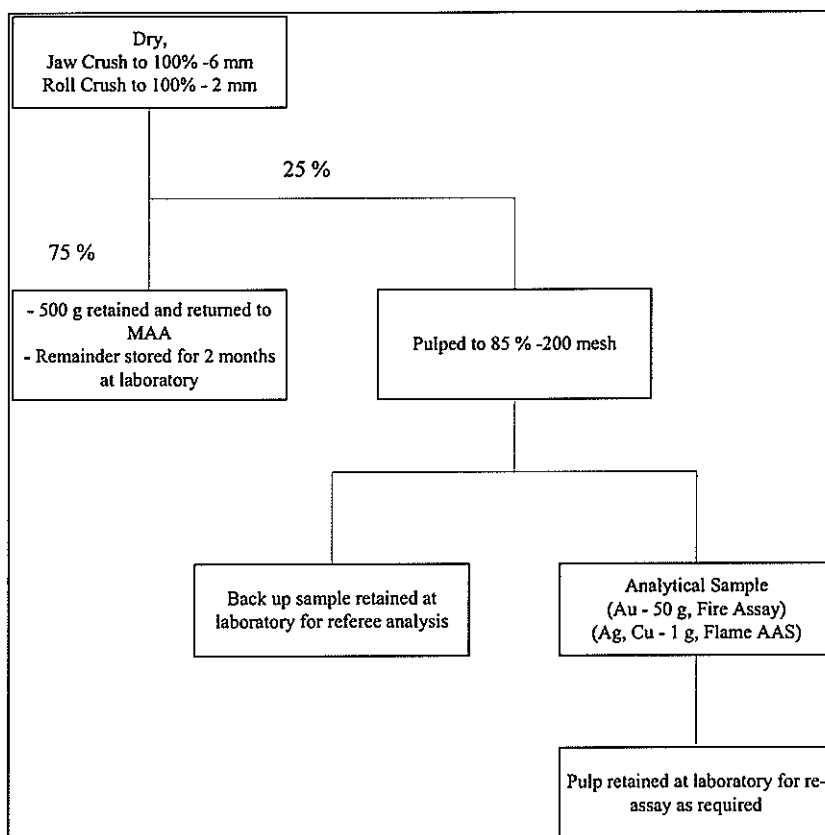
MAA's core logging and storage facility is located in the administration and warehouse building complex beside the concentrator. These facilities are located approximately 1 km behind the mine security gatehouse which is manned 24 hours a day, 365 days a year. The facilities are secure from entry by non-MAA personnel.

Exploration samples are shipped from this location using scheduled mine delivery trucks bringing in general supplies.

13.2 SAMPLE PREPARATION

Exploration samples are sawn (core) or split (RC) as described in Section 11 above and sent to ALS Chemex in Mendoza for further preparation and analysis. All exploration and duplicate blast hole samples are prepared using the same protocols as set out in Figure 13.1.

Figure 13.1
MAA Sample Preparation Flowsheet



MAA's sample preparation laboratory followed a similar procedure for blast hole samples submitted to it for analysis.

13.3 SAMPLE ANALYSES

Exploration samples were analysed for gold using a 50-g fire assay with a flame AAS finish after nitric acid/aqua regia digestion of the bead. This method has a detection limit of 0.01 ppm and is suitable for the low gold grades seen at Alumbrera. Samples were analysed for copper and silver using an aqua regia mixed-acid digestion and elemental determination by flame AAS. The detection limit for copper and silver by this method are 100 ppm and 1.0 ppm, respectively. Silver values are not checked by fire assay methods since they are not reported in the ore reserve and form a minor portion of the total value of minerals recovered.

Minor element analyses have been routinely carried out on approximately 10 % of samples in order to determine background levels of elements of interest within the ore and surrounding waste rock of the orebody. These analyses were intended to determine base line quantities of potentially toxic metals that could be potentially released into the environment. Samples were randomly selected and analyzed for antimony, arsenic, bismuth, cadmium, lead, mercury, molybdenum, selenium, tellurium and zinc. Additional sampling was conducted in areas identified to have lead- and zinc-bearing veins.

Sulphur and sulphate analyses were also conducted in order to estimate the amount of pyrite within the deposit in order to assist in the prediction of acid mine drainage potential, as well as to predict rougher and cleaner cell loads within the concentrator while treating certain ore types. Sulphur was determined through a Leco infrared detection of sulphur dioxide from combustion of sulphide.

Assay results were reported by ALS Chemex by both fax and e-mail. Signed assay certificates are available at Alumbrera for review.

13.4 QA/QC PROGRAMS

The program set up to monitor the quality of the assay database consisted of the following procedures.

- The use of internal standards by the laboratory.
- The use of MAA submitted standard samples with each sample batch.
- Regular re-analysis of pulps by the laboratory.
- Re-analysis of pulps as requested by MAA.
- Check analysis of randomly selected pulps by a second laboratory.
- ¼ core re-sampling of selected sample intervals mixed with each batch.

13.4.1 Laboratory Standards

As is not surprising the results for the two ALS Geolab standards show tight control over the analytical process and that reasonable accuracy was maintained through out the program. Results would not have been released if there were a problem. MAA reports that a review of the full quality control data show similar results and indicate that there has been no significant systematic underestimation of copper and gold values. This observation is supported by the good reconciliation of ore reserve tonnage and grade to the mill.

13.4.2 MAA Standards

In addition to the ALS Chemex laboratory standards used, MAA submitted its own standards with each sample batch. Appropriate standards were selected from a group of seven available, which would cover the range of gold and or silver values expected in each sample batch. The use of multiple standards aids in determining analytical precision near cutoff and at higher grades.

MAA tracked the response of all standards used over the life of the exploration sampling program using tables and graphs to show the response of the samples over time and to track batches with quality control problems so that the laboratory could be approached for a response.

Of all the standards used, only one, A996, has raised any concern with respect to analytical precision or accuracy. This standard was selected as a medium range base metal and gold standard. While the copper response has consistently fallen within what MAA considers the acceptable range (defined by the nominated Standard Assay plus or minus 10 %), gold has behaved more erratically. MAA now considers it to be of questionable use as a gold standard. In all, the standard has failed tolerance limits in seven of the 16 sample batches in which it was used. In these sample batches, the laboratory standards, and other standards analysed have reported acceptable values, so that MAA feels that there is no reason for concern regarding sample accuracy in these batches. The reasons for the poor response are unclear. However, the high sulphide matrix of the sample makes fire assay cupellation difficult and this could be leading to the problem.

13.4.3 Laboratory Duplicates

ALS Chemex reassayed approximately 10 % of samples for both copper and gold as part of its QA/QC program. MAA has estimated precision by dividing the difference between the original and duplicate assay by the average of the two assays and expressing this as a percentage.

The precision for copper analyses was good, with 97 % of samples having a percentage difference better than plus or minus 10 %. The precision for the gold analyses is less than that of copper. Overall, 69 % of samples fell within plus or minus 10 % of the original assay. Some of this variation is probably explained by the large number of assay results which were close to the detection limit of the method used. In these situations, minor variations in the assay will result in a large precision error. The check data were separated into two grade populations, one above

and one below 0.2 ppm Au. For samples below 0.2 ppm Au, 66 % fell within plus or minus 10 % relative difference, while the other population showed 72 % within plus or minus 10 %. Therefore, while analytical factors are contributing to the poorer repeatability of gold assay results at Alumbreira, natural short range variability in gold grades is also an important factor introducing errors into gold estimation.

13.4.4 MAA Selected Reassays

MAA selected samples for reanalysis after entry of assay data and comparison of results to drill log descriptions and neighbouring geochemical trends. Any results determined to be anomalous or unexpected were selected for reassay by ALS Chemex. Upon receipt of the new assay the geologist would then make a decision whether to accept the reassay or to use the original data.

13.4.5 External Laboratory Reassays

MAA runs a program of submitting selected group of samples for analysis at a second referee laboratory. These samples are chosen randomly from seven copper grade ranges so that high, medium and low grade analyses are checked. For the 1998/99 drill program, a total of 309 samples (approximately 1 % of the total) were selected and sent to Bequerel laboratories of Sydney, Australia for gold analysis and to Analabs of Townsville, Australia for copper and silver analysis. A separate laboratory was chosen for the analysis of gold and silver, in order to use Neutron Activation Analysis (NAA) for gold determination. NAA was chosen because of the technique's high sensitivity regardless of sample matrix, and because of simple preparation and analytical procedures which reduce the potential for introduced preparation and analytical errors.

The results showed good overall and range by range correlation between the ALS Chemex fire assay data and the Bequerel NAA data, with an overall correlation coefficient of 0.94 and no apparent systematic bias. The basic population statistics for the two datasets are set out in Table 13.1.

Table 13.1
Population Statistics Comparison with Referee Laboratory, Gold Analyses

	ALS Chemex	Bequerel
Mean	0.45	0.46
Standard Error	0.02	0.02
Median	0.35	0.36
Mode	0.17	0.20
Range	2.97	2.64

The referee analysis for copper and silver were conducted using the ICP-OES technique. Analabs and an ICP analysis were chosen based on the generally poor results for base metals determination using NAA. The results show that the Analabs data have a larger proportion of samples in the lower grade ranges. In the ALS-Chemex data, 56 % of samples were less than 0.4 % Cu, while only 51 % of the Analabs results fell within the same grade range. This

indicates a slight positive (+5 %) bias by ALS relative to Bequerel in samples less of than 0.4 % Cu.

Similarly, there were almost twice as many samples greater than 1.0 % Cu in the ALS-Geolab results compared to the Analabs data, although the Analabs data did contain a number of samples slightly below the 1.0 % Cu limit. Overall, there appears to be a slight relative bias towards higher copper grades in the ALS Chemex dataset for samples containing greater than 1 % Cu. The basic population statistics for the two datasets are set out in Table 13.2.

Table 13.2
Population Statistics Comparison with Referee Laboratory, Copper Analyses

	ALS Chemex	Analabs
Mean	0.43	0.40
Standard Error	0.01	0.01
Median	0.39	0.37
Mode	0.38	0.36

13.4.6 Duplicate Quarter Core Samples

The results of the ¼ core re-sampling program show relatively poor agreement between original and second gold assays, with a best fit line to an x-y plot of $y = 0.75x + 0.08$, $R^2 = 0.64$. However, very good agreement was found between original and second copper assays with a best fit line to an x-y plot of $y = 0.85x + 0.04$, $R^2 = 0.92$. The copper data indicate there has been little or no sample handling error by the laboratory but the gold data indicate a fair degree of short-range variability in gold assays.

The QA/QC program designed by MAA is a basic industry standard program, although field blanks (unprepared blank samples) and blank standards (matrix matched pulps with nil gold) were not submitted. Such samples are useful in detecting contamination in the sample preparation area and contamination of reagents or mixing up samples in the laboratory, respectively. While these steps were omitted, the Alumbra deposit is of low gold grade and the gold tends to be fine and encapsulated in chalcopyrite. As such, it likely will not experience serious contamination problems. The close overall reconciliation of the ore reserve estimates to the milled tonnes and grade, as discussed in Section 17.3.4, Production Reconciliation, lends confidence to the quality of the database used to estimate the ore reserves.

13.5 LABORATORY CERTIFICATION

ALS Chemex claims that its laboratories "operate according to the guidelines set out in ISO/IEC Guide 25 - "General requirements for the competence of calibration and testing laboratories"" and that it ensures "compliance to the ISO 9002 standard adopted by the company". ALS Chemex has attained ISO 9002 registration at all of its North American and Peruvian laboratories, as well as the Brisbane, Australia site. ALS Chemex is currently working towards accreditation to ISO 17025, the replacement for Guide 25. It is NATA-registered in Brisbane

and participates in a number of external round robin monitoring programs, including Geostats and Canmet's Proficiency Testing Program.

The MAA mine laboratory, like most mine laboratories, is not certified. It does, however, engage in a program of cross submission of pulps with ALS Chemex as a check procedure.

14.0 DATA VERIFICATION

14.1 DATABASE VALIDATION

The Medsystem software, like most modern mining software, has built-in checks for consistency of the database in order to prevent hole-depth, over-lapping logging/sampling intervals or hole-name validation errors. These checks were employed. All assays over 1 % Cu and 1g/t Au were flagged by Medsystem and manually checked for accurate entry. All drill holes are paper plotted on section and visually checked for unusual collar location and drill hole orientation or unusual assay patterns/values. A checklist is used before proceeding to interpolation.

14.2 INDEPENDENT REVIEWS

MAA has retained outside expertise to advise on the construction of the block model and grade interpolation. Gary F. Raymond, P.Eng., of Summerland, B.C., a consulting engineer in the field of applied mining geostatistics, has provided this advice. Raymond reviewed the drill spacing and parameters for orebody modelling used in the ALUF model and has performed cross checks on the model.

In reviewing the ALUF model, Raymond examined biasing in the assay databases. While a minor bias was identified between the drill hole and blast hole gold assays, used in the reserve and grade control models, respectively, a significant low bias in copper assays was discovered in the IDEMSA drilling. Acting upon Raymond's recommendation, the IDEMSA drill results have not been used for grade interpolation.

In a later review of the ALUG model, with further drill data from the 14 new holes, Mr. Raymond came to the conclusion that there was no significant bias in either copper or gold grades between the YMAD drilling and later drill hole samples. He also determined that, while there is a slight bias in gold assays from blastholes at grades higher than 0.80 g/t, the drill hole gold samples agree with the mill head grades and there is no problem with exploration drill gold grades. The IDEMSA holes are still regarded as unreliable.

Raymond also verified and audited the database and block model using his own statistical checks, jack knifing programs and section plotting to validate information.

14.3 MICON'S REVIEW

Micon did not collect any samples to verify the gold-copper mineralization at Alumbrera. Alumbrera is a copper-gold mine operated by MAA. MAA is owned by MIM, BHPB and WRM. It has been in continuous operation for five years producing gold and copper-gold concentrates. There can be no doubt as to the presence of copper and gold in the Alumbrera deposit. The collection of a few samples would have merely confirmed this and would not have confirmed the grade of the ore reserves.

Micon visited the Alumbrera open pit twice during the site visit in order to view mineralization in place, exposed in pit development. Micon also viewed several mineralized drill intersections laid out at MAA's core logging facility.

MAA also reconciles its ore reserve block model to concentrator production and the grade control block model on a regular basis. This reconciliation is discussed in the Mineral Resources and Mineral Reserves section below.

15.0 ADJACENT PROPERTIES

The mineral properties being evaluated here are limited to the mineral rights of the 600 ha contract area with YMAD and surface access rights to a much larger surrounding area for plant infrastructure. The currently planned Alumbrera pit occupies most of the contract area. Any additional mineral or exploration rights would require a separate agreement with YMAD.

As such, any adjacent properties have no material effect on the opinions offered herein.

YMAD has performed exploration work of its own on nearby properties with no current economic success. However, details of this work are not known.

16.0 MINERAL PROCESSING AND METALLURGICAL TESTING

16.1 INTRODUCTION

The economic mineralogy of the primary, unweathered ore consists of chalcopyrite, native gold and pyrite in a simple textural relationship. Chalcopyrite occurs in disseminated grains and in veinlets; copper and gold are positively correlated, with the gold occurring as free grains or, more usually, as inclusions within the chalcopyrite. As a classic porphyry copper-gold deposit, it was expected that the ore should respond to conventional sulphide flotation for recovery of gold-bearing copper concentrate.

In addition to establishing the main metallurgical and process design criteria, issues addressed by the testing are: orebody hardness variations; copper selectivity in the presence of pyrite (concentrate grade), while maximizing gold recovery; orebody recovery-concentrate grade relationship variations.

As a project now in its fifth full year of production, there is a wide range of metallurgical testing and operating experience available and planned, including:

- Original feasibility studies and process design laboratory and pilot scale testing.
- Post-commissioning laboratory and plant scale process optimization.
- Post-commissioning laboratory testing and simulation studies in support of strategic planning and development.

16.2 FEASIBILITY STUDIES AND PROCESS DESIGN

The original testing was carried out in four phases from 1992. Samples for metallurgical testing were obtained from surface trenches, shafts, exploration drill core and metallurgical drill core. Due to the variety of samples, different test methods were used to complement and validate the results. However, the methods and procedures are standard and appropriate, and the work was conducted by experienced, reputable organizations.

16.2.1 Phase 1

Lakefield Research (Lakefield), Canada (for laboratory testing) and Centro de Investigaciones Metalurgicas y Mineralogicas (CIMM), Chile (pilot plant testing) conducted the Phase 1 studies on surface bulk samples. Although oxidation and secondary copper mineralization affected the flotation results, and the samples represented only two of the four rock types identified in the geological model, the work established the amenability of the material to semi-autogenous (SAG) grinding without pebble crushing.

16.2.2 Phase 2

Lakefield and G & T Metallurgical Services Ltd. (G & T), Canada conducted laboratory testing on 17 near-surface and deep drill hole samples, which represented the four rock types. The work confirmed that 90 % copper recovery and 70 % gold recovery to a 27 % Cu concentrate were achievable. Primary grind and regrind sizes were established. Rock breakage and grindability testing was conducted by third parties.

16.2.3 Phase 3

Lakefield and G & T conducted laboratory testing on seven drill holes that represented the four rock types and earlier core (10 to 15 years old) representing all four rock types and average grade in the five-year pit. Coarser primary grind, high lime addition and cleaner cell type were investigated.

16.2.4 Phase 4

G & T (laboratory testing) and CIMM (pilot scale) conducted further testing of the five-year pit drill core composite, a near surface shaft sample and a metallurgical drill core that represented three rock types. Flotation testing investigated reagents, lime addition, water recirculation and rougher cell type. Gravity gold recovery, and copper concentrate thickening and filtration were investigated. The feasibility study flowsheet was finalized.

16.3 PROCESS OPTIMIZATION

Since commissioning of the operation, MAA has conducted an ongoing program of laboratory and plant testing and optimization, aimed primarily at increasing metal recovery and lowering cost through economies of scale and improved technology. Micon understands that this testing investigated areas including reagent control, pH, primary grinding and regrinding operations, and rougher and cleaner circuit operation.

MAA's May, 2002 LOM Plan indicates that gold recovery, both from the gravity circuit and to copper concentrate, will be an area of major effort in 2003 and 2004. The focus for gravity recovery will be on operations and equipment and, for concentrate recovery will be on reagent types and pH control. In addition, MAA has outlined a comprehensive program of plant trials and surveys which, in effect, are a continuation of the work conducted to date aimed at further increasing metal recovery and lowering cost.

16.4 STRATEGIC PLANNING AND DEVELOPMENT

Deep ore samples were tested in 1999 to provide better data for analysis of future ore treatment options. The work was by AMDEL (comminution), JKMRRC (comminution simulation) and G & T (flotation) and was reviewed by the owners' technical representatives.

In general, the results confirmed the feasibility study assumption that the ore is more competent and harder at depth. Also, the results confirmed the expected metal recovery from porphyry ore types. However, it was found that copper and gold recoveries from the andesite ore are lower than were assumed for the feasibility study. Further work to investigate andesite copper and gold recoveries was recommended.

Micon notes that capital has been allocated in the 2002 LOM Plan for continued research on optimization of copper and gold recoveries from low grade stockpiled ore, which is scheduled to be processed in 2011 and 2012.

16.5 SUMMARY

Metallurgical testing for the feasibility study confirmed the amenability of the orebody to conventional copper porphyry processing. Although the program, possibly, was not as systematic in establishing the metallurgical response of the orebody as has been the case on other similar projects, Micon considers that the testing adequately addressed all the expected issues and generated appropriate criteria for process design. These criteria have been generally confirmed by operating experience to date.

As a result of its strategic planning, MAA decided, in 2001, to install a third grinding line and a pebble crushing circuit in order to meet the objective of maintaining concentrate production at lower ore grades over the LOM. Based on its operating experience to date, MAA has not increased the capacity of the flotation circuit or other areas (see Section 19.2 for more details of the expansion).

Together with the feasibility study testing, post-commissioning operating results and process optimization, it appears that an adequate and comprehensive program of testing and study has been conducted in support of the recent expansion and the LOM Plan. Although Micon has not directly verified the results, it is understood that all of the work has been subject to review by owners' representatives and third party specialists.

17.0 MINERAL RESOURCE AND MINERAL RESERVE ESTIMATES

MAA estimates and reports its mineral resources and mineral reserves using the current (1999) version of the Australasian Code for Reporting of Mineral Resources and Ore Reserves (JORC Code), the Australian, BHPB and MIM standards.

The following is reproduced from the 1999 JORC Code:

"A '**Mineral Resource**' is a concentration or occurrence of material of intrinsic economic interest in or on the Earth's crust in such form and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade, geological characteristics and continuity of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge. Mineral Resources are sub-divided, in order of increasing geological confidence, into Inferred, Indicated and Measured categories.

"An '**Inferred Mineral Resource**' is that part of a Mineral Resource for which tonnage, grade and mineral content can be estimated with a low level of confidence. It is inferred from geological evidence and assumed but not verified geological and/or grade continuity. It is based on information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes which may be limited or of uncertain quality and reliability.

"An '**Indicated Mineral Resource**' is that part of a Mineral Resource for which tonnage, densities, shape, physical characteristics, grade and mineral content can be estimated with a reasonable level of confidence. It is based on exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes. The locations are too widely or inappropriately spaced to confirm geological and/or grade continuity but are spaced closely enough for continuity to be assumed.

"A '**Measured Mineral Resource**' is that part of a Mineral Resource for which tonnage, densities, shape, physical characteristics, grade and mineral content can be estimated with a high level of confidence. It is based on detailed and reliable exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes. The locations are spaced closely enough to confirm geological and/or grade continuity.

"An '**Ore Reserve**' is the economically mineable part of a Measured or Indicated Mineral Resource. It includes diluting materials and allowances for losses which may occur when the material is mined. Appropriate assessments, which may include feasibility studies, have been carried out, and include consideration of and modification by realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. These assessments

demonstrate at the time of reporting that extraction could reasonably be justified. Ore Reserves are sub-divided in order of increasing confidence into Probable Ore Reserves and Proved Ore Reserves.

“A ‘*Probable Ore Reserve*’ is the economically mineable part of an Indicated, and in some circumstances Measured Mineral Resource. It includes diluting materials and allowances for losses which may occur when the material is mined. Appropriate assessments, which may include feasibility studies, have been carried out, and include consideration of and modification by realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. These assessments demonstrate at the time of reporting that extraction could reasonably be justified.

“A ‘*Proved Ore Reserve*’ is the economically mineable part of a Measured Mineral Resource. It includes diluting materials and allowances for losses which may occur when the material is mined. Appropriate assessments, which may include feasibility studies, have been carried out, and include consideration of and modification by realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors. These assessments demonstrate at the time of reporting that extraction could reasonably be justified.”

17.1 MINERAL RESOURCE ESTIMATION METHODOLOGY

To date, MAA has used several different models (designated A through G) to estimate the mineral resources at Alumbrrera. At the time of Micon’s visit in October 2002, the current model in use was referred to as ALUF. This model was used to estimate the December 2001 ore reserve statement and the June, 2002 ore reserves used in the LOM plan. Previous models have used inverse distance weighting to perform grade interpolation and will not be discussed here since they have not been employed for resource estimation since 1998.

A new and improved variant of the ALUF model, called ALUG, had been prepared and was being tested at the time of the visit. ALUG had not yet been presented to the MAA joint venture partners and therefore, it could not be shown to Micon. The ALUG model is now complete and has been tested. It was used to prepare the December, 2002 reserve statement. Micon has now reviewed the differences between the ALUF and ALUG models. Both ALUF and ALUG will be discussed here.

17.1.1 ALUF Reserve Block Model

The ALUF model was created using geostatistical methods based heavily on the recommendations and findings of Gary Raymond’s work. Block model interpolation was extended to 1900m RL. (bench 1897), 150 m below the previous ALUE model bottom (2050m RL.)

The grades were interpolated using a database comprising approximately 53,000 m of diamond drilling and 14,000 m of RC drilling. All IDEMSA holes and the 1999 RC metallurgical drilling results were discarded and not used.

The new information gained since construction of the ALUF model has allowed for reinterpretation and refining of the geological model, including rock type, grade zone and alteration domain boundaries used in the interpolation process. Grade estimation was performed on a geologically constrained block model using ordinary kriging methods and parameters proposed by Gary Raymond. A complex system of hard and soft domain boundaries has been used to control interpolation.

Domain Modelling and Geological Interpretation

Prior to domain modelling, all assay results and geological information are plotted onto vertical sections oriented N75°E and located 50 m apart, coinciding with the exploration drilling grid. Once plotted, the sections are interpreted by hand, digitized and then wireframed to create 3D solids for each domain.

The wireframed solids are plotted on bench plans where they are checked for consistency and geological sense. At this time the solids are also smoothed to compensate for differences in interpretation on each individual section.

The ALUF model uses a scheme for coding the different identified geological domains in the deposit. The names have been selected so as to optimize the grade interpolation work. The geological codes used at Alumbra are summarized in Table 17.1 below. The solids created are used to assign the geological codes to the block model. "Centre of the block" criteria were used for assigning a code to each block in the model. Horizontal outlines were created and used for tagging the composites.

Geotechnical data collected during logging are also used as tags or variables in that are applied to the sample intervals, composites and blocks in the model. These were not used for grade interpolation but are available for other characterization of ore types.

Table 17.1
Alumbrera Geological Codes

ROCK TYPE	CODE	GRADE ZONES	CODE
Colluvial Deposit	60	Country Rock Domain	90
Los Amarillos Porphyry	61	Feldspar Destructive Domain	91
Mineralized Porphyry (P2 & P3)	62	Mineralization Boundary 0.0 % Cu	92
Late Porphyry Dyke	63	External 0.15 % Cu Envelope	93
Late Porphyry 3 (North Porphyry)	65	Lower Grade Halo	94
Andesite	70	Barren Core	95
North Andesite	71		
ALTERATION TYPE	CODE	FAULT ZONES	CODE
Leached Zone	31	SW of Steve's Fault, W of Gypsum Fault	101
Enriched Zone	32	E of Steve's Fault, W of Gypsum Fault	104
Fresh Zone	33	E of Gypsum Fault	105
METALLURGICAL DOMAINS	CODE		
Andesite no Rubble Zone	50		
Andesite Rubble Zone	51		
Los Amarillos	52		
Porphyry 2	53		
Porphyry 3	54		
Dikes & Barren Core	55		

Sample Data

All sample intervals within the extents of the block model were loaded into a data file along with associated variables. The 1998 drilling campaigns provided only copper and gold values and no specific gravity results were loaded for these campaigns. Point load index and magnetic susceptibility were loaded where they were available from earlier campaigns. The variables created in data file are set out in Table 17.2 below.

Table 17.2
Assay Record Variables

Variable	Description
From, to, -AI-	Sample location information
Cu	Total copper %
Au	Au g/t
SolCu	Soluble copper
SG	Specific Gravity (where available)
PLI	Point Load Index on intact rock (assigned to assays interval)
MAG	Magnetic susceptibility
ROCK1	Rock Type (ALUE)
ALTR1	Alteration Type (ALUE)
GRAD1	Grade Zone (ALUE)
FAUL1	Fault Zone (ALUE)
DHTY	Drilling Campaign (ALUE) 1 = YMAD, 2 = IDEMSA, 3 = MUSTO, 4 = Alumbra DDH 95, 5 = Alumbra RC 95 6 = Alumbra RC 97, 7 = Alumbra RC 98 8 = Alumbra DDH 98
ORE	Flag for to use or not the assays. 1 = Sample to be used 0 = Sample to be discarded.

Compositing

All assays were composited to the bench height (17 m vertical) without geological restriction using Medsystem® programs. As described above, the IDEMSA holes and the 1999 RC metallurgical holes were not used in the calculation of composites. Sample composites with lengths less than 7.5 m were not included for use in grade interpolation.

Geological tagging of the composites was done using VBMs (horizontal Medsystem® geological outlines), which were constructed from the 3D wireframes. The variables created and assigned as tags to the composites are set out in Table 17.3 below.

Table 17.3
Assay Composite Variables

Variable	Description
East, North, Elev:	Composite location
To, Lngth	Composite location information
Cu	Total copper %
Au	Au g/t
SolCu	Soluble copper
SG	Specific Gravity (where available)
PLI	Point Load Index on intact rock.
MAG	Magnetic susceptibility
ROCK	Rock Type (Table 17.1)
ALTR	Alteration Type (Table 17.1)
GRAD	Grade Zone (Table 17.1)
FAULT	Fault Zone (Table 17.1)
DHTY	Drilling Campaign (ALUE) 1 = YMAD, 2= IDEMSA, 3= MUSTO, 4 = Alumbreira DDH 95, 5 = Alumbreira RC 95 6 = Alumbreira RC 97, 7 = Alumbreira RC 98 8 = Alumbreira DDH 98
ORE	Flag for to use or not the composite. 1 = Sample to be used 0 = Sample to be discarded.
ZONKR	Flag for changing the kriging search orientation

Block Model

A block model, some 3,000 m x 2,700 m x 1,020 m in size, was created for Alumbreira. The block model extents created for the deposit are set out in Table 17.4, below

Table 17.4
Block Model Extents

East	38200 - 41200
North	76500 - 79200
Elevation	2849 - 1829
Interpolated Benches	2645 - 1897

The individual block size is 20 m wide x 20 m long x 17 m high. This block size is the same as the selective mining unit (SMU) and the bench height in the pit.

As in the assay and composite files, various tags are added to the block model. The variables used in the ALUF 1999 model, the first year it was used, are summarized in the Table 17.5 below.

Table 17.5
Block Model Variables

TOPO	Percentage of topography December 31st 1998
TOPOL	Percentage of original topography
PIT1	Percentage within pit 810, and Dec.98 surface, just for comparisons
CUKRG	Interpolated Copper Values, Kriging algorithm
AUKRG	Interpolated Gold Values, Kriging algorithm
VAR	Kriging Variance
ZONKR	Zone for Kriging.
CATEG	Resource Category, Measured = 2, Indicated = 3, Other = 4
RECCU	Calculated with April 6th, 1999 curves
RECAU	Calculated with April 6th, 1999 curves
OTLP	Ore Type: 1:waste, 2:low, 3:medium, 4:millfeed. April, 1999 cutoff table
CDIST	Distance to the closest composite
NCOMP	Number of Composites used for interpolation
ROCK	Rock Type, Table 17.1
ALTR	Alteration Type, Table 17.1
GRAD	Grade Zone, Table 17.1
FAULT	Fault Zone, Table 17.1
METAL	Metallurgical Domains, Table 17.1
SG	Specific Gravity, Table 17.10
EQCU1	CuKrg + 0.55AuKrg, used just for comparisons against ALUE model
EQCU2	Calculated with April 6th, 1999 curves
EQ\$\$	Blank
EXTR2	Rubble Zones
EXTR3	P2 Porphyry
ORE	Blank

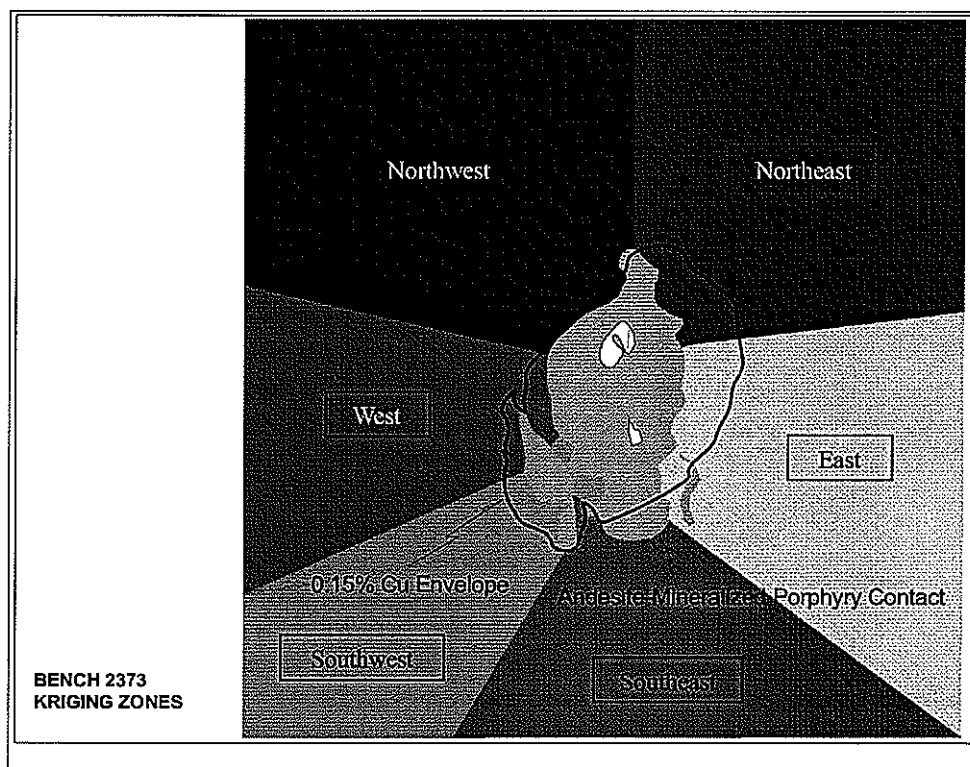
Different variables, such as more recent surveys or different copper equivalency calculations, can be added and used each year. In 2001, a true payable copper equivalency variable, EqCu5, was added to the block model for use in grade control decision making, for example, the stockpile on which a truckload of rock delivered to the pit rim should be placed.

Grade Interpolation

Grade interpolation was performed using the ordinary kriging algorithm in Medsystem®, employing search and variogram parameters based on an analysis and recommendations made by Gary Raymond. Blocks outside grade zones 93 and 94 had their grades reset to zero, as did blocks with a kriging variance equal or greater than 0.32.

The variographic analysis identified the requirement for the use of different kriging zones within the main mineralized porphyry and in the surrounding andesite. Seven kriging zones were established, one covering the main mineralized porphyry and the Northeast, East, Southeast, Southwest, West and Northwest zones within the andesite, as shown in Figure 17.1, below.

Figure 17.1
Alumbrera Kriging Zones



For the main mineralized porphyry, the search and variogram parameters used are set out in Tables 17.6 and 17.7, below.

Table 17.6
Search Parameters

Search distance on Easting :	225 m
Search distance on Northing :	225 m
Min number of composites :	5
Max number of composites :	10
Max number of composites per hole :	3

Table 17.7
Variogram Parameters

Model type	Spherical
Nugget	0.1
Sill	0.5
Range along major axis	450 m
Range along minor axis	170 m
Range along vertical axis	650 m
Direction of major axis in Grade Zone = 93	150 °
Direction of major axis in Grade Zone = 94	170 °
Plunge of major axis	0
Dip easterly	0
Distance along major axis	225 m (Half variogram range along major axis)
Distance along minor axis	85 m (Half variogram range along minor axis)
Distance along vertical axis	325 m (Half variogram range along vertical axis)
Anisotropic distances	Yes
Block discretization	4 x 4 x 1

Because of the relatively large size of the blocks in comparison to the data spacing, discretization was employed in the grade interpolation. This process is often used on blocks where the distance from one corner of the block to a data point is significantly different from another corner. In these cases, a series of points is established within each block and separate grades are estimated for each. The grade of the block is then determined from these separately estimated points, usually by arithmetic average.

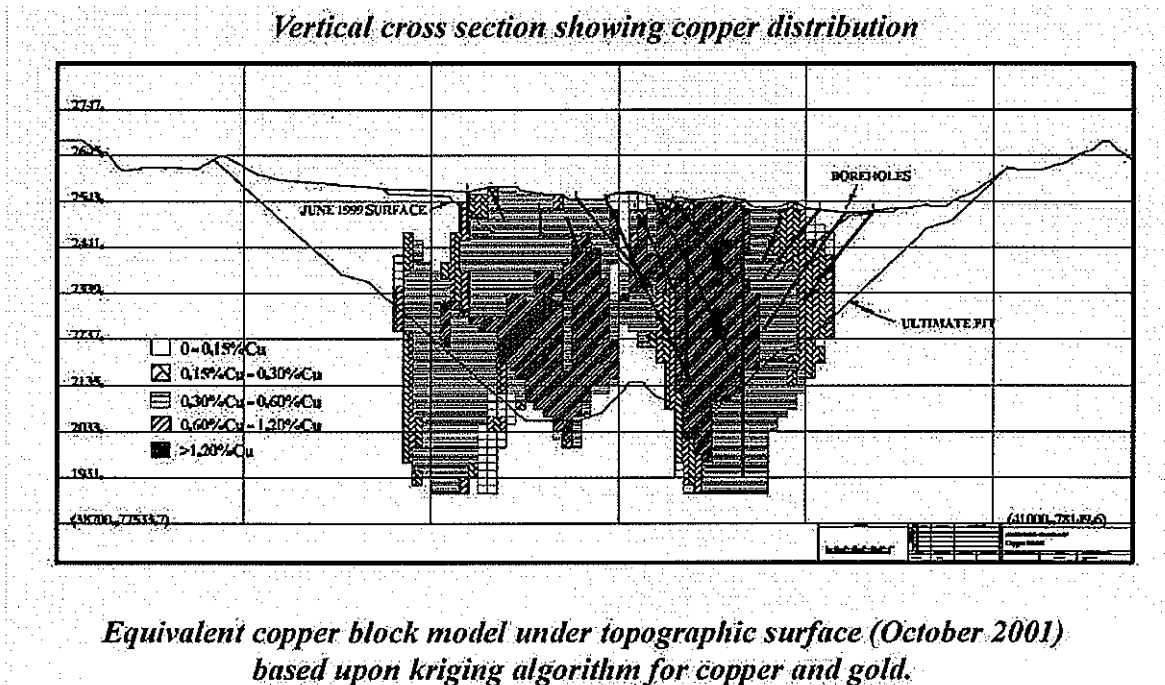
For the andesite and Los Amarillos Porphyry the same search and variogram parameters were used, but the searching directions were adjusted so as to be parallel to the Mineralized Porphyry-Andesite contact. The search azimuth parameters for the six kriging zones created in the Andesite-Los Amarillos domain are set out in Table 17.8.

Table 17.8
Andesite Kriging Zones, Search Azimuths

Zone Northeast		Zone East	
Direction of major axis (azimuth)	150 °	Direction of major axis (azimuth) :	010 °
Plunge of major axis :	0 °	Plunge of major axis :	0 °
Dip easterly :	0 °	Dip easterly :	0 °
Zone Southeast		Zone Southwest	
Direction of major axis (azimuth) :	085 °	Direction of major axis (azimuth) :	150 °
Plunge of major axis :	0 °	Plunge of major axis :	0 °
Dip easterly :	0 °	Dip easterly :	0 °
Zone West		Zone Northwest	
Direction of major axis (azimuth) :	180 °	Direction of major axis (azimuth) :	045 °
Plunge of major axis :	0 °	Plunge of major axis :	0 °
Dip easterly :	0 °	Dip easterly :	0 °

Figure 17.2 shows an example section through the ALUF block model and the distribution of estimated equivalent copper grades.

Figure 17.2
Example ALUF Block Model Section



Geological Domain Boundaries

All rock domains were considered hard boundaries, so that grades within the Mineralized Porphyry do not create blocks in the Andesite domain and vice versa. North Andesite and Late P3 were considered hard boundaries as well.

Within the grade zones, the 0.15 % Cu envelope was considered a soft boundary in one direction. This means that composites in the outer 0.0 % Cu envelope were allowed to create or influence blocks in the 0.15 % Cu domain, but the opposite was not allowed to occur. The remaining grade zones were considered hard boundaries.

In alteration domains, the leached domain was considered a hard boundary in both directions. The enriched and fresh zones were considered soft boundaries in both directions.

The Steve's and Gypsum faults were considered hard boundaries. The Colorado and 50-56 faults were not used as boundaries in this interpolation.

For storing of the kriging variance, only the faults and the Andesite-Porphyry contact were used as hard boundaries. The remaining domains were considered soft in all directions, in order to

have a better classification of the resource which is based on the kriging variance, as described below.

The relationship between these domain boundaries is expressed graphically in Figures 17.3 to 17.6 below.

Figure 17.3
Rock Domain (Composites Influence)

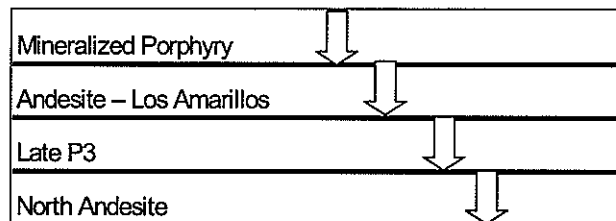


Figure 17.4
Grade Domain (Composites Influence)

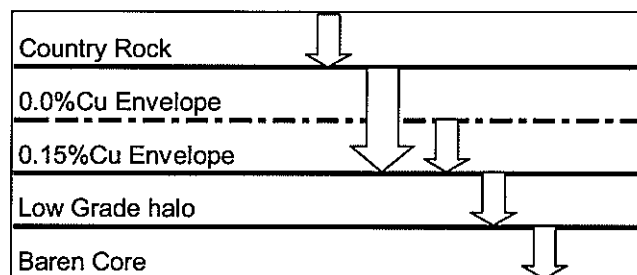


Figure 17.5
Alteration Domain (Composites Influence)

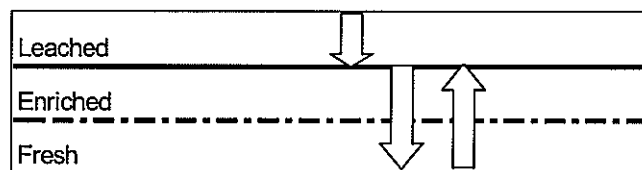
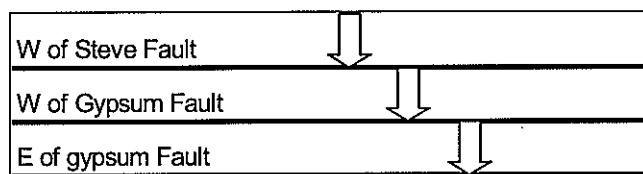


Figure 17.6
Faults Domain (Composites Influence)



Resource Classification

The mineral resources estimated for the Alumbrera deposit have been categorized into confidence levels (measured, indicate or inferred) based on the block kriging variance for each block in the model. As explained by Gary Raymond, kriging variance is normally calculated at the same time as kriged grade during modelling. It is dependent on sample spacing around the block being estimated and is a predictor of the mean squared estimation error. Kriging variance increases with sample spacing and with distance from nearby samples.

The variable, CATEG, in the block model was used to store each block's confidence level classification based on its kriging variance, and was coded as set out in Table 17.9 below.

Table 17.9
Block Classification Criteria

CATEG	Category	Comments
= 1	Waste	All blocks outside the 0.15 %Cu Envelope and Low Grade Halo (Grade Zone = 93 & 94) or within these domains but with an undefined kriging variance.
= 2	Measured	All blocks with a kriging variance ranged between 0.00 and 0.159 and within the 0.15% Cu Envelope and Low Grade Halo (Grade Zone = 93 & 94).
= 3	Indicated	All blocks with kriging variance ranging between 0.16 and 0.239 and within the 0.15 % Cu Envelope and Low Grade Halo (Grade Zone = 93 & 94).
= 4	Other	All blocks with a kriging variance ranging between 0.24 and 0.319 and within the 0.15 % Cu Envelope and Low Grade Halo (Grade Zone = 93 & 94).
= 5	Waste	All blocks with a kriging variance greater than 0.32 and within the 0.15 % Cu Envelope and Low Grade Halo (Grade Zone = 93 & 94).

Mr. Raymond is of the opinion that high kriging variance blocks are not inferred resources, rather they are just bad estimates and should not be used in economic studies. For this reason the "Other" category was created and no inferred resource has been reported. Only measured and indicated blocks are used for mine planning.

17.1.2 ALUG Reserve Block Model

Based in part on recommendations received in 2000, MAA drilled 14 new holes at depth below the Alumbrera pit bottom in order to upgrade as much mineralization as possible to the measured category. Two new PQ-sized geotechnical drill holes were also available for resource estimation. These new holes had been completed at the time of Micon's visit but had not been used in the final resource estimation runs using the ALUF model. They were used in part to

modify the ALUF model resulting in ALUG, which was being tested for possible future use at the time of the visit.

Several changes were made in the ALUG model parameters in order to reduce the large number run setups used in estimation with ALUF. These included:

- Leached material was not distinguished from Transition and Fresh. Previously the Leached material was constrained by a hard boundary. All of the leached ore has now been mined out and no longer affects grade interpolation.
- The ALUF model used a hard boundary at 78,200N to approximate the boundary between high-grade Mineralized Porphyry and lower-grade Late P3. Now the low-grade Late P3 has been moved out of Mineralized Porphyry, and included with Andesite + P1 instead. The Mineralized Porphyry boundary is now hard and used for the same purpose.
- ALUG run setups required Low Grade Halo and Barren Core to be contained entirely within Mineralized Porphyry bounds.

Set out below is a summary of the parameters used to estimate the ALUG model:

Compositing

- All IDEMSA and Met DHs were discarded as before.
- Intervals not assayed because of poor visual estimates were set to zero grade. All others ignored in compositing.
- Drill holes steeper than -45° were composited within 17 m bench RLs.
- Drill holes flatter than -45° were composited down-hole in 17-m increments.
- Composites with less than 8.5 m of assayed length were discarded.
- Composite grades capped at 2.0 % Cu and 2.8 g/t Au for kriging.

Hard and Soft Domain Boundaries

- Setups required Low Grade Halo and Barren Core to be contained entirely within Mineralized Porphyry.
- Hard boundaries were used on Gypsum and Steve's Faults in all runs, including kriging variance. Son of Steve's Fault was not used because of poor defined uncertainty about significant offset of mineralization.

- Hard boundaries used on Mineralized Porphyry/Andesite (including P1 and Late P3) contacts in all runs, including kriging variance.
- Barren Core, P4 Dikes and outside-the-0.15 %-Cu-envelope model blocks set to waste.
- P4 composites were not used in any estimates.
- Mineralized Porphyry set to include P2 and P3, with soft bounds between P2 and P3. P2 bounds are very irregular and were used only in assigning SG.
- Mineralized Porphyry model blocks estimated using only Mineralized Porphyry composites for kriged grades, but using also Low Grade Halo and Barren Core composites for kriging variance.
- Low Grade Halo model blocks were estimated using only Low Grade Halo composites for kriged grades, but using also Mineralized Porphyry and Barren Core composites for kriging variance.
- Andesite, P1 and Late P3 (all outside Mineralized Porphyry), were grouped together with soft bounds between them, and are referred to as Andesite. Andesite model blocks were estimated using composites of Andesite (all kriging zones), and outside the 0.15 %Cu Envelope, for both kriged grades and kriging variance.
- Composites outside outer 0.15 % Cu envelope were used to estimate Andesite, but model blocks outside 0.15 %Cu envelope were not estimated.

Variogram and Kriging

- Variogram parameters remained unchanged
- Ordinary kriging, with unchanged block size or discretization parameters.
- Kriging variance limits for Resource/Reserve classification remain unchanged.

Ellipsoidal Search with Parameters

- Minimum 3, maximum 10 composites per estimate
- Maximum 3 composites per DH
- 325 m search radius in major direction (strike horizontal)
- 225 m search radius cross-strike horizontal (1.44:1 ratio)
- 85 m search radius vertical (3.82:1 ratio)
- Azimuths for Variograms and Searches remain unchanged and the Kriging zones continue to be used. An eighth kriging zone within the Mineralized Porphyry but outside of the 0.15 % Cu envelope (the Low Grade halo) was used

Other

- The EqCu5 formula has been replaced with EqCu8 which uses somewhat different commodity price, recovery and cost assumptions.

Figures 17.7 And 17.8 below show two views of an example section (Section 47) through the ALUG block model. Shown are the distribution of estimated kriged copper grades (Figure 17.7) and the new “gained blocks” in the ALUG model colour coded by equivalent copper grades calculated using the EqCu8 formula (Figure 17.8).

Figure 17.7
Example ALUG Block Model Section Showing Kriged Copper Grades
(Section 47)

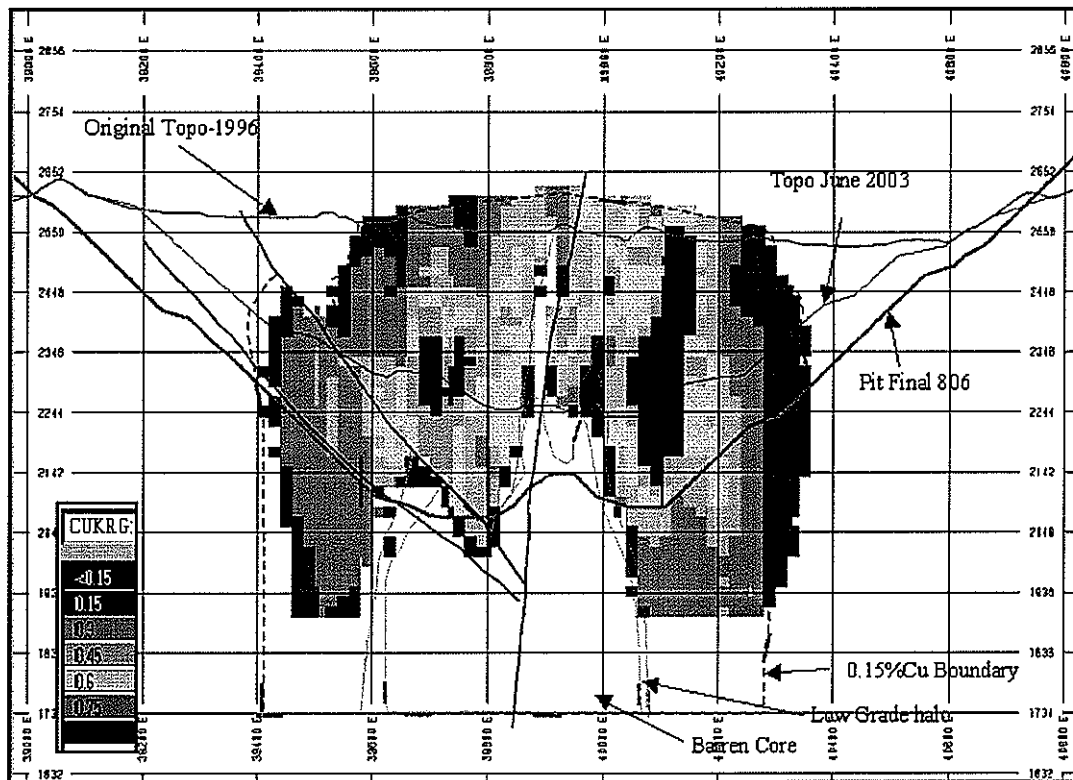
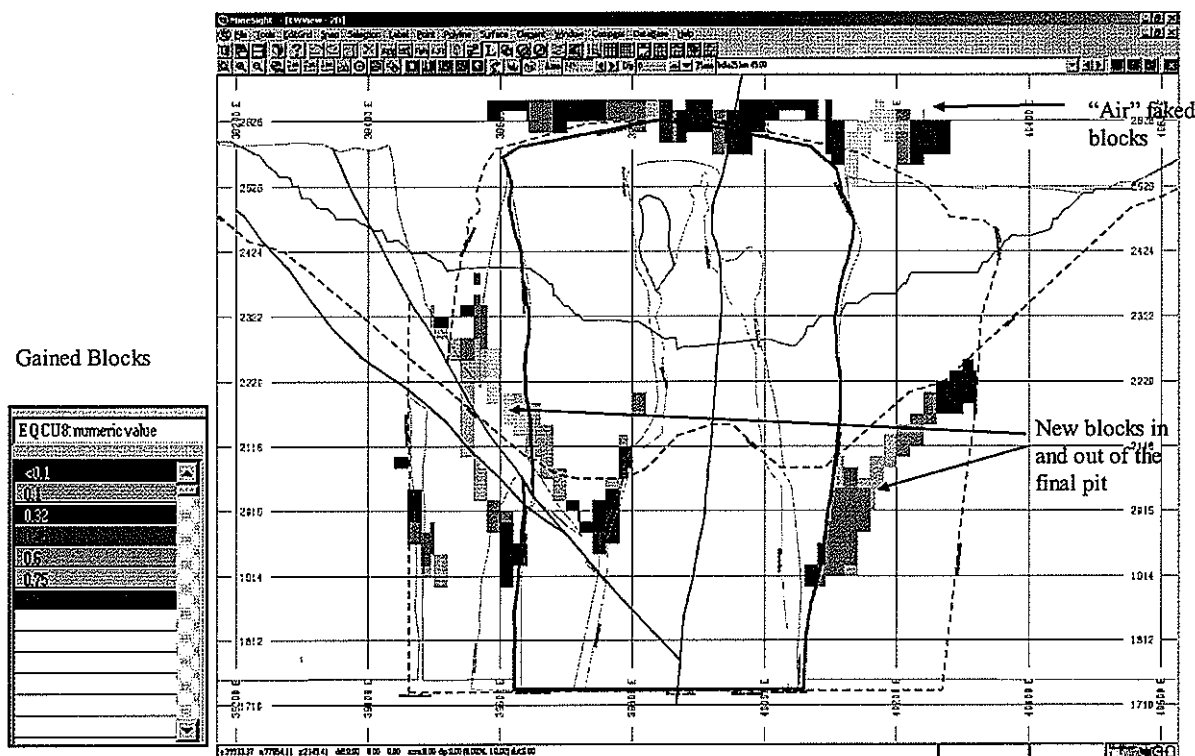


Figure 17.8
Example ALUG Block Model Section Showing Calculated Equivalent Copper Grades
(Section 47)



17.1.3 Treatment of High Grade Assays

Based on Gary Raymond's analysis of bias between drill campaigns and grade estimation differences between the ALUF ore reserve model, the grade control model and his conditional simulation, it was recommended that drill hole composite assays be top cut to 2 g/t Au, the 98th percentile of the population distribution. No top cutting of copper composites was recommended for ALUF.

Several of the 14 new drill holes used in the ALUG model were oriented in such a manner as to be paralleling some massive chalcopyrite veins, in the high grade area, as the holes flattened. As a result several very high copper and gold assays were encountered, particularly in one hole (maximum values of 3.92 % Cu and 6.38 g/t Au). In the ALUG model it was decided to cap copper at 2.0 % and gold at 2.8 g/t in these 14 holes. This capping was applied to 5 copper composites and 4 gold composites and affected only material on the upper remaining benches that was well within previous ultimate pit designs.

MAA has accepted these recommendations and is following them.

17.1.4 Bulk Density

MAA has an extensive database of specific gravity measurements made on whole core using the wet balance (or weight in air/weight in water method). A total of 410 specific gravity measurements were taken in the Musto drilling program and an additional 3,626 measurements were made in the MAA 1998/1999 drilling campaign.

Specific gravity measurements in this historical database are averaged by rock and mineralization type to give an average bulk density for each of the principal mineralization styles/lithologies seen in the deposit. Copper and gold grade distributions were seen to have little effect on the densities. The specific gravity values available to be assigned to the model are as follows are set out in Table 17.10.

Table 17.10
Specific Gravity by Rock Type

Andesite	2.62
Los Amarillos Porphyry	2.65
Quartz-Magnetite Alteration	2.86
Mineralized Porphyry	2.54
Barren Core (outside Mineralized Porphyry)	2.56

After creation of the block model, each block was assigned a specific gravity value using the averages obtained and based on the rock type variable for that block. A specific gravity model has not been created.

17.1.5 Grade Control Model

MAA samples and assays all blast holes drilled in the pit. These holes are drilled on a tightly spaced pattern just ahead of the mining. A separate block model, called the grade control model and which is similar to the ore reserve block model, is run on these samples. However, the grade control model uses 5 m x 5 m x 17 m-sized blocks. It is free interpolated without the use of geological domains because the hole spacing is so close that sufficient data exist to find the boundaries of the domains accurately.

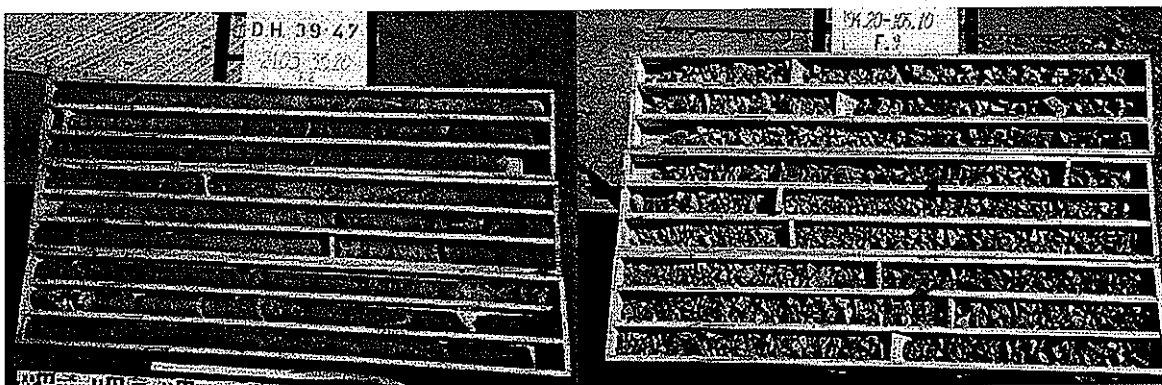
The grade control model is used principally for day-to-day mining decisions in the pit, such as the stockpile onto which broken rock should be placed and the grades of those piles. The grade control model is not used to estimate the in situ ore reserves at Alumbraera however, it is used to estimate grade for the stockpile reserves.

17.1.6 Throughput Model

Considerable differences exist in the grinding performance characteristics of the various mineralization types at Alumbraera. The extremes of these differences can be seen in Figure 17.9. These changes can result in significant swings in daily mill performance, throughput and grinding efficiency of the SAG mills. MAA has created a Grindability Domain Model within the

current ALUF Block Model for the prediction of future throughput on daily, weekly, monthly and annual bases.

Figure 17.9
Quartz Magnetite Porphyry and Rubble Andesite Photographs
(17.9 a - left, 17.9b - right)



Creation of the grindability model required the relogging of existing drill core using a new alteration criteria, the Feldspar Destructive Alteration (FDA) concept and combining the new alteration information with the existing Rock Type Model to produce the Grindability Domain Model.

The block model was tagged using the following criteria after determination of the plant's grinding capacity by rock type during a study performed by JKTech.

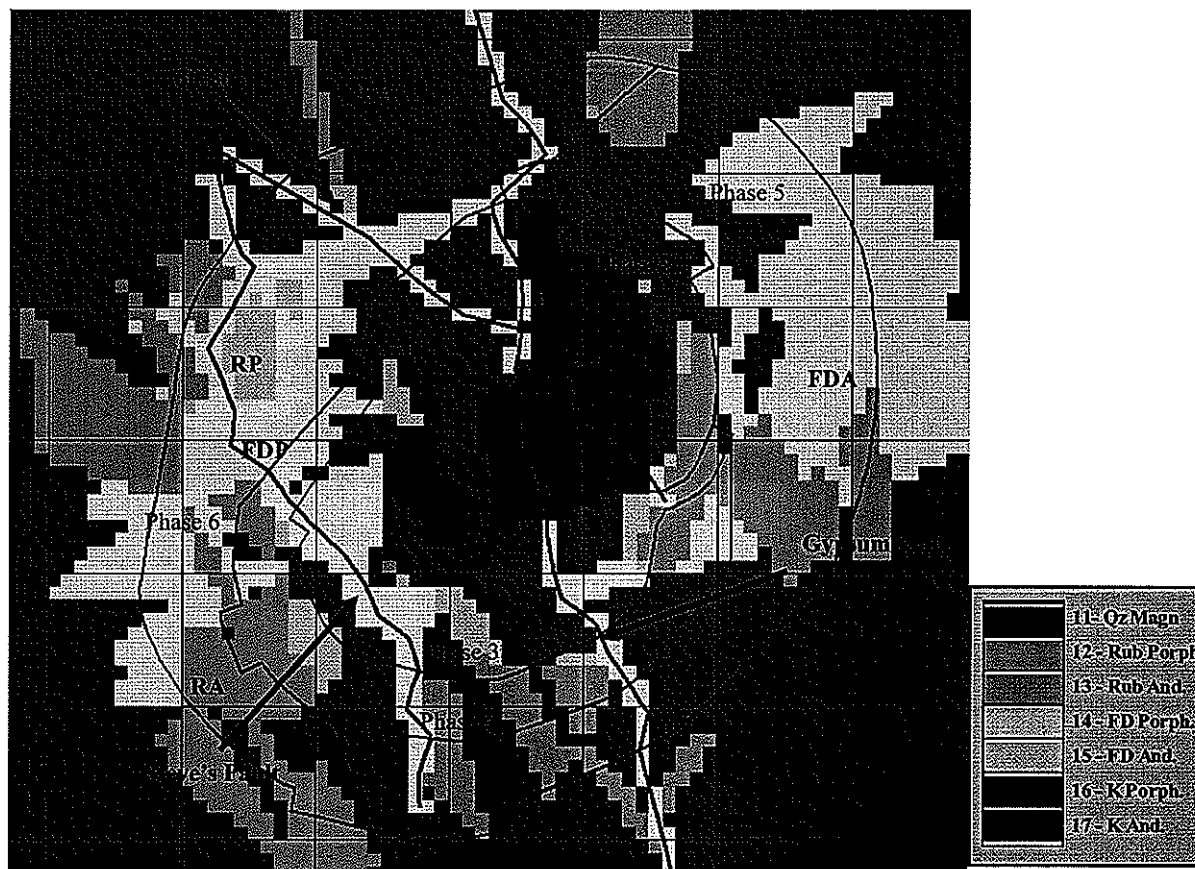
- P2 Model tagged as 11-Quartz-Magnetite Alteration.
- Rubble Porphyry geotechnical Model tagged as 12-Rubble Porphyry.
- Rubble Andesite geotechnical Model tagged as 13-Andesite Rubble.
- FDA Altered Porphyry (combined P1 and P3) tagged as 14- FDA Porphyry.
- FDA Altered Andesite tagged as 15- FDA Porphyry.
- Potassic Altered Porphyry (combined P1 and P3) tagged as 16-Potassic Porphyry.
- Potassic Altered Andesite tagged as 16-Potassic Andesite.

Additionally, if one of the major faults passes through a block, that block is tagged as either FDA Porphyry or FDA Andesite.

The grindability model can be run on either of the ore reserve or grade control block models. An example plan view of the 2373 bench of the grindability domains in the ore reserve block model is shown in Figure 17.10.

Throughput modelling for the ore reserve block model is used for life of mine planning, annual budgets and monthly forecasts. The grade control throughput model is used for daily and weekly forecasts and for daily, weekly and monthly balances.

Figure 17.10
Grindability Domains in ALUF Block Model, 20 x 20 m Blocks - Bench 2373



17.1.7 Software

Resource estimation work at MAA is performed using Medsystem® software operating on IBM compatible PCs. Wireframing and 3D modelling was performed using Minesight®. Gary Raymond's conditional probability work, using cylindrical searches, was performed using his own proprietary software.

17.1.8 External Audits

As discussed above, MAA has retained Gary F. Raymond, P.Eng. to advise on the construction of the block model and the grade interpolation into the model. Mr. Raymond has reviewed the drill spacing and parameters for orebody modelling used in the ALUF model and has performed a conditional probability estimation check on it.

Mr. Raymond's 1999 review made certain recommendations for improvement in the ALUF model and these have been acted upon. These recommendations included the discarding of the IDEMSA drill results, changes to assay cutting practices and suggested modelling and interpolation parameters and practices.

MAA has prepared a new geological model, known as ALUG, discussed above. This model has been reviewed by Mr. Raymond. Raymond used his own software to do a parallel run of the new model to check the Medsystem results from MAA. He also repeated his conditional probability estimation check on the model using the 14 new drill holes available for ALUG and has deemed it to be satisfactory. Raymond states that "ALUG has been extensively checked and is an excellent model. It should become the basis for Resource/Reserve statements, ultimate pit design and economic studies" (Raymond, 2002).

17.2 MINERAL RESERVE ESTIMATION METHODOLOGY

The resources, as discussed above, have been estimated from a block model using procedures described earlier in this report.

The estimation of mineral reserves from these mineral resources is carried out by the application of economic criteria. The mineral reserves have been estimated by fitting a pit shell to the mineral resource block model and the surrounding waste, which renders a maximum NPV from the resulting cash flows. The ultimate pit shell is determined using applicable revenue and cost data. Each block in the resource model is assigned a copper equivalent grade, based on the relative prices of copper and gold and the recoverable grades of copper and gold in the block. Each block must cover the full cost of mining, ore re-handle, processing and all other downstream costs. Incremental costs are applied for each deeper bench to cover the cost of additional haulage. Metal prices of US\$0.88/lb for copper and US\$298/oz for gold were used in the pit design. The costs used in the 2002 LOM Pit Plan were the same as for 2001, except that fuel costs were reduced from US\$0.40/L to US\$0.24/L, reflecting the current practice of purchasing fuel free of import duties. These costs and metal prices also have been used in the ALUG resource model, upon which the latest mineral reserves are based. This pit shell design process utilizes the "Whittle" software.

Ore recovery, from, and waste dilution to, the mineral reserve are dealt with in the pit outline determination process. The mineral reserve is then determined by the application of a cutoff grade between ore and waste. Accordingly, the cost of mining the material in the shell has been included in this process. However, the pit shell includes waste, which is required to be transported to a waste rock dump.

In the estimation of mineral reserves (December 31st, 2002) MAA utilized a cutoff grade of 0.32 % equivalent copper grade to determine the split between ore to be processed and waste to be stored permanently. This equivalent grade takes into account copper and gold grades, respective metal prices and metallurgical recoveries. The recoverable copper equivalent grade of 0.32 % represents in-situ copper and gold grades generally in the range of 0.15 % Cu and 0.40 g/t Au to 0.25 % Cu and 0.24 g/t Au. The cutoff grade was determined appropriately by using

NSR values for the ore and estimated operating costs as shown in Table 17.11 below. Currently, ore above 0.40 % equivalent copper grade is fed directly to the mill, with ore between 0.32 % and 0.40 % equivalent copper stockpiled for subsequent processing.

The cutoff grade is that equivalent copper grade, which is sufficient to cover the cost of re-handling low grade ore, which has been stockpiled; processing, including overhead; and all down stream costs. The formula as included in the MAA 2002 LOM Plan, with updated costs and revised metal prices, is presented below in Table 17.11.

Table 17.11
NSR Calculation

NSR Calculation	Concentrate	Copper	Gold	Silver
Metal Prices, US\$/lb, US\$/oz		0.800	295	4.50
Concentrate grade, % Cu, g/t Ag		27.70 %	30	25.00
Moisture Content, %	7.50 %			
Payable lbs Cu metal/DMT	96.39 %	588.60		
Payable g Au./DMT	97.15%		29.15	
Payable g Ag/DMT	55.00 %			13.75
Gross Concentrate Value, US\$/DMT	747.30	470.88	276.42	1.99
Filter Plant, US\$/DMT	1.80	1.80		
Rail & Port, US\$/DMT	8.50	8.50		
Ocean Freight, US\$/DMT	32.07	32.07		
Shipping & Marketing Overhead, US\$/DMT	1.45	1.45		
Smelting Charge, US\$/DMT	68.20	68.20		
Refining Charge Cu, US\$/lb, US\$/DMT	0.0682	40.14		
Refining Charge Au, US\$/oz	5.00		4.69	
Refining Charge Ag, US\$/oz, US\$/DMT	0.37			0.16
Price Participation - Base Price, US\$/lb Cu	0.90			
Price Participation-Participation Rate, %, US\$/DMT	10.0 %	2.94		
Royalty – US\$0.026/lb Cu sold	0.026	15.88		
Total Concentrate Charges, US\$/DMT	168.04	168.04	4.69	0.16
Total Concentrate Charges, US\$/lb Cu	0.285			
Net Copper Revenue, US\$/DMT		302.84		
Net Gold credits US\$/DMT			271.74	
Net Silver Credits, US\$/DMT				1.83
Net Smelter Return, US\$/DMT		302.84	271.74	1.83
NSR US\$/lb Cu , US\$/g Au (including Ag)		0.653	9.383	

Given the copper NSR value above, the cutoff grade is computed as shown below:

$$\text{Cutoff Grade} = (\text{C mill} + \text{C overhead} + \text{C re-handle}) / (\text{NSR Cu} * \text{Cu Recovery} * 22.045 \times \% \text{Payable Cu})$$

Where C mill = Milling cost per tonne milled
C overhead = Mine site overhead cost per tonne of ore milled
C re-handle = Stockpile re-handle cost per tonne
NSR Cu = Copper NSR

Where C mill = US\$2.25/t

C overhead = US\$0.50/t
C re-handle = US\$0.40/t
NSR Cu = US\$0.515/lb
Cu Recovery = 80 %

Cutoff Grade = $(2.25 + 0.50 + 0.40) / (0.515 \times 0.80 \times 22.045)$
= 3.15 / 8.75
= 0.36 % Cu equivalent

The cut-off grade was raised from 0.28 EqCu to 0.32 EqCu in January 2003. Reviews of this cut-off grade continue periodically.

The previous (2001) LOM Plan was based on a 0.45 % EqCu cutoff grade, for direct feed to the mill, from fiscal year 2003 until the end of mining from the pit. The current LOM Plan (fiscal year 2002), upon which the economic evaluation in this report is based, attempts to optimize haulage, combined with revised phase designs, and incorporates a lower cutoff grade, of 0.40 % Cu eq. The balance of this plan requires the stockpiling of a further 15 Mt of low grade ore and the ultimate reclamation of 124 Mt of low to high medium grade ore.

Micon considers the procedures described above, for conversion of mineral resources to mineral reserves, to be appropriate.

17.3 MINERAL RESOURCES AND MINERAL RESERVES

17.3.1 Mineral Resources

It is MAA's policy that the published Identified Mineral Resources for Alumbrera are in addition to mineralized material reported in the Ore Reserves. Therefore, resources which have been converted to reserves are not reported, also, as Mineral Resources.

In the past it has been MAA's practice to report mineralization outside the current LOM ultimate pit shell in its Mineral Resource statement. MAA's current projections of likely economic and technical conditions during the mine life have led it to the conclusion that "reasonable prospects for mining to extend outside the LOM ultimate pit are not considered to exist." As a result, and in order to remain in compliance with the JORC Code requirement that a Mineral Resource have "reasonable prospects for eventual economic extraction", this mineralization is no longer reported.

As described in Section 17.1.1 above, blocks for which the kriging variance does not meet the requirement for classification as an indicated resource have the grades nulled. As such, no inferred resources are estimated for the Alumbrera project and, therefore, no inferred resources within the ultimate pit shell are available to be reported.

As a consequence of the decisions and analysis above, there currently are no Mineral Resources to be reported at Alumbrera.

17.3.2 Mineral Reserves

MAA's fiscal year end is June 30 and it re-estimates its Ore Reserves at that time. MAA's joint venture partners report their Ore Reserves as of December 31 each year and the block model is simply queried for this date, using an up-to-date survey and the current pit shell, to produce a remaining reserve report. The ore reserves at MAA as of December 31, 2002, the most recent data available, are set out in Table 17.12 below.

Table 17.12
Alumbrera Ore Reserves as of December 31, 2002, Using the ALUG Model

Material	Cutoff	Confidence Category	Tonnes (million)	Au (g/t)	Cu (%)	Contained Metal	
						Gold (oz)	Copper (Mt)
In Situ	0.32% EqCu*	Proved	234	0.68	0.58	5,081,000	1.360
		Probable	23	0.49	0.47	362,000	0.108
		Total	257	0.65	0.57	5,443,000	1.468
Stockpiles	Various**	Proved	111	0.41	0.36	1,463,000	0.400
		Probable	0	0.00	0.00	0	0.000
		Total	111	0.41	0.36	1,463,000	0.400
Total		Proved	345	0.59	0.51	6,544,000	1.760
		Probable	23	0.49	0.47	362,000	0.108
		Total	368	0.58	0.51	6,906,000	1.868

* Payable equivalent Copper, @ \$295 oz Au & \$0.80 lb Cu. The pit has been optimized with the Whittle software package. The cutoff grade is used at the pit rim for stockpiling decisions.

** In its past the mine has operated using different cutoff criteria.

As a result of the changes from the ALUF to ALUG model, the "Pit 708" to "Pit 806" design and the 0.28% EqCu to 0.32% EqCu cutoff grade a net increase in ore reserves of 30 mt occurred (after allowance for 2002 production). The grade of the reserves decreased from 0.60 g/t Au and 0.51% Cu in 2001 to 0.58 g/t Au and 0.51% Cu in 2002.

As an "apples and apples" comparison of the two models MAA queried the ALUF- and ALUG-generated blocks using the Pit 806 design and the December 2002, mining surface. The results of that comparison are set out in Table 17.13 below with contained metal calculated by Micon.

Table 17.13
Comparison, In-Pit Reserves, ALUF vs. ALUG Models
Using Pit 806 and December, 2002 Surfaces

Model	Category	Ore (Mt)	Au (g/t)	Cu (%)	Contained Metal	
					Au (oz)	Cu (Mt)
ALUF	Proved	203				
	Probable	40				
	Total	243	0.66	0.58	5,156,000	1.41
ALUG	Proved	234				
	Probable	23				
	Total	257	0.65	0.57	5,443,000	1.48

It can be seen from the Table 17.13 above that when comparing the two block models using the same controlling surfaces there is an additional 14 Mt in total reserves and a net 17 Mt upgraded from the Probable to Proven categories in ALUG. While the grades in ALUG have decreased slightly there is somewhat more contained metal.

17.3.3 Responsibility For Estimation

In June, 2002 the Ore Reserves were prepared under the overall direction of David Keough, Chief Geologist, who acted as the Competent Person under the requirements of the JORC Code. Mr. Keough is a member of the AusIMM (Membership No. 104142) and would be considered a Qualified Person in Canada. The December 31, 2002 Ore Reserve Statement was prepared under the overall direction of C. R. (Randy) Van Order, P.Eng., who acted as the Competent Person. Mr. Van Order is a member of the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC #13929) and would be considered a Qualified Person in Canada.

17.3.4 Production Reconciliation

MAA reconciles its reserve block model to the metallurgical balance in the concentrator and to the grade control block model, on a monthly basis using the following process.

Monthly survey pickups are used to determine exact volumes of mill feed, stockpile material and waste mined each month. These volumes are used to query both block models and hence to determine predicted tonnages and copper and gold grades. Block model and grade control model predictions are then directly compared and a percentage difference calculated.

The tonnage milled, head grade and contained copper and gold, as determined by the concentrator, are compared to the tonnes and grade of mill feed predicted by the reserve block model after adjustments for additions to, or removal from, stockpiles. (All medium and low grade ore is stockpiled separately for processing late in the mine life.) The contained copper and gold in the head feed is also apportioned to each bench in the pit based on design grades and tonnes produced. The apportioned copper and gold is then compared to the amount of gold predicted by the resource block model on a bench by bench basis.

The ALUF block model has been in use since July, 1999 and, therefore, comparisons and reconciliations over that period are likely the most appropriate test of the current ore reserves. Table 17.14a below is a comparison of the grade control and reserve block models for the period July, 1999 to June, 2002. The ALUG model was used to reconcile the year to date fiscal 2003 (July 2002 to June 2003) production at December 31, 2002. Table 17.14b below is a comparison of the grade control and reserve block models for the period July, 2002 to December, 2003, the most recent data presented to Micon.

Table 17.14a
ALUF Block Model Reconciliation, July, 1999 to June, 2002

Material	Grade Control Block Model			Reserve Block Model			% Difference		
	Tonnes (Dry)	Cu (%)	Au (g/t)	Tonnes (Dry)	Cu (%)	Au (g/t)	Tonnes (Dry)	Cu (%)	Au (g/t)
Mill Feed	82,798,505	0.69	0.90	85,799,727	0.66	0.92	3	-5	2
Med Grade	43,052,455	0.41	0.45	41,570,950	0.40	0.45	-4	-2	2
Low Grade	18,141,021	0.30	0.31	22,774,845	0.29	0.31	20	-2	-1
Total	143,991,980	0.56	0.69	150,145,523	0.53	0.70	4	-5	1

Table 17.14b
ALUG Block Model Reconciliation, July, 2002 to December, 2002

Material	Grade Control Block Model			Reserve Block Model			% Difference		
	Tonnes (Dry)	Cu (%)	Au (g/t)	Tonnes (Dry)	Cu (%)	Au (g/t)	Tonnes (Dry)	Cu (%)	Au (g/t)
Mill Feed	17,899,314	0.69	0.79	18,241,025	0.67	0.81	2	-3	2
Med Grade	54,947	0.36	0.35	-	0.00	0.00			
Low Grade	5,356,151	0.33	0.31	4,457,153	0.32	0.29	-20	-3	-7
Total	23,310,412	0.61	0.68	22,698,178	0.60	0.71	-3	-2	4

Table 17.15 below is a summary comparison of the reserve block model predictions of tonnes and copper and gold grades to concentrator production for the Alumbreira project to date, the first two years of the ALUF model, for fiscal year 2002. Also shown are the results for the first six months fiscal year 2003, representing the first use of the ALUG model.

Table 17.15
Mill Feed Reconciliation

Model	Reserve Block Model			Other Material to Crusher			Concentrator "Milled"			% Difference Mill to Model		
ALUF	Tonnes (Dry)	Cu (%)	Au (g/t)	Tonnes (Dry)	Cu (%)	Au (g/t)	Tonnes (Dry)	Cu (%)	Au (g/t)	Tonnes (Dry)	Cu (%)	Au (g/t)
Project to Dec, 2002	155,334,820	0.68	0.92	808,658	0.50	0.56	150,085,211	0.72	0.94	-4	6	2
July, 1999 to June, 2002	85,799,727	0.66	0.92	808,658	0.50	0.56	85,219,414	0.69	0.97	-2	5	6
July, 2001 to June, 2002	27,644,125	0.68	0.98	247,920	0.68	0.75	29,477,466	0.73	1.03	6	7	5
ALUG												
July, 2002 to Dec, 2002	18,241,025	0.67	0.81	-	-	-	16,736,761	0.65	0.80	-8	-3	-1

It can be seen from these three tables that Alumbra's ALUF and ALUG models agree well with the blast hole model, which is based on much tighter sample spacing. ALUF has, over time, predicted the mill tonnes to within 2% and head grade to within 5% to 6%. The initial experience with ALUG has shown it to be slightly less accurate on tonnes and more accurate on grade. Further experience with ALUG will be required before definitive answers can be given, however, the initial results are good. It has been Micon's experience that mill reconciliations are rarely much closer than those seen for Alumbra and that this closeness lends confidence to the accuracy of the ore reserve estimate at Alumbra.

17.3.5 Reconciliation to CIM Standards

Micon has reviewed the mineral resource and ore reserve estimates prepared by MAA staff under JORC Code rules. It is Micon's opinion that, while areas for further work have been identified by MAA and its consultants, the mineral resources and ore reserves have been appropriately estimated and categorized under the JORC code. It is Micon's understanding that the recommendations have already been acted upon and a new geological model has been designed to replace the ALUF model and is currently being tested.

It is Micon's opinion that the Measured and Indicated Mineral Resources estimated at Alumbra are individually the equivalent of the Measured and Indicated Mineral Resource categories as presented in the CIM Standards on Mineral Resources and Reserves, Definitions and Guidelines adopted by CIM Council on August 20, 2000. MAA does not estimate Inferred Resources. Micon is also of the opinion that the Proved and Probable Ore Reserves prepared by MAA staff and presented above are the equivalent of Proven and Probable Mineral Reserves under the same CIM standards.

The Proved and Probable Ore Reserves prepared by MAA staff are also the equivalent of Proven and Probable Reserves used in The United States Securities and Exchange Commission's Guide 7, Description of Property by Issuers Engaged or to Be Engaged in Significant Mining Operations. The Guide 7 definitions are taken from USBM Circular 831, Principles of a Resource Reserve Classification System for Minerals.

17.3.6 Issues Affecting Mineral Resource and Mineral Reserve Estimates

Alumbrera is an operating mine currently producing and selling copper-gold concentrates and doré bars. All known environmental, permitting, legal, title, taxation, socio-economic, marketing, political or other relevant issues potentially affecting the mineral resources and mineral reserves have been discussed elsewhere in this report. Given that production is ongoing, it is not anticipated that any such issues will affect the mineral resources and mineral reserves presented here.

18.0 OTHER RELEVANT DATA AND INFORMATION

All relevant data and information in regard to MAA are included in other sections of this report.

19.0 ADDITIONAL REQUIREMENTS FOR TECHNICAL REPORTS ON DEVELOPMENT PROPERTIES AND PRODUCTION PROPERTIES

19.1 MINING OPERATIONS

Standard truck and shovel mining techniques operations are employed in the open pit, utilizing 42-m³ shovels and 220-t haul trucks to move both ore and waste. Mining is carried out on 17-m benches, with 2-m sub-drill, which suits the size of the equipment necessary for the production rate.

Current mineral reserves have a low waste to ore ratio of an average of some 1.8:1. Operation of the mine is carried out at an elevated cutoff grade, which is reduced over the mine life to the economic cutoff grade. This practice requires that some ore be temporarily stockpiled for later processing. The average reserve grade is 0.51 % Cu and 0.58 g/t Au.

The mining rate in fiscal year 2002 marginally exceeded 300,000 t/d for a total of approximately 112 million t of material mined, comprised of some 39 million t of ore and 73 million t of waste. The total material mined is planned to increase to an average of 355,000 t/d, or approximately 130 million t/y, for the fiscal years 2004 to 2007, after which time waste stripping reduces significantly.

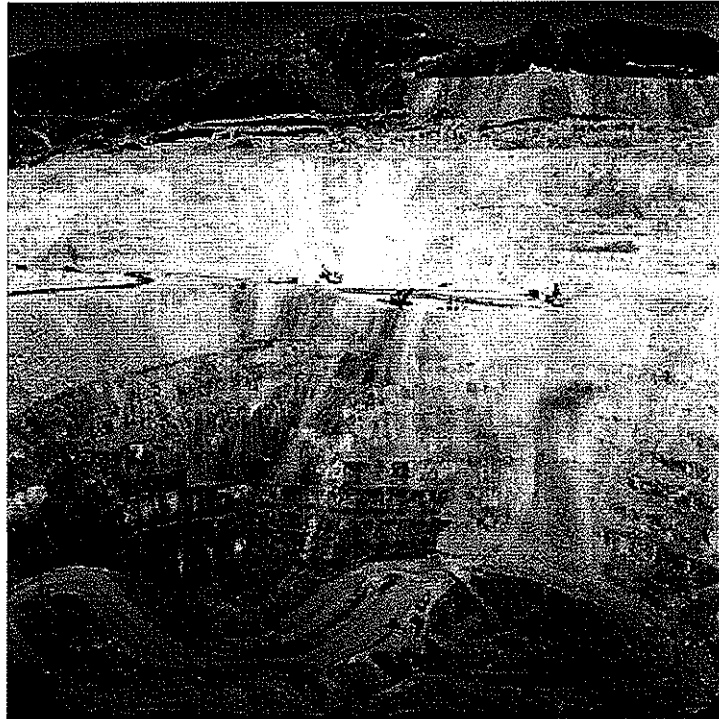
19.1.1 Production Operations

The current pit depth at the time of the Micon site visit was some 250 m of an ultimate pit depth of 500 m. Figure 19.1 illustrates the pit showing shovels on the Phase 4 North bench on the west side of the pit.

From visual observation, the pit operation appeared to be in an orderly state, with good road conditions.

Pit slopes have been designed to fail. This designed failure necessitates some re-handle of ravelling material. Interim slope angles, of between 42 and 46 °, have been recommended by Call and Nicholas as an optimal compromise between the cost of re-handling material and versus the cost of extra waste mining at flatter angles.

Figure 19.1
Bajo De La Alumbreira Open-Pit
(Looking at Phase 4 North)



Final slopes are planned to be steeper by some 2 to 5 °, rendered by proposed smooth blasting techniques and depressurization of in-slope groundwater. Only two upper benches have been excavated to final limit. Smooth blasting with pre-splitting and buffer blasting with smaller holes have been carried out.

Pioneering in the upper limits of the pit currently is difficult and unproductive because of the lack of suitable equipment. It was reported that future pioneering would require the procurement of smaller mining equipment, or the recruitment of a contractor with such equipment.

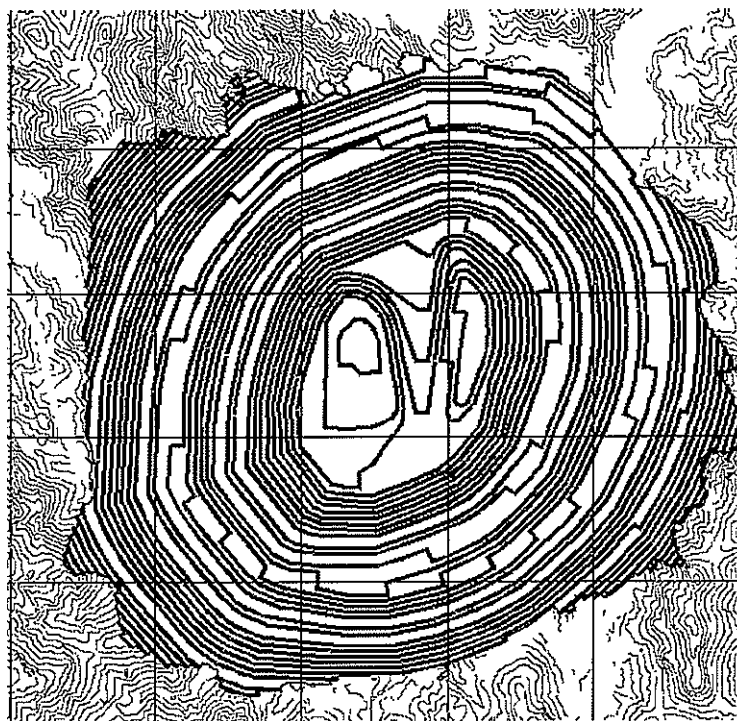
Dewatering is carried out satisfactorily using 17-in diameter, vertical, holes, drilled from benches in the pit. No dewatering holes are planned outside the final pit limit. At the time of the site visit, it was reported that the water table was being maintained at a minimum of 10 m below the pit bottom. The 2002 LOM Plan calls for maintenance of the water table two benches below the pit bottom, or some 34 m. At the time of Micon's site visit, it was reported that the dewatering rate was some 40 L/s and that in order to achieve the recommended water table level below mining, the pumping rate would need to be increased to 100 L/s. An hydro-geological model is being developed by Water Management Consultants, and which was reported to be ready by the end of 2002. It is recommended that the dewatering program continue to be implemented diligently.

Comparison with data on file at Micon, drawn from benchmarking studies carried out at large open pits in the United States, Australia, South America and South Africa, indicates that the Alumbreira operation is performing in the upper quartile of operations using similar sized equipment.

19.1.2 Mine Planning

Planning incorporates the ALUF resource block model, as described earlier in this report, which utilizes Medsystem® software. The final pit design, upon which the 2002 LOM Plan is based, is illustrated in Figure 19.2 below.

Figure 19.2
2002 - Final Pit Design



The 2002 pit plan introduced modifications to the 2001 plan, which permit a faster access to ore by splitting the mining phases into two narrower, north and south, benches, with separate ramp accesses. Figures 19.3 and 19.4, below, illustrate these modifications to the bench phases.

Figure 19.3
2001 - Pit Phase Designs

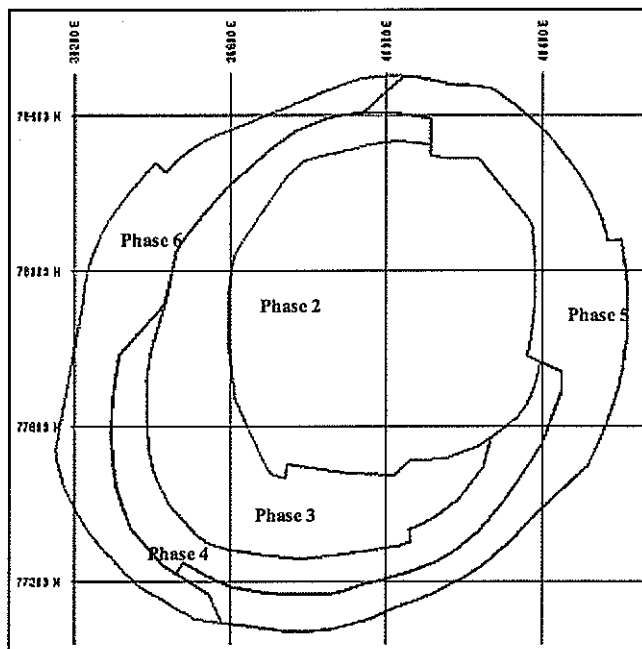
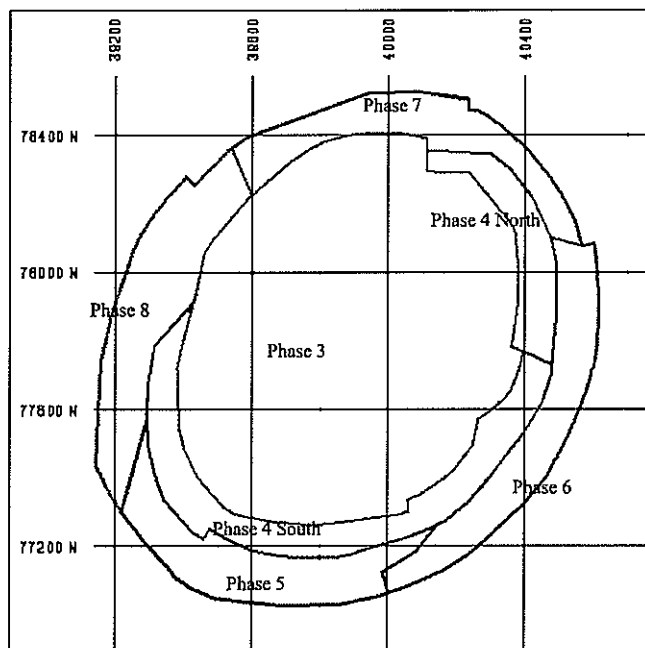


Figure 19.4
2002 - Pit Phase Designs

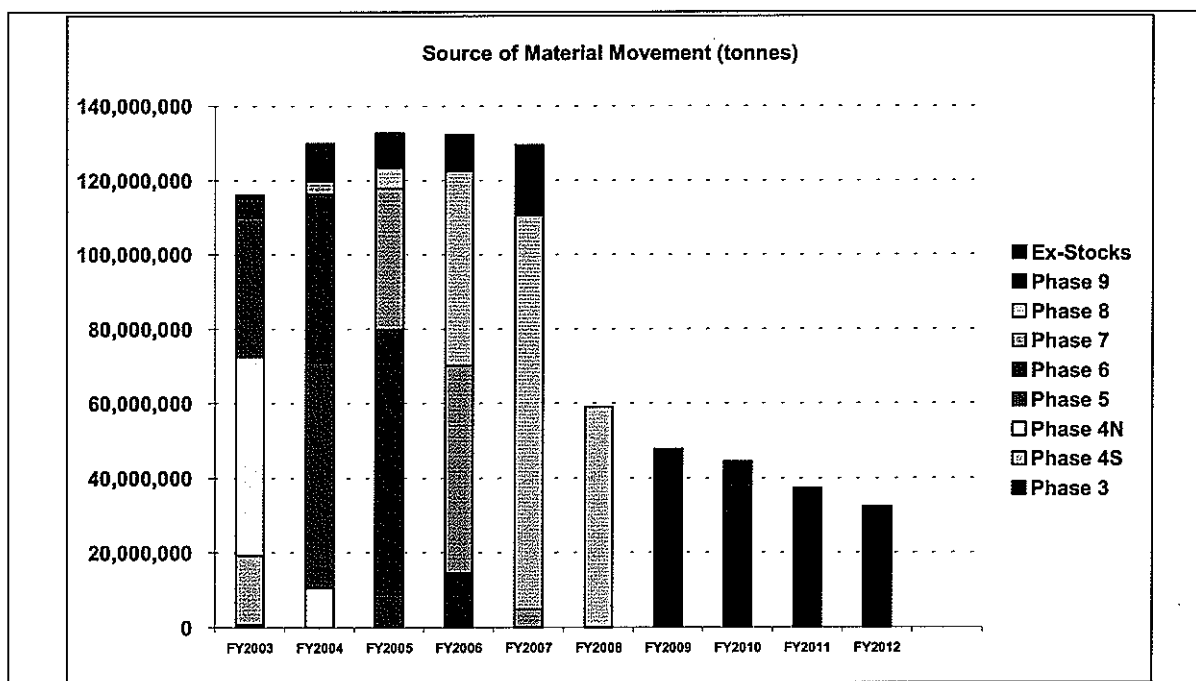


The reduced bench width, of 70 m, is relatively narrow for the size of the equipment, but operations have been developed in a safe and efficient manner. However, the resulting constraint imposed by the narrower benches has resulted in a target of 4,750 t/h compared with an earlier target of 5,000 t/h, for shovel productivity. Phase 4 North can be seen in Figure 19.1, included in Section 19.1.1, where three shovels are working in relatively close proximity.

In an effort to release ore in a timely manner, in order to achieve and maintain the increased ore production rate, the current 2002 LOM Plan requires activity on a large number of benches per year, up to as many as 14, which typically would be deemed excessive.

Re-scheduling of the phases has rendered improvements in the ore release during the first three years of the plan. However, the May 2002 LOM Plan indicates that, in year 2007, a major push-back of waste is required, in Phase 8, resulting in reduced ore production. This necessitates more stockpile recovery, at lower grade, to fill the mill and, thus, results in an annual lower mill feed grade and reduced economic performance. Continuing planning efforts are being made to reschedule the pit phases in order to smooth out the waste removal and ore release from Phases 6, 7 and 8, over that period. These efforts are fully supported by Micon, since the potential economic gain in fiscal year 2007 is significant. Figure 19.5, below, illustrates sources of material movement over the mine life.

Figure 19.5
Material Movement



Source: MAA 2002 LOM Plan

Pioneering, currently, is a constraint. Purchase of smaller equipment, or hiring of a suitable contractor needs to be considered in order to improve the rate of pioneering, i.e., the excavation of the slopes of the surrounding mountains.

19.1.3 Mine Fleet Requirements

The mine utilises large-scale open pit mining equipment. The loading fleet consists of four Bucyrus 495 electric rope shovels, with 42-m³ buckets, which are supported by two L1800 Le Tourneau front-end loaders, of 25-m³ bucket capacity. MAA proposes to replace one of the L1800's with a CAT 994-sized front-end loader in the second half of fiscal 2003. The replacement is due to the age of the machines and their declining availability. The loader fleet is primarily used for blending and pioneering purposes.

The truck haulage fleet currently consists of 36 CAT 793, mechanical drive trucks, of 220-t capacity. Currently the operation is under-trucked, in that the shovel capacity exceeds haulage capacity. Accordingly, in order to compensate for longer haul distances at depth, an additional six trucks, of similar capacity, will be purchased in fiscal year 2004.

Four electric-powered Ingersoll Rand DMH units drill blastholes on 17-m bench heights, with two Ingersoll Rand DMM2 drilling smaller diameter blast holes, which are required for pioneering activity and final wall "limit" blasting. As discussed above, the need for accelerated pioneering development may require additional equipment resources.

An ancillary fleet consisting of track dozers, graders, rubber-tired dozers and water carts keep the bench and dumps surfaces smooth and on grade. This fleet also constructs ramps, maintains hauls roads and undertakes pioneering activity for the development of the upper pushback benches.

The mine utilises a dispatch system for production optimization and control, as well as a reporting/data collection system. The dispatch operator carries out real time trucking optimization to ensure that the shovels are appropriately trucked both via automated haulage resource allocation and by discretionary "override" allocation. Future planning assumes that cost-effective dispatching occurs and, additionally, that all mobile ancillary equipment (water carts, graders, and wheel dozers) are fitted with low precision global positioning systems for management of this ancillary fleet.

The LOM fleet requirements are shown in Table 19.1

Table 19.1
LOM Mining Equipment Requirements

Fleet Description	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012
DMH Production Drill	4	4	4	4	3	2	2	2		
DMM2 Secondary Drill	1	2	2	2	2	2	2			
ECM 690 Development Drill	1	1	1	1	1					
BE495 Rope Shovel	4	4	4	4	4	2	2	2	2	1
Front End Loaders L1800/994	2	2	2	2	2	2	1	1	1	1
CAT 793 Haul Truck	36	40	42	42	42	25	19	18	11	10
D10 Track Dozer	5	5	4	4	4	2	2	2	2	1
DI I Track Dozer	1	1	1	1	1	1	1	1	1	1
Grader	5	5	5	5	5	3	3	3	3	2
CAT773 Water Truck	3	3	3	3	3	2	2	2	2	1
CAT 834 Wheel Dozer	2	2	2	2	2	1	1	1	1	1
Tiger 690 Wheel Dozer	2	2	2	2	2	1	1	1	1	1
Aux Wheel Loader	3	3	3	3	3	3	3	3		
330LME	1	1	1	1	1	1	1	1		
350 Rock Breaker	2	2	2	2	2	2	2	2		
Civil Equipment	1	1	1	1	1	1	1	1		
CAT D6 Equipment	4	4	4	4	4	4	4	4		
Ancillary Equipment	1	1	1	1	1	1	1	1		
Total	78	83	84	84	83	55	48	45	24	19

19.1.4 Maintenance

Equipment maintenance recently has received management attention in an effort to increase availability. Availabilities for fiscal 2002 and the 2002 LOM Plan expectations are presented in Table 19.2, below.

Table 19.2
Major Equipment Availability

Availability	FY 2002 Actual	FY 2002 Budget	2002 LOM Plan
Shovels	87.4 %	89.0 %	89.0 %
Trucks	85.9 %	89.0 %	89.0 %

It was reported that maintenance could be the "Achilles heel" in the production process and that continued attention is required.

Truck maintenance consists of 27 trucks maintained by Macroasa, under a "MARC" agreement, and nine trucks maintained by MAA. The MARC agreement is based on 60,000 hours per truck, although a formal agreement with Macroasa/Caterpillar, in January, 2002, has now specified the termination dates, being July 31, 2005 for the 793B fleet, and July 31, 2006 for the 793C fleet., After that time, the trucks will be maintained by MAA, unless otherwise agreed.

Shovel maintenance is performed by Bucyrus, under a MARC agreement, which covers the four Bucyrus 495 shovels. A revised term for the MARC agreement provides for 60,000 hours per unit. Currently the fleet average is at approximately 30,000 hours, which means that the first shovel will terminate around 2007, with others following, unless otherwise agreed with Bucyrus. The renegotiated agreement also ensures a 5 % reduction in the overall cost rate.

The ancillary equipment is maintained primarily by MAA, with only six pieces of equipment currently maintained by Macrosa, under the MARC agreement. Macrosa currently maintains three CAT 773 water carts, two CAT D10's and one CAT 988 loader, all of which are due to reach the agreed termination of 30,000 hours in the second half of fiscal 2003. MAA's strategy, from the termination date onward, is for the equipment to be maintained by MAA.

The loader fleet, consisting of two L1800 units, is maintained by MAA. The loaders are used in the pit, stockpile re-handle and in pioneering development. The average fleet life, currently, is some 30,000 hours, with the main concern for MAA being the high cost of operation, parts and the demonstrated poor availability. It is planned to purchase a CAT 994 front-end loader, or similar, to support operations.

MAA, Macrosa and Caterpillar have made commitments to ensure that the equipment fleet is supported by all parties. Issues under resolution include component rebuilds, workmanship, quality control on major components and also guarantee of parts supply by Macrosa. Currently MAA, Caterpillar and Macrosa are working together to resolve all of these issues and ensure that the availability targets of 89 % are reached for the LOM Plan.

19.1.5 Summary

In summary, based on visual inspection and review of performance data, it is Micon's opinion that the operation is being conducted in a satisfactory manner. The open pit has been developed and operated over several years and with attendant improvement is reaching on-going steady state routine processes. While it is evident from discussions with responsible MAA personnel that several challenges exist and which require attention, no major impediments were identified that, in Micon's opinion, would prevent the achievement of MAA's mining production and cost targets.

19.2 MILLING OPERATIONS AND RECOVERABILITY

19.2.1 Process Description

The original plant uses a conventional porphyry copper flotation circuit with proven, large scale equipment. The plant produces two products, a copper flotation concentrate, containing the major gold credit, and doré bullion from gravity recovery of coarser free gold. The original design capacity was 80,000 t/d with a utilisation of 94 %, equivalent to 29.2 million t/y. Provision was made for expansion to 100,000 t/d by the addition of a third grinding line, in order to maintain metal production as the ore grade decreases.

Based on its strategic planning, MAA has increased the capacity of the original plant to approximately 100,000 t/d by the addition of the third grinding circuit, albeit using smaller equipment than that already installed. The expansion also included a pebble crushing circuit to handle critical size material from the SAG mills, of which some 1 to 1.5 million t, at 0.4 % Cu, already had been accumulated. The planned utilization for fiscal year 2003 is 93 %, increasing to 94 % in fiscal 2007.

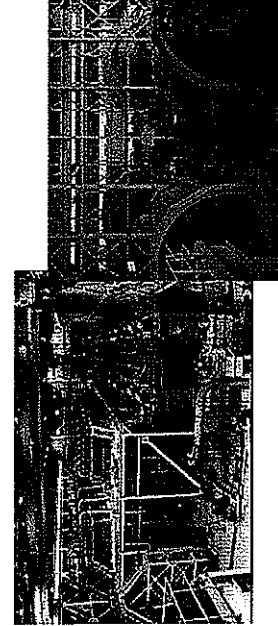
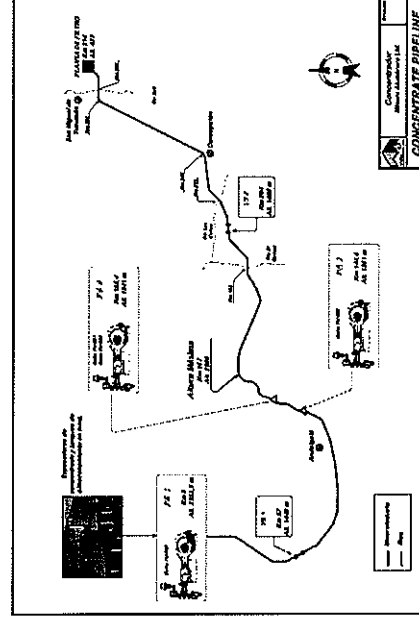
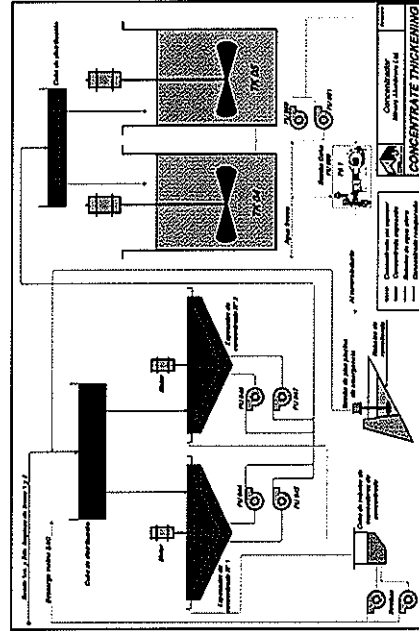
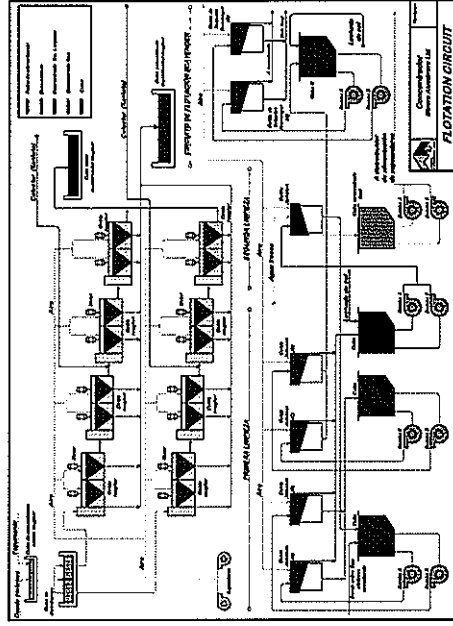
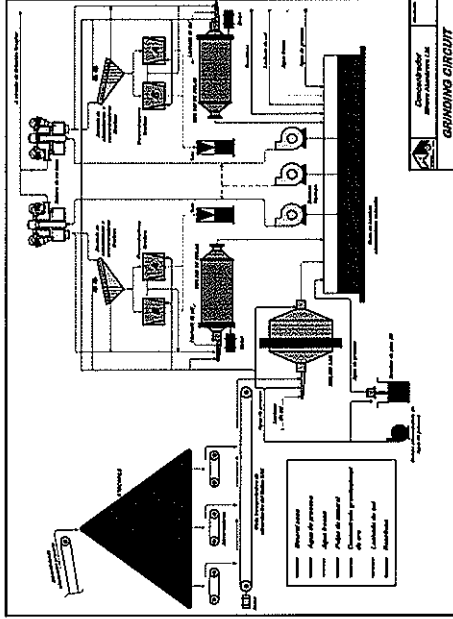
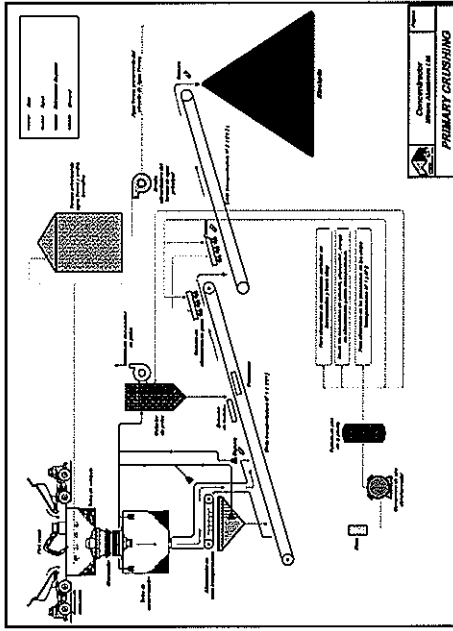
MAA expects that the ball mills will become the limit to throughput with the expanded circuit, particularly on softer ore. Micon understands that the rougher flotation section has sufficient capacity for the increased throughput. Although the cleaner flotation circuit is a constraint to feed metal, this will not be a problem except on the softest, high grade ore, as lower ore grade will compensate for the increased throughput. MAA has not identified any other areas that require expansion, although it acknowledges that increased utilization is required in most areas.

A flow diagram for the process plant is shown in Figure 19.6 with a brief description as follows.

The mined ore is crushed in a 1,540 mm by 2,770 mm gyratory crusher. The crushed ore is conveyed 1.7 km to an 80,000 t live capacity stockpile. The ore is drawn from the stockpile by apron feeders to conveyors feeding three parallel grinding circuits. The two original grinding lines each consist of an 11-m diameter, 5.14-m long SAG mill and two 6.1-m diameter, 9.34-m long ball mills operating in closed circuit with hydrocyclones. The third grinding line, which was commissioned in August, 2002, consists of a 8.53-m diameter, 4.27-m long SAG mill and a 5.03-m diameter 8.84-m long ball mill, both of which are reconditioned second-hand units. It has been the practice to remove and stockpile the minus 35-mm critical size pebbles from the SAG mill discharge when processing harder ores with lower throughput rate. A circuit was commissioned in August 2002 for crushing the stockpiled pebbles and the newly generated pebbles, as required. The pebbles are conveyed via a surge bin to a crusher operating in open circuit and the crushed pebbles will be conveyed via a surge bin to each of the three SAG mill feed conveyors.

SAG and ball mill discharge is pumped to a cluster of hydrocyclones, one cluster for each ball mill. Hydrocyclone underflow discharges to the ball mill feed, with a minor proportion diverted via two centrifugal gravity concentrators for each cluster, for removal of coarser free gold. Hydrocyclone overflow at 80 % passing 150 μ m gravitates to the flotation circuit. The gravity concentrate is transferred to the secure gold room for further cleaning and smelting with fluxes to bullion.

After conditioning with reagents, the hydrocyclone overflow passes to the rougher flotation circuit consisting of 32 100-m³ mechanical flotation cells. MAA has concluded that there is sufficient rougher cell capacity to accommodate the increased throughput. Rougher concentrate is reground in one or two 5.0-m diameter, 7.32-m long ball mills operating in closed circuit with hydrocyclones, and centrifugal gravity concentrators for further free gold recovery. The reground rougher concentrate passes to the cleaner flotation section, consisting of 14 pneumatic flotation cells arranged for two stages of cleaning and a cleaner scavenger, all in closed circuit. The concentrate from the second stage cleaner is the final product and the tailings



PROCESS FLOWSHEETS

Creado por Pablo L. Gomez

Figure 19.6

from the cleaner scavenger are now recirculated to the rougher circuit, although as commissioned these cells operated in open circuit producing final tailings.

Final concentrate is thickened to 63 % solids in two 30-m diameter thickeners for storage in surge tanks before being pumped via a 316-km long, 175-mm diameter pipeline to MAA's filter plant near Tucumán. Positive displacement pumps at the mine site and two booster stations elevate the concentrate to a high point from where it flows by gravity 150 km to the filter plant. Sustaining and environmental work on the pipeline remains a significant capital cost throughout the life of the mine. At the filter plant, the concentrate is stored in surge tanks and thickened prior to three 120-m³ continuous belt filter presses, which reduce the moisture content to 7.5 %. The filters discharge to a storage building, where a front-end loader reclaims the filter cake for rail transport 830 km to the port near Rosario. MAA owns the locomotives and wagons used for rail transport, but the rail system operator runs them under contract. MAA owns and operates the ship loading facility, on the Río Parana, at Rosario.

Tailings from the process plant flow by gravity pipeline for 8.5 km to an engineered, centreline dam constructed across the Vis Vis canyon. Distribution is effected by spigotting along the upstream face of the dam. Supernatant water is pumped back to the process plant and seepage is collected downstream of the dam and pumped back. The dam is raised using waste rock with a core of selected material and remains a significant capital cost throughout the life of the mine. MAA retains Knight Piésold as its consultant for tailings dam management and construction quality control

The concentrator, concentrate pipeline and tailings facilities constitute the Processing Department. The filter plant and port facilities, including rail operations and sales and marketing, constitute the Concentrate Logistics and Marketing Department.

During its inspection of the concentrator and associated facilities, Micon observed that equipment condition and housekeeping were generally excellent and gave every indication of a well-managed operation. Based on information provided by and discussions with MAA, it appears that manning levels, operating, maintenance and metallurgical accounting procedures, and the range and quantity of consumables, operating spares and insurance spares retained on site and on consignment are appropriate for the nature of the operation.

19.2.2 Performance

Metallurgical performance from 1999, the first full year of operation, generally met feasibility expectations, albeit at higher feed grades than the LOM average. By fiscal year 2001, copper recovery had increased from 87.2 % to 89.6 % and concentrate grade increased from 26.1 % Cu to 27.8 % Cu, with total gold recovery in excess of 72 %.

Poor SAG mill availability has affected average throughput, although it appears that the SAG mills and the flotation cleaner circuit have been capacity constraints. The daily rate in 1999, at 81,614 t/d exceeded design. However, in 2000 and 2001 it was below design, at 75,932 t/d and 76,863 t/d respectively, due to low SAG mill power efficiency and utilization, together with

harder ore. These problems appear to have been related primarily to the design and excessive breakage of the liners. MAA has implemented changes into this and other areas of grinding circuit operation and maintenance planning. This program is ongoing, but has already resulted in significant improvements in throughput and utilization.

Key process performance indicators for the fiscal year ended June, 2002 and for the current fiscal year to April, 2003 are shown in Table 19.3

Table 19.3
Process Performance

	Fiscal Year 2001/2002		Fiscal Year 2002/2003 to April 2003		Fiscal Year 2002/2003
	Actual	Plan	Actual	Plan	Plan
Mill Feed					
Total, thousand t	29,477	31,398	27,967	30,377	36,640
Gold Grade, g/t	1.03	0.95	0.77	0.70	0.72
Copper Grade, %	0.73	0.67	0.62	0.59	0.61
Utilization, %	92.57	92.68	92.17	92.42	93.1
Rate, t/d	80,759	86,022	91,997	99,924	100,384
Recovery					
Gravity Gold, %	5.0	3.9	6.8	5.0	5.1
Total Gold, %	77.5	73.7	79.1	74.7	75.0
Copper, %	92.6	90.3	91.9	92.0	92.1
Concentrate, g/t Au	30.5	30.4	26.4	24.9	25.1
Concentrate, % Cu	27.6	27.7	27.0	27.7	27.7
Unit Cost					
Ore milled, US\$/t	2.22	2.58	1.46	2.40	NA

The third grinding line and the pebble crushing circuit were commissioned by the end of August, 2002. Although feed rate and tonnes milled subsequently have been somewhat below budget, Micon has no reason to believe that the LOM plan ore throughput cannot be achieved.

In addition to the grinding circuit modifications already implemented, in its May, 2002 LOM Plan MAA has outlined comprehensive plans for work in the following areas:

- Grinding circuit operation and maintenance.
- Flotation circuit copper and gold recovery.
- Gravity gold recovery.
- Reagent handling and feeding.
- Concentrate thickening and storage.
- Concentrate pipeline operations, maintenance and risk management.
- Tailings disposal.
- Safety management.
- Maintenance management.
- Operations and maintenance staffing and supervision.

MAA indicated that it expects that further improvements in throughput, metal recoveries and operating costs, over and above those incorporated into its May, 2002 LOM Plan, should result from much of this work.

Based on the results of the reported metallurgical testing, reported plant performance to date and its own observations, Micon considers that the process metallurgical and cost inputs to the ore reserve calculations, MAA's May, 2002 LOM Plan and Micon's LOM Plan cash flow analysis are valid. Annual variations in the LOM plan inputs reflect the expected metallurgical response of the orebody, particularly harder and lower grade and gypsum bearing ores.

19.3 MARKETS

MAA's objective is to sell 90 % to 95 % of its concentrate production through frame contracts, with the balance for sale into the spot market. This should reduce the annual average treatment and refining charges and should provide short-term flexibility of production, sales and revenue against budget.

Sales and marketing operate from the port facilities, with a specialist consultant being retained for annual contracts exceeding 30,000 t, and MIM Japan retained through a negotiated sales agency agreement for annual contracts into the Far East and for general market intelligence in this region.

Micon considers that there should be no difficulty in marketing MAA's concentrate at the terms used in the 2002 LOM Plan and Micon's LOM plan cash flow analysis.

19.4 CONTRACTS

MAA employs several outside sources under contractual agreements, the principal of which are described below.

19.4.1 Mining

Mine haulage trucks and some ancillary equipment are maintained by Macroasa under a MARC agreement. Currently the contract involves 27 haulage trucks, with nine trucks maintained by MAA. The MARC agreement is based on 60,000 hours per unit, although a formal agreement with Macroasa/Caterpillar in January, 2002 has now specified the termination dates which are July 31, 2005 for the 793B fleet and July 31, 2006 for the 793C fleet. From then onwards, the trucks will be maintained by MAA, unless otherwise agreed.

MAA, Macroasa and Caterpillar have made commitments to ensure that the equipment fleet is supported by all parties. Issues under resolution include component rebuilds, workmanship, quality control on major components and also guarantee of parts supply by Macroasa. Currently MAA, Caterpillar and Macroasa are working together to resolve all of these issues and ensure that the availability targets of 89 % are reached for the LOM.

Shovels at Alumbreira are maintained by Bucyrus under a MARC agreement, which involves the four Bucyrus 495 shovels. The current term for the MARC agreement provides for 60,000 hours per shovel. Currently, the fleet average usage is approximately 30,000 hours, which means that the first shovel will terminate around 2007, with the others following thereafter, unless further agreement with Bucyrus is reached. The renegotiated agreement also ensures a 5 % reduction in the overall rate.

Currently, only six units of ancillary equipment are maintained by Macrosa, under the MARC agreement. These are three CAT 773 water carts, two CAT D10's and one CAT 988 loader, all of which are due to reach the agreed termination of 30,000 hours in the second half of fiscal 2003. The 2002 LOM strategy, from the termination date onward, is for the equipment to be maintained by MAA.

19.4.2 Power

A maintenance and service contract for the supply of electrical power from the National Grid, which has been in place for the last two years, recently has been renewed for another five years.

19.4.3 Concentrate Sales

As at May, 2002, MAA reported that it had thirteen frame contracts in place, including three with traders and three (two traders and one smelter) additional long-term contracts, established to cater to the increased production scheduled by the LOM Plan. The lowest annual commitment is for 10,000 to 40,000 t and the largest is for 100,000 t. The earliest contract expiry date is December 31, 2003 and the latest expiry date is September 30, 2008. Smelter locations are in Europe, India, the Far East, Canada and Brazil.

19.4.4 Concentrate Logistics

Nuevo Central Argentino (NCA), the railroad concessionaire, is under contract to operate MAA's concentrate trains between Tucumán and Rosario. The NCA contract is based on a peso per cycle rate and will be renegotiated due to the devaluation of the peso. MAA has a separate, US dollar based, contract with Siemens for maintenance of the locomotives and wagons.

Port operation and maintenance is currently performed by Terminal 6 S.A. (T6). MAA and T6 have two contracts in place, one for port operations and the other for a project lifetime land lease agreement. The annual land lease payment depends on whether T6 operates the port. The T6 contract also will be renegotiated due to the devaluation of the peso.

Shipping contracts are established annually, currently under consultation with Anderson Hughes in Buenos Aires, which is part of the same company used by MIM.

19.5 ENVIRONMENTAL CONSIDERATIONS

19.5.1 Permitting

Micon's understanding of the current status of the project's environmental liabilities and permits is based on information provided by MAA. Micon did not review a full suite of documentation regarding environmental liability and permitting. The required legislation in Argentina, currently, is not developed to the extent in other countries.

The main environmental permit is the original EIR, which was prepared to 1988 World Bank guidelines and was approved in 1997 as part of the project approval process. The EIR must be updated bi-annually as two separate reports for approval by the Tucumán and Catamarca provincial authorities. Micon understands that the 2001 EIR update was received and accepted by the provincial authorities. Other statutory environmental controls are the water license associated with the fresh water supply from Campo Arenal (Catamarca) and the filter plant discharge license (Tucumán).

In addition to the direct statutory controls, the UTE agreement and requirement for consultation with YMAD on strategic issues, including closure, impact on environmental management. The port facility is within the limits of and in conjunction with the operator, Terminal 6.

Third party auditors are utilized to review key environment areas such as tailings storage facility design, construction and management. Through MIM and the other shareholders, MAA conducts regular audits of its environment programs to ensure that corporate, community and statutory standards have been adequately identified and are being adhered to.

19.5.2 Compliance

Under the terms of the UTE agreement, commitments made in the EIR reside with MAA. In response to these commitments, MAA currently is implementing a revised Environmental Management System. Various initiatives have been taken, and are ongoing, to ensure compliance which is demonstrated by routine monitoring of air and water quality against background levels. Micon understands that the incidence of non-compliance has been generally excellent and it is considered that MAA is addressing the main issues in an appropriate manner.

Of particular significance is the commitment to zero discharge, which is implemented by intercepting and pumping back surface and near surface groundwater downstream of the tailings storage facility. Despite design considerations, a seepage plume has developed in the natural groundwater downstream of the facility, albeit currently well within MAA's concession, due to the area's complex structural geology. A series of pump back wells have been established to capture the seepage, which is characterized by high levels of dissolved calcium and sulphate. The pump back wells will be augmented over the life of the mine in order to contain the plume within the concession and monitoring wells will be provided for the Vis Vis River. Based on the latest ground water model, the pump back system will need to be operated for several years after mine closure.

The other potentially significant environmental risk lies with the concentrate pipeline. This pipeline crosses areas of mountainous terrain, significant rivers, high rainfall and active agriculture. Any rupture of the pipeline would pose an environmental risk from spillage of concentrate. Subsequently, control structures and river crossing protection have been, and continue to be, installed in order to minimise the risk of breakage and spillage, a program of geotechnical inspection has been implemented to monitor landslide risk areas, and routine physical surveillance of the pipeline route is carried out.

19.5.3 Reclamation and Closure

Although the fixed assets of the project revert to YMAD on final termination of commercial production, MAA is legally responsible for reclamation and closure costs in its capacity as operator of the UTE. MAA is committed to stabilizing tailings and waste rock against potential acid generation and water pollution and, to this end, is conducting progressive rehabilitation on the tailings storage facility and waste rock dumps. Other activities that have been committed to include contaminated land remediation, removal and stabilization of potentially acid generating road base material, securing pit safety and closure of infrastructure. The ultimate requirement is to achieve final landforms that do not require MAA's presence post closure.

MAA has prepared an Interim Mine Closure Plan in response both to commitments in the EIR and to meet the requirements of those existing shareholders who are signatories to the Australian Minerals Council Code for Environmental Management. MAA's closure planning is an ongoing process that is refined as operations plans are revised and operational and monitoring data are evaluated. Closure costs are revised on an annual basis. Micon considers that the assumptions used have given appropriate consideration to the full potential cost of closure, including complete rehabilitation of all project areas.

Ongoing rehabilitation is recognized as part of routine operations and associated costs are included in the project's financial plan. Testing is being completed in order to generate information regarding the potential for acid generation from waste materials, and initial testing of capping materials has been completed. Progressive rehabilitation commenced in 2002, with the placement of barren core material on final batters of the northwest waste dump. Micon considers that MAA has an appropriate acid rock drainage management plan.

19.5.4 Bond-Posting

MAA makes provisions for reclamation and closure in its May, 2002 LOM Plan, annual profit and loss statements and balance sheets, and in the final year cash flow statement. However, Micon understands that MAA is not required to post a bond and no cash provisions are being made.

19.6 TAXES

Two forms of taxation are borne by MAA, namely, income tax and IVA tax. The latter a value added tax, similar to the Canadian Goods and Services Tax (GST) and applicable to purchases at a rate of 21 %. Full reimbursements are available to mining companies. A net reimbursement, over the life of the mine, of US\$23.5 million is included in the projections of cash flow.

The mining industry in Argentina pays income tax at a rate of 30 %, as compared to 35 % for other industries. This rate is protected under a “Fiscal Stability Regime”, which also provides for favoured treatment in terms of special deductions for interest paid on foreign loans.

After the devaluation of the Argentine peso in January, 2001, the Senate introduced a resolution supporting the continuance of the “Fiscal Stability Regime”. The following explanatory paragraphs are quoted from the 2002 LOM Plan.

“In May 2001 the Senate passed a resolution relating to the following issues

- As a result of the accelerated depreciation under the Mining Investment Law, tax losses would not be lost by expiration if not utilised in the 5 year allowable time.
- Fiscal stability on Income Tax withholding rates on interest paid to off-shore banks and shareholders
- Fiscal stability withholding on distribution of income provided that no income tax has been paid on such income by MAA

“The official gazettement of this law is still pending confirming the above, however MAA’s 2001 income tax affidavit was lodged applying these changes. Further discussions on this law are not expected; the formal signing is currently in the backlog of administrative issues pending within the government.

“As a part of the introduction of the Emergency Exchange Reform Law 25661, the government granted a tax concession to companies realising losses on translating monetary USD items to pesos. This deduction is to be taken over a 5 year period.”

The section on taxation in the MAA 2002 LOM Plan is quoted in full as Appendix II to this report.

In its 2002 LOM Plan projections of cash flow, MAA has assumed the taxation treatment applicable under the “Fiscal Stability Regime”. Similarly, Micon has assumed an income tax rate of 30 % in its estimates of cash flow, included in the economic evaluation section of this report, and has utilised the available Tax Loss schedule computed by MAA. Some simplifying assumptions have been made in Micon’s estimates of taxation, which, while in total are greater, but not materially different, than those included in the MAA 2002 LOM.

Potential changes to the tax regime, resulting from the current Argentine political, economic and social crisis, are a risk to the estimated levels of future cash flow. However, it is not expected that any increased taxation would have a material effect on the value of the property, given the current fully developed stage of the operations and the high levels of projected annual cash flows. Also, it was reported by MAA that other major international companies have told the Argentine Government that elimination of the "Fiscal Stability Regime" would affect their decisions on future investments in the Argentine minerals industry.

19.7 CAPITAL AND OPERATING COST ESTIMATES

19.7.1 Capital Costs

The Bajo de la Alumbrera project was commissioned in 1998 after the expenditure of some US\$1.233 billion of project development capital. After additional capital expenditure of some US\$79 million in 1999, on-going annual sustaining and project capital has been expended since that time at a rate of approximately US\$26 million per fiscal year.

Some US\$29 million was expended in FY 2000, followed by US\$18 million and US\$30 million, in FY's 2001 and 2002, respectively, and with a further US\$29 million forecast to be spent in FY 2003. As at the end of March, 2003, some US\$12.3 million, of the total for FY 2003, had been expended.

Micon has accepted the MAA estimates of capital expenditure as input to its cash flow model. Micon has included closure cost as a capital expenditure of some US\$23 million, in year 2013, in dollars of 2002 value. It is understood that closure costs will be incurred after operations cease; this simplification renders a minor degree of conservatism to the economic evaluation. The capital estimates included in the Micon estimates of future annual cash flows are presented below in Table 19.4

Table 19.4
MAA Capital Expenditure, 2003 to 2012
(US\$ million of 2002 value)

Item	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Mining	13.6	10.3	4.8	4.8	4.2	5.1	1.7	2.1			46.6
Tailings Dam	2.8	2.8	2.4	2.4	2.4	2.3	2.3	2.2	2.2	0.1	21.9
Concentrator	3.3	2.6	1.8	1.8	1.6	2.1	1.3	1.4	2.1	1.8	19.8
Administration	0.29	0.28	0.32	0.32	0.14	0.3	0.13	0.15	0.05		2.0
Filter Plant, Rail, Port	0.69	0.22	0.19	0.19	0.15	0.08	0.81	0.35	0.16	0.05	2.9
Closure Cost										23.5	23.5
Total	20.6	16.2	9.5	9.5	8.4	9.9	6.3	6.3	4.5	25.5	116.7

¹ MAA 2002 LOM Plan Capital adjusted by Micon for one additional year of reserves. Totals may not add due to rounding

Mining

The major items of capital expenditure for mining consists of the purchase of loaders and haul trucks, as described in Section 19.1.3, which will be expended over the next three years. Other significant expenditures are required for pit dewatering wells, to be drilled and installed on a regular basis over the pit life. The balance of capital provides for geotechnical drilling and monitoring, GPS units for dispatch, and replacement of ancillary equipment.

Processing

The Processing Department capital budget consists of improvement and sustaining projects, some of which are ongoing for several years, particularly those associated with the tailings dam, the concentrate pipeline and the reclaim water system. Major items in the fiscal year 2002/2003, with a total budget of US\$5.5 million, in order of cost are as follows:

- Tailings dam construction stage nine.
- Concentrate pipeline. This is a sustaining project in an area of high business interruption and environmental risk, involving river-crossing defences, landslip control and maintenance and, possibly, an emergency pump station.
- Reclaim water system replacement. This is an improvement project for reduction of fresh water usage by maximizing the recycle of process water from the tailings dam.
- Grinding and gravity circuit operating improvement items.
- Grinding circuit and tailings dam maintenance sustaining items.
- Spare ball motor stator. The absence of a spare ball mill motor has been identified as a major business interruption risk.

In addition to the above items, the May, 2002 LOM Plan provides further sustaining capital of US\$37.5 million from 2004 to 2012 for tailings dam construction and the concentrator, and for sustaining capital of US\$3.5 million from 2003 to 2012 for the filter plant, rail and port facilities.

Administration

The major items of capital expenditure included in the Administration accounts, for fiscal 2003, cover requirements for camp enhancements and upgrades to IT systems and hardware replacement. In addition to these items, the 2002 LOM Plan provides further sustaining capital of US\$1.6 million, from 2004 to 2011, for camp refurbishments, periodic airport and airstrip upgrades and other miscellaneous items. This has been adjusted by Micon to account for one additional year of mine life resulting from the latest ALUG reserve estimate.

Based on its observations and discussion with MAA management, Micon believes that the capital provisions for the mining, process and other facilities in the LOM Plan and, as used in Micon's LOM cash flow analysis, are adequate.

19.7.2 Operating Costs

The current on-site operating costs were compared with estimates included in the 2002 LOM Plan cash flow estimates, and which have been used as a basis for estimating the costs in the Micon cash flow projections provided in the economic evaluation section of this report. These costs are included in the projections of cash flow under the functional headings of mining, concentrator and pipeline, filter plant and administration.

Operating costs have been significantly influenced by the depreciation of the Argentine peso, in January, 2002, and the impact of this is still being realised. Prior to that date, for ten years the peso had been fixed at parity with the US dollar. Since floating against other currencies, the Argentine peso to the US dollar currently is at a rate of 2.85:1. In its cost estimates included in the 2002 LOM Plan, MAA has assumed 100 % inflation of the peso for fiscal year 2003, with zero inflation (i.e., constant peso rates) thereafter. Actual inflation in Argentina subsequent to the preparation of the 2002 LOM Plan, has been significantly less than the projected annual rate. At the time of the Micon site visit in October, 2002, it was reported by responsible MAA personnel that inflation had reduced from levels prevailing earlier in the year.

The MAA Monthly Performance Report for April, 2003, recorded a monthly inflation of minus 3.19 % and a year-to-date total for the period July, 2002 to April, 2003 of 9.07 %. As a result, the actual costs in US Dollars for on-site, concentrate pipeline and rail, port and marketing costs, up to on-board ship (FOB), were US\$4.26/ t milled, some 22 % below the budget estimate of US\$5.45/t milled.

Table 19.5, below, compares actual operating costs for fiscal year 2002 with the average LOM estimates used in Micon's economic analysis, included in Section 19.8 of this report.

19.7.3 Mine Operating Costs

The mine will continue to be dominated by high haulage costs associated with a deepening pit and increasing haul distances. Drilling, blasting and loading unit costs remain relatively constant over the life of the mine, with total costs being volume dependent.

The largest components of the LOM operating costs include contractors' maintenance (MARC), diesel oil and grease, explosives, tyres, labour and components/spare parts for self perform maintenance, which collectively make up 76 % of all mine expenditure.

Tire costs average 7 % of the mine operating costs, representing a large proportion of the budget. The expected tire life of 5,000 hours is aggressive and its achievement will require diligent management attention.

Table 19.5
Actual Operating Costs for Fiscal Year 2003 Compared with LOM Estimates

		2003 1st Half	2003 2nd Half	LOM 2004	LOM Average
Mine Unit Costs	US\$/t moved	0.62	0.69	0.69	0.72
Mine Costs	US\$ '000s	36,202	38,990	89,617	627,655
Concentrator & Pipeline Unit Costs	US\$/t milled	1.53	1.49	2.47	2.46
Concentrator & Pipeline Costs	US\$ '000s	25,649	26,010	90,570	863,768
Filter Plant Unit Cost	US\$/t milled	0.04	0.04	0.05	0.05
Filter Plant Cost	US\$ '000s	600	747	1,943	16,514
Administration Unit Cost	US\$/t milled	0.40	0.43	0.55	0.54
Administration Cost	US\$ '000s	6,637	7,543	20,222	190,932
Total FOR Unit Cost	US\$/t milled	4.13	4.19	5.51	4.84
Total FOR Cost	US\$ '000s	69,091	73,288	202,351	1,698,868
Rail, Port & Marketing Unit Cost	US\$/t milled	0.18	0.23	0.33	0.29
Rail, Port & Marketing Cost	US\$ '000s	2,946	3,938	12,020	102,308
Total FOB Unit Cost	US\$/t milled	4.30	4.42	5.84	5.13
Total FOB Cost	US\$ '000s	72,037	77,226	214,371	1,801,176
Sea Freight Unit Cost	US\$/t milled	31.80	29.71	27.97	27.97
Sea Freight Cost	US\$ '000s	11,863	10,607	22,709	183,984
Total Unit Cost, incl. Sea Freight	US\$/t milled	5.01	5.02	6.46	5.66
Total Cost, incl. Sea Freight	US\$ '000s	83,897	87,835	237,081	1,985,160

Costs associated with self perform maintenance of trucks and ancillary equipment (9 % of total costs), such as components and spare parts (i.e., engines, power train and transmissions, drive trains, and hydraulics), increase with time. This is due to MAA gradually taking over responsibility for the maintenance of equipment from the MARC agreement with Macrossa.

The LOM explosives costs include the considerable savings realised from the recent MIM group agreement with Orica and the benefits from the dewatering program which has significantly reduced the use of wet product explosives.

It is recommended that further detailed cost reporting be introduced to provide mine management with an enhanced ability to effect cost controls.

19.7.4 Processing Costs

MAA has included processing operating costs equivalent to an average unit cost of US\$2.5/t of ore milled over the life of the mine. Based on actual fiscal year 2001/2002 and fiscal 2002/2003 year to April, 2003 costs, and allowing for MAA's inflation and exchange rates, Micon considers that the budgeted cost is reasonable.

Administration

Administration costs are projected to increase in 2004, related to enhanced camp facilities and, in real dollar terms, to remain constant thereafter.

19.7.5 Other Costs

Other off-site costs are incurred for transport of concentrate. The MAA forecast costs, of US\$11.63/t of wet concentrate, for rail transport to, and ship-loading at, Rosario, with sea freight costs averaging US\$31.07/t of wet concentrate.

Provincial and YMAD royalties are also imposed in addition to site and off-site costs. The Provincial royalty currently paid is some 2 % of net revenue after deduction of off-site smelter and refining charges. The YMAD royalty is 20 % of cash flows after all costs, debt service and recovery of initial productive capital expenditure. The projected base case cash flows do not trigger any payments of this royalty. Micon's estimates of annual cash flows, with base case metal prices increased by 10 %, indicate small payments commencing in 2011. However, in order to assist the local community, MAA has agreed to pay to YMAD an advance of US\$10 million, to be deducted from future royalty payments. A final US\$2 million of this amount is scheduled to be paid in fiscal 2003.

Micon considers that the process used by MAA for estimating future operating costs is sound. The operation has reached a relatively steady state condition which facilitates reliable cost forecasting, while the economic parameters outside the control of operating management remain stable. Accordingly, based on actual fiscal year 2001/2002 and fiscal 2002/2003 year to April, 2003 costs, and allowing for MAA's assumed inflation and exchange rates, Micon considers that the budgeted costs are reasonable.

19.8 ECONOMIC ANALYSIS

19.8.1 Method of Evaluation

The overall economic potential of the MAA operation has been evaluated using conventional discounted cash flow techniques. This procedure has been used for the purpose of estimating the financial returns expected to accrue to NOE as the owner of 12.5 % of the MAA mining, processing and concentrate transportation operations.

Discounted cash flow analysis requires that reasoned estimates be prepared of all the individual elements of cash revenue and cash expenditure, which will be associated with the initial development and construction of the project, as well as with ongoing operation up to the end of the projected life. The relevant estimates of production, revenue and cost, including overhead and taxes, used to compute estimates of future annual cash flow, have been discussed within the preceding chapters of this report and are summarized below.

All monetary amounts are expressed in constant US dollars of second quarter, 2003 value. Given the current estimate of ore reserves, the life of the operation is expected to be 10 years, up to 2013.

Recent project performance is compared with projections for the fiscal year 2003 and the LOM Plan averages in Table 19.6, below:

19.8.2 Resources and Reserves

The estimates of cash flow are based on mineral reserves as described above, in Section 17 above.

The December 31, 2002 proved and probable mineral reserve estimates, as discussed earlier are reported by MAA as 368 million t, grading 0.51 % Cu and 0.58 g/t Au. This reserve is estimated to support milling at a rate of some 37 million t/y, or slightly in excess of 100,000 t/d, for 10 years.

19.8.3 Production Estimates

The MAA operation will draw the majority of its economic value from the sale of copper and gold in concentrate. In addition, doré containing gold and silver is produced at site. Recovery of metal to bullion and concentrate is discussed in Section 19.2 of this report. In the estimates of future annual cash flow, metal recoveries to concentrate as estimated by MAA, which are considered reasonable by Micon, have been used. These, from year to year, are dependent on ore type processed, with average values over the life of the mine of 67.5 % and 4.8 % to concentrate and doré, respectively, and 90.7 % for copper. The production rates are based those projected by MAA in its May, 2002, LOM Plan. Micon has adjusted the production schedule to account for MAA reserves estimated at December, 2002 and actual production to April, 2003, and MAA forecasts to June, 2003.

Production is derived from ore mined at the Bajo de la Alumbrera open pit. It is assumed, in the estimates of annual cash flow, that the current mining rate of some 111 million t/y of ore and waste will increase to some 130 million t/y, by fiscal year 2004, and will continue at that level for four years, after which waste mining will diminish significantly. Ore will be mined from the pit until fiscal year 2011 and for a final two years, fiscal years 2012 and 2013, low grade ore will be reclaimed from stockpile for processing.

Table 19.6
Recent Project Performance Compared
With Fiscal Year 2003 and LOM plan Average Projections

	2001	2001	2002	2002	Jul 02- Apr 03	Jul 02- Apr 03	Life of Mine Plan (Based on Micon Input)	
	Actual	Budget	Actual	Budget	Actual	Budget	2004	LOM
Ore Mined								
Open Pit Ore Mined, 000 t			38,650		34,613	35,636	29,700	239,920,000
Waste Mined, 000 t			72,760		58,894	61,184	89,920	444,730,000
Total Mined, 000 t	111,160	112,826	111,400	115,266	93,507	96,820	119,620	684,650,000
Ore Milled								
Ex Stockpile, 000 t			1,000		2,651	0	10,300	142,840
Total, 000 t	28,055	28,047	30,060	31,398	27,967	30,377	36,710	350,920,000
Gold Grade, g/t	0.89	0.88	1.01	0.95	0.77	0.70	0.76	0.58
Copper Grade %	0.68	0.65	0.72	0.67	0.62	0.59	0.60	0.51
Recovery								
Total Gold, %	72.15	70.26	77.38	73.69	79.12	74.72	74.59	72.48
Gold in Bullion, %	4.06	4.00	4.94	3.9	6.82	4.98	5.09	4.76
Gold in Concentrate, %	68.09	66.26	72.38	69.79	72.30	69.74	69.50	67.71
Gold in Bullion, oz	32,718	32,456	55,503	37,571	50,243	33,760	45,657	313,583
Gold in Concentrate, oz	543,807	524,902	704,932	670,631	499,189	473,582	623,410	4,319,687
Total Gold Produced, oz	576,526	557,358	760,435	708,202	549,432	507,342	669,067	4,633,270
Copper Recovery, %	89.61	90.03	92.27	90.34	91.92	91.99	91.92	90.82
Copper Produced in Concentrate, t	169,857	164,109	200,086	190,387	158,909	164,084	202,463	1,640,281
Concentrate Grade, % Cu	27.83	27.72	27.58	27.71	27.01	27.67	27.70	27.70
Concentrate Grade, g/t Au	27.71	27.71	30.53	30.35	26.39	24.87		
Concentrate Produced, DMT	610,309	591,181	723,211	687,316	588,309	592,362	730,913	5,921,594
Net Revenue US\$ 000	379,659	403,336	448,170	439,261	350,911	343,204	475,444	3,627,366
Gold Price, US\$/oz	297.97	313.99	309.03	284.62	333.37	304.49	320	320
Copper Price, US\$/lb	82.31	86.29	68.93	77.86	0.72	0.72	0.80	0.80
Unit Cost FOR US\$/t milled	6.54	7.70	5.58	6.24	4.08	5.16	5.51	4.77
Unit Cost FOB US\$/t milled	7.01	7.20	5.95	6.67	4.26	5.45	5.95	5.14

19.8.4 Revenue Projections

The smelter terms and treatment and refining charges used in the estimates of cash flows are those included in the MAA 2002 LOM Plan estimates, which are based on historical experience. Concentrate smelting is estimated at US\$66/t of dry concentrate, while refining charges are

US\$0.066/lb of payable copper and US\$5.00/oz of payable gold in concentrate. The cash flow estimates utilize payable gold in bullion at 99.9 %, gold in concentrate at 96.8 % and copper in concentrate at 96.4 %. No allowance is made for the small amount of silver in bullion and concentrate, as this has no material effect on cash flow and hence project value.

For a base case estimate of future annual cash flows, a constant gold price of US\$320/oz and a constant copper price of US\$0.80/lb have been assumed. Formal supply and demand analyses have not been carried out by the authors in arriving at these assumed prices.

MAA's current gold hedging cover is as follows (see Table 19.7) and realises an average of US\$352 per ounce.

Table 19.7
MAA's Current Gold Hedging Cover

Year	Ounces	Average Price, US\$/oz	% Cover
2002/2003	145,000	350	23
2003/2004	100,000	354	17
2004/2005	50,000	354	9

Micon has used the above total ounces of hedged gold and prices in its projections of cash flow.

19.8.5 Debt Service

The original funding from the bank syndicate was US\$659,586,000. MAA reported that, at the beginning of fiscal year 2003, the amount outstanding of this senior debt was US\$358,368,000. In the May, 2002 LOM Plan, MAA projected that the senior bank debt would be fully repaid by fiscal year 2007. Because of lower than budget operating costs for FY 2003, above budget cash flow caused higher than projected special principal repayments to be made. In the MAA monthly report for April, 2003, it was reported that at the end of June, 2003, the outstanding debt would amount to US\$206,246,000. In its estimates of cash flow, Micon has utilized the interest and repayment schedule currently projected by MAA. This procedure renders a simplifying approximation in Micon's model in that the debt service payments do not vary as a function of the amount of cash flow available for debt service. However, the amounts of available cash flow are sufficiently large, at all reasonably foreseeable levels of metal price and operating cost, that it would be unlikely that the debt repayment schedule would have a material effect on the ultimate total free cash flow available for distribution to shareholders.

In the sensitivity case estimates of cash flow, the Micon model was modified to provide a scenario with a full sweep of available cash flow for accelerated debt repayment, with no distribution to shareholders until after full debt repayment. Under this scenario, for base case metal prices, the debt would be fully repaid in one year and, for the alternative with metal prices 10 % less than base case, full debt repayment would require some two years.

In the cash flow projection, included in the MAA 2002 LOM Plan document, it is stated that:

“MAA is able to make the first payments to Shareholders in FY 2004 of US\$68.6 million. This payment is the first payment against accrued interest owing to Shareholders. The first Principal repayment is in FY 2005 with Shareholder Subordinated Debt being fully repaid in FY 2007 according to the 2002 LOM Plan.”

In fact, MAA made the first payments to shareholders in FY 2003. A payment of US\$49.5 million was made to shareholders on May 31, 2003. This payment included interest on the Shareholder Subordinated Debt of US\$38.6 million.

Table 19.8
Shareholder Subordinated Debt Repayment Schedule

US\$ M	2004	2005	2006	2007	2008
Shareholders Loan Repayment		4.0	208.3	56.1	
Interest	68.6	69.7	16.2	3.2	
Dividends				2.9	454.7
Redemption of Preference Shares					228.5
Equity					65.8
TOTAL	68.6	73.7	224.5	62.3	749.0

Source: Table copied from MAA 2002 LOM Plan

It is understood that MAA anticipates that interest payments on shareholder loans will be less than forecast in the MAA 2002 LOM Plan, due to current expectations of lower interest rates and accrued interest paid to date. The estimated cash flows, presented in Table 19.9 include the lower interest payments totalling some US\$61 million.

19.8.6 Overall Cash Flow Projection

The overall base case cash flow projections for the MAA operation, based on the input estimates and assumptions discussed above, are presented in Table 19.9. These projections incorporate the currently reported mineral reserves of MAA. It can be seen that:

- Over its projected operating life of 10 years, at exchange and inflation rates projected by MAA, the operation is expected to generate a total undiscounted net cash flow, after senior debt service and available for distribution to shareholders, of some US\$1.12 billion, of which 50 % of BHPB's 25 % share would equate to approximately US\$140 million.
- The net present value of 50 % of BHPB's 25 % share of the projected future cash flows for the operation, at a discount rate of 10 % per year, is estimated at some US\$89 million. At a discount rate of 15 % per year, the net present value is reduced to US\$73 million.

The effects on operating cost and, hence, on cash flows of the foreign exchange rate and the escalation of the Argentine peso are significant. However, the absolute levels of the base case cash flows are so large that even significant changes in operating cost render less material changes in the current value of the Bajo de la Alumbrera property. As discussed earlier in

Table 19.9
Baio de la Alumbra Base Case Cash Flow

[illegible]

YEAR	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
OPERATING COSTS											
Mining											
Fixed Cost	19,200,000	19,200,000	19,200,000	19,200,000	19,200,000	19,200,000	19,200,000	19,200,000	19,200,000	19,200,000	19,200,000
Variable Cost	70,116,640	71,361,340	71,361,340	71,361,340	71,361,340	71,361,340	71,361,340	71,361,340	71,361,340	71,361,340	71,361,340
Cost of Sales	89,316,640	90,561,340	90,561,340	90,561,340	90,561,340	90,561,340	90,561,340	90,561,340	90,561,340	90,561,340	90,561,340
Concentrator & Pipeline Cost											
Fixed Cost	34,000,000	34,000,000	34,000,000	34,000,000	34,000,000	34,000,000	34,000,000	34,000,000	34,000,000	34,000,000	34,000,000
Variable Cost	50,570,710	50,570,710	50,570,710	50,570,710	50,570,710	50,570,710	50,570,710	50,570,710	50,570,710	50,570,710	50,570,710
Cost of Sales	84,570,710	84,570,710	84,570,710	84,570,710	84,570,710	84,570,710	84,570,710	84,570,710	84,570,710	84,570,710	84,570,710
Filter Plant Cost											
Fixed Cost	554,000	554,000	554,000	554,000	554,000	554,000	554,000	554,000	554,000	554,000	554,000
Variable Cost	1,245,000	1,245,000	1,245,000	1,245,000	1,245,000	1,245,000	1,245,000	1,245,000	1,245,000	1,245,000	1,245,000
Cost of Sales	1,799,000	1,799,000	1,799,000	1,799,000	1,799,000	1,799,000	1,799,000	1,799,000	1,799,000	1,799,000	1,799,000
Administration Cost											
Fixed Cost	20,222,000	20,222,000	20,222,000	20,222,000	20,222,000	20,222,000	20,222,000	20,222,000	20,222,000	20,222,000	20,222,000
Variable Cost	202,357,485	202,357,485	202,357,485	202,357,485	202,357,485	202,357,485	202,357,485	202,357,485	202,357,485	202,357,485	202,357,485
Cost of Sales	222,579,485	222,579,485	222,579,485	222,579,485	222,579,485	222,579,485	222,579,485	222,579,485	222,579,485	222,579,485	222,579,485
Rail Port & Marketing Cost											
Fixed Cost	3,520,000	3,520,000	3,520,000	3,520,000	3,520,000	3,520,000	3,520,000	3,520,000	3,520,000	3,520,000	3,520,000
Variable Cost	8,570,622	8,570,622	8,570,622	8,570,622	8,570,622	8,570,622	8,570,622	8,570,622	8,570,622	8,570,622	8,570,622
Cost of Sales	12,090,622	12,090,622	12,090,622	12,090,622	12,090,622	12,090,622	12,090,622	12,090,622	12,090,622	12,090,622	12,090,622
Sea Freight											
Fixed Cost	227,594,477	227,594,477	227,594,477	227,594,477	227,594,477	227,594,477	227,594,477	227,594,477	227,594,477	227,594,477	227,594,477
Variable Cost	257,057,424	257,057,424	257,057,424	257,057,424	257,057,424	257,057,424	257,057,424	257,057,424	257,057,424	257,057,424	257,057,424
Cost of Sales	484,651,901	484,651,901	484,651,901	484,651,901	484,651,901	484,651,901	484,651,901	484,651,901	484,651,901	484,651,901	484,651,901
Total Operating Cost											
Cost of Sales	218,357,218	218,357,218	218,357,218	218,357,218	218,357,218	218,357,218	218,357,218	218,357,218	218,357,218	218,357,218	218,357,218
Cost of Sales	555	555	555	555	555	555	555	555	555	555	555
Cost of Sales	218,357,773	218,357,773	218,357,773	218,357,773	218,357,773	218,357,773	218,357,773	218,357,773	218,357,773	218,357,773	218,357,773
Royalties											
Fixed Cost	9,528,878	9,528,878	9,528,878	9,528,878	9,528,878	9,528,878	9,528,878	9,528,878	9,528,878	9,528,878	9,528,878
Variable Cost	0	0	0	0	0	0	0	0	0	0	0
Cost of Sales	9,528,878	9,528,878	9,528,878	9,528,878	9,528,878	9,528,878	9,528,878	9,528,878	9,528,878	9,528,878	9,528,878
Other Miscellaneous Costs											
Fixed Cost	3,338,000	3,338,000	3,338,000	3,338,000	3,338,000	3,338,000	3,338,000	3,338,000	3,338,000	3,338,000	3,338,000
Variable Cost	0	0	0	0	0	0	0	0	0	0	0
Cost of Sales	3,338,000	3,338,000	3,338,000	3,338,000	3,338,000	3,338,000	3,338,000	3,338,000	3,338,000	3,338,000	3,338,000
Total Unit Op. Cost (incl. Royalties & Misc)											
Cost of Sales	227,895,991	227,895,991	227,895,991	227,895,991	227,895,991	227,895,991	227,895,991	227,895,991	227,895,991	227,895,991	227,895,991
Cost of Sales	1,095,720,735	1,095,720,735	1,095,720,735	1,095,720,735	1,095,720,735	1,095,720,735	1,095,720,735	1,095,720,735	1,095,720,735	1,095,720,735	1,095,720,735
Cost of Sales	1,205,616,725	1,205,616,725	1,205,616,725	1,205,616,725	1,205,616,725	1,205,616,725	1,205,616,725	1,205,616,725	1,205,616,725	1,205,616,725	1,205,616,725
Operating Cash Flow	267,275,857	163,381,302	152,500,236	97,330,316	147,385,525	289,372,586	216,436,036	228,039,613	28,413,287	1,214,123	7,765,625

YEAR	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
Capital Cost	US\$ 20,642,000	US\$ 10,535,000	US\$ 3,595,000	US\$ 5,575,000	US\$ 5,385,000	US\$ 9,355,000	US\$ 235,000	US\$ 6,886,000	US\$ 4,480,000	US\$ 2,930,000	US\$ 92,322,000
Fin. Variable & Const	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ 23,532,000
Cash Flow Before Tax & Debt Service	US\$ 225,637,857	US\$ 165,645,302	US\$ 142,805,285	US\$ 117,805,515	US\$ 119,000,558	US\$ 225,158,585	US\$ 3,523,000	US\$ 223,150,515	US\$ 31,952,257	US\$ 114,732,739	US\$ 1,324,897,525
Debt Service	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -
Senior Debt Balance	US\$ 2,824,000	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -
Shareholder Loans	US\$ 258,454,000	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -
Senior Debt Service Schedule (AM LOM)	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -	US\$ -
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000
Senior Debt Service	US\$ 30,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,000,000	US\$ 55,00	

Section 19.7.2 of this report, the MAA projections of operating cost, which Micon has used as a basis for its projections of cash flow, assume a 100 % inflation of the Argentine peso in fiscal year 2003 and a AR\$:US\$ exchange rate of 3.5:1. Prevailing inflation in peso-denominated costs is less than the 100 % forecast, for fiscal year 2003, by MAA, in its 2002 LOM Plan. At the end of April, 2003, an annualized rate of some 22 % was forecast by MAA. In Micon's projections of cash flow, adjustments have been made for a 22 % inflation of the Argentine Peso in FY 2003, with zero thereafter, and a Peso : US\$ exchange rate of 2.85.

19.8.7 Sensitivity Analyses

Sensitivity analyses have been performed to test the impact on project economics of changes in the price of the metals produced. Net present values, for the BHPB 25 % share of cash flows available to shareholders after full debt service, have been estimated for metal prices 10 % higher and lower than the base case prices.

The results of these analyses are summarized in Table 19.10. Detailed cash flow projections for the different scenarios are on file and available at NOE's offices in Vancouver.

Table 19.10
Sensitivity to Metal Price

Input Parameter	Total NPV (50 % of BHPB 25 %) (US\$ million)		
	0	10	15
Discount Rate, %			
Base Case Prices	140	89	73
Base Case Prices +10 %	173	110	91
Base Case Prices -10 %	106	66	54

19.8.8 Payback

Payback in the case of MAA is not considered meaningful. All of the initial project capital for developing the property has been expended and from year 2004 onwards the operation generates amply sufficient cash flow to cover all operating, sustaining capital and all debt service requirements.

19.8.9 Mine Life

In the base case projection, which utilizes the current mineral reserves available, the MAA operations cease in 2013. As discussed in Section 10, recent exploration drilling on the fringes of the mineralized area indicates that some potential exists to extend the life of the operations. However, any such extension is not expected to have a material affect on economic value.

20.0 INTERPRETATION AND CONCLUSIONS

While certain biases have been detected with the Alumbrera assay database, the only significant one is the copper grades from the IDEMSA drilling. MAA has removed these data from the database used to estimate resources at Alumbrera. The close overall reconciliation of the ore reserves to the milled tonnes and grade and grade control model lend confidence in the database used to estimate the ore reserves. Some month-to-month variation is seen in the reconciliation. However, this is inevitable given the difficulties in allowing for stockpiles and process inventory changes in a monthly metallurgical balance. While there may be some short-range variation in individual block gold grades from the block model, available data do not suggest that this is a problem.

Micon concurs with the procedures used by MAA for estimating the mineral resources and ore reserves at the Alumbrera mine. The Mineral Resources and Ore Reserves at Alumbrera have been appropriately estimated and categorized in accordance with the JORC Code.

It is Micon's opinion that the Measured and Indicated Mineral Resources prepared for the block model are individually the equivalent of the Measured and Indicated Mineral Resource categories as presented in the CIM Standards on Mineral Resources and Reserves, Definitions and Guidelines adopted on August 20, 2000. Micon is also of the opinion that the Proved and Probable Ore Reserves prepared by MAA staff and presented above are the equivalent of Proven and Probable Mineral Reserves under the same CIM standards.

The published Proved and Probable Ore Reserves as of December 31, 2002, total 368 Mt grading 0.51 % Cu and 0.58 g/t Au as presented in Table 17.12 in Section 17.3.2, Mineral Reserves. MAA has published no Mineral Resources for the Alumbrera mine.

It is Micon's opinion that NOE can use the ore reserves published for Alumbrera, by MAA, for any financial analysis of a proposed transaction to acquire 50 % of BHPB's interest in MAA.

This reserve will support mining at a rate, which will enable the supply of some 37 million t/y of ore for almost ten years. The existing mining, ore processing and transportation infrastructures are adequate to maintain this rate of production over the projected mine life.

The procedures adopted by MAA, for estimating future operating and capital costs, generally are considered by Micon to be appropriate. Some adjustments have been made by Micon in its estimates of future cash flow, included in Section 19.8, Economic Analysis, principally related to the estimates of future inflation of the Argentine peso.

Over its projected life of about ten years, the operation is expected to generate a total undiscounted net cash flow of some US\$1.12 billion, of which 50 % of BHPB's 25 % share amounts to some US\$140 million.

21.0 RECOMMENDATIONS

. As discussed elsewhere in this report, there are no identifiable factors that are outside MAA's control and which would preclude MAA's achievement of its forecast production and cost targets. However, some recommendations are made with regard to the open pit operations.

It is evident to Micon that mine management is well aware of the importance of equipment maintenance and some of the historical shortcomings. It is recommended that continued attention and diligent effort be given to both the existing MARC maintenance contracts and the MAA maintenance procedures.

At the time of Micon's site visit, it was reported that the dewatering rate was some 40 L/s and that in order to achieve the recommended water table level below mining, the pumping rate would need to be increased to 100 L/s. A hydrogeological model is being developed by Water Management Consultants, which was reported to be ready by the end of 2002. It is recommended that the dewatering program receives significant attention and continues to be implemented diligently.

Re-scheduling of the mining phases has rendered improvements in the ore release during the first three years of the LOM Plan. However, in fiscal year 2008, a major push-back of waste is required, in Phase 8, resulting in reduced ore production. This necessitates more stockpile recovery, at lower grade, to fill the mill and results in a lower annual mill feed grade and reduced economic performance. Continuing planning efforts are being made to reschedule the pit phases in order to smooth out the waste removal and ore release from Phases 6, 7 and 8, over that period. These efforts are fully supported by Micon, since the potential economic gain in fiscal year 2008 is significant.

Pioneering, currently, is a constraint. Purchase of smaller equipment, or hiring of a suitable contractor needs to be considered in order to improve the rate of pioneering, i.e., the excavation of the slopes of the surrounding mountains.

June 5, 2003

22.0 REFERENCES

- Brown, S., 1999a, 1998-99 Resource Definition Drilling Program, MAA Internal Report.
- Brown, S., 1999b, Density Values for Alumbrera Ore Types, MAA internal Memo.
- Cutfield, Freeman and Co. Ltd., 2001, Information Memorandum, Minera Alumbrera Ltd., Confidential Information Memorandum prepared for RTP and Billiton.
- Guilbert, J. M., 1995, Geology, alteration, mineralization, and genesis of the Bajo de la Alumbrera Porphyry Copper-Gold Deposit, Catamarca Province, Argentina, in Arizona Geological Society Digest 20, Porphyry Copper Deposits Of The American Cordillera, pp 646 – 655, edited by F.W. Pierce and J.G. Bolm, 656p., 43 papers, hardbound.
- Keough, D., 2002, June 30th, 2002 MAA Ore Reserve Statement, Resource/Reserve Statement for Publication, MAA memo to Joint Venture Partners.
- MAA Staff, 2001, Minera Alumbrera Limited, Project Technical Briefing (Updated December 2001), Minera Alumbrera Limited, The Bajo De La Alumbrera Copper-Gold Deposit, Province of Catamarca, Argentina.
- MAA Staff, 2002, MAA Life of Mine Business Plan, May 2002.
- Raymond, G. F., 1999a, Bajo de la Alumbrera Deposit Geostatistical Study, Part 2. Drill Hole Spacing Parameters for Orebody Modelling, Consulting Mining Geostatistician's Report to MAA.
- Raymond, G. F., 1999b, Bajo de la Alumbrera Soft Boundary Orebody Model with Cylindrical Searches and Conditional Probability, Consulting Mining Geostatistician's Report to MAA.
- Raymond, G. F., 2000, Bajo de la Alumbrera Geostatistical Study, ALUG Orebody Model Studies, Consulting Mining Engineer, Applied Mining Geostatistician's Report to MAA.
- Rivera, L. A., 1999a, Metodologia De Muestreo En Mina, MAA internal memo.
- Rivera, L. A., 1999b, ALUF Model Creation, MAA internal memo.
- Rivera, L. A., 2001, Throughput Model Presentation, MAA Internal PowerPoint Presentation.
- Rivera, L. A., 2002a, ReconciliacionJun2002.xls, MAA Year 2002 Reconciliation Spreadsheet.
- Rivera, L. A., 2002b, June 2002 Alumbrera Ore Resource and Reserve Statement, MAA internal memo.

Rivera, L. A., 2002c, Project Technical Briefing (Geology), Minera Alumbrera Ltd, Bajo De La Alumbrera Deposit January 1998, (Modified November 2002).

Rivera, L. A., 2002d, "01-Drilling2002ResultsAndBlockModel.ppt", PowerPoint presentation on the ALUG model and comparisons to ALUF, MAA internal document.

Rivera, L. A., 2002e December, 2002 Geology Dept. Monthly Report, MAA internal memo.

Van Order, C. R., 2002, Resource/Reserve Statement for Publication, December 31, 2002, MAA Joint Venture partnership memo.

23.0 CERTIFICATES

CERTIFICATE OF AUTHOR

As the author of a portion of this report on Minera Alumbrera Ltd. in which Northern Orion Explorations Ltd. is to earn an interest, I, H. Burgess do hereby certify that:

1. I am employed by, and carried out this assignment for,

Micon International Limited
Suite 900
390 Bay Street
Toronto, Ontario
M5H 2Y2

tel. (416) 362-5135
fax (416) 362-5135;

2. I hold the following academic qualifications:

B.Sc. (Mechanical Engineering)	London University	1966
B.Sc. (Mining Engineering)	London University	1968
M.Sc. (Engineering)	University of Witwatersrand	1980

3. I am a registered Professional Engineer with the Association of Professional Engineers of Ontario (membership number 6092506); as well, I am a member in good standing of several other technical associations and societies, including:

The Australasian Institute of Mining and Metallurgy (Fellow)
The Institution of Mining and Metallurgy (Fellow)
The Canadian Institute of Mining, Metallurgy and Petroleum (Member)

4. I have worked as a mining engineer in the minerals industry for 35 years;
5. I am familiar with NI 43-101 and, by reason of education, experience and professional registration, I fulfill the requirements of a Qualified Person as defined in NI 43-101. My work experience includes 13 years as a mining engineer working in mine planning and production operations in underground copper and gold mining and 22 years as a consulting mining engineer working in open-pit and underground operations involving many minerals and all aspects of mining from mine design to financial evaluation.;
6. I am responsible for the preparation of Sections 1 (portions), 2.0, 3.0, 4.0 (portions), 16.0 (portions), 17.0 to 20.0 (portions) and 21.0 of the technical report titled "Technical Report On Mining And Processing Assets Minera Alumbrera Ltd., In Argentina", and dated May, 2003, relating to the Minera Alumbrera properties. I visited the Minera Alumbrera data room from October 14 to 17, 2002. I visited the Alumbrera property from October 22 to 23, 2002;

7. I have reviewed the Minera Alumbra property previously, in 2002, in respect of a purchase of Rio Tinto's interest by Wheaton River Minerals.
8. I am not aware of any material fact, or change in reported information, in connection with the subject properties, not reported or considered by me, the omission of which makes this report misleading;
9. I am independent of the parties involved in the transaction for which this report is required, other than providing consulting services;
10. I consent to the filing of the report with any Canadian stock exchange or securities regulatory authority, and any publication by them of the report.

Dated this 17th day of June, 2003

"Harry Burgess"

Harry Burgess, P.Eng.

CERTIFICATE OF AUTHOR

As the author of a portion of this report on Alumbrera Ltd. in which Northern Orion Explorations Ltd. is to earn an interest, I, B. Terrence Hennessey do hereby certify that:

1. I am employed by, and carried out this assignment for,

Micon International Limited
Suite 900
390 Bay Street
Toronto, Ontario
M5H 2Y2

tel. (416) 362-5135
fax (416) 362-5135;
2. I hold the following academic qualifications:

B.Sc. (Geology) McMaster University 1978
3. I am a registered Professional Geoscientist with the Association of Professional Geoscientists of Ontario (membership number 0038); as well, I am a member in good standing of several other technical associations and societies, including:

The Australasian Institute of Mining and Metallurgy (Member)
The Geological Association of Canada (Fellow)
The Canadian Institute of Mining, Metallurgy and Petroleum (Member)
4. I have worked as a geologist in the minerals industry for 25 years;
5. I am familiar with NI 43-101 and, by reason of education, experience and professional registration, I fulfill the requirements of a Qualified Person as defined in NI 43-101. My work experience includes 6 years as an exploration geologist looking for gold, base metal and tin deposits, 11 years as a mine geologist in both open pit and underground mines and over 6 years as a consulting economic geologist;
6. I am responsible for the preparation of Sections 1 (portions), 3.0, 4.0 (portions), 5.0 to 15.0, 17.1, 17.3 (portions), and 20 (portions) of the technical report titled "Technical Report On Mining And Processing Assets Of Peak Goldmines, In New South Wales, Australia And Minera Alumbrera Ltd., In Argentina" and dated January, 2003 relating to the Peak Gold Mines and Minera Alumbrera properties. I visited the Minera Alumbrera data room from October 14 to 17, 2002. I visited the Alumbrera property from October 22 to 23, 2002;

7. I have reviewed the Minera Alumbrera property previously in 2002 in respect of a purchase of Rio Tinto's interest by Wheaton River Minerals;
8. I am not aware of any material fact, or change in reported information, in connection with the subject properties, not reported or considered by me, the omission of which makes this report misleading;
9. I am independent of the parties involved in the transaction for which this report is required, other than providing consulting services;
10. I consent to the filing of the report with any Canadian stock exchange or securities regulatory authority, and any publication by them of the report.

Dated this 17th day of June, 2003

"B. Terrence Hennessey"

B. Terrence Hennessey, P.Geo.

CERTIFICATE OF AUTHOR

As the author of a portion of this report on Minera Alumbrera Ltd. in which Northern Orion Explorations Ltd. is to earn an interest, I, David T. Wells, CEng do hereby certify that:

1. I am currently employed as a Senior Metallurgist by:

Micon International Co Limited
Suite 10, Keswick Hall
Norwich
NR4 6TJ
United Kingdom

tel. (44) 1603 501 501
fax (44) 1603 507 007

2. I graduated with the Associateship of Camborne School of Metalliferous Mining in 1966.
3. I am registered by or belong to the following professional associations:

The Engineering Council, United Kingdom (Registered Chartered Engineer, CEng)
The Institute of Materials, Mining and Metallurgy, United Kingdom (Member, MIMMM)
The American Institute of Mining, Metallurgical and Petroleum Engineers (Member, MAIME)
The Minerals Engineering Society, United Kingdom (Fellow, FMES)

4. I have worked as a metallurgist for a total of 36 year since my graduation from university.
5. I have read the definition of Qualified Person set out in National Instrument 43-101 (NI 43-101) and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience I fulfill the requirements to be a Qualified Person for the purposes of NI 43-101. My work experience includes 28 years as a production metallurgist at copper/gold, base metal and other mines and 8 years as a consulting metallurgist.
6. I am responsible for the preparation of Sections 1 (part), 4.0 (part), 15.0, 17.2, 17.3, 17.4 (part), 17.5, 17.7 (part), of the technical report entitled "Technical Report on Mining and Processing Assets of Minera Alumbrera Ltd., in Argentina" and dated May, 2003 relating to the Minera Alumbrera property. I visited the Minera Alumbrera data room on 16th October 2002 for two days and on 21st October 2002. I did not visit the Minera Alumbrera property

7. I have reviewed the Minera Alumbrera property previously in 2002 in respect of a purchase of Rio Tinto's interest by Wheaton River Minerals.
8. I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in the Technical Report, the omission to disclose which makes the Technical Report misleading.
9. I am independent of the parties involved in the transaction for which this report is required, other than providing consulting services.
10. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them, including electronic publication in the public company files on their websites accessible by the public, of the Technical Report.

Dated this 28th Day of May 2003.

"David T. Wells"

David T. Wells, CEng

APPENDIX I
MINERA ALUMBRERA TAXES

Taxes (quoted directly from the MAA 2002 LOM Plan)

Income Taxes

In May 2001 the Senate passed a resolution relating to the following issues

- As a result of the accelerated depreciation under the Mining Investment Law, tax losses would not be lost by expiration if not utilised in the 5 year allowable time.
- Fiscal stability on Income Tax withholding rates on interest paid to off-shore banks and shareholders
- Fiscal stability withholding on distribution of income provided that no income tax has been paid on such income by MAA

The official gazettement of this law is still pending confirming the above, however MAA's 2001 income tax affidavit was lodged applying these changes. Further discussions on this law are not expected; the formal signing is currently in the backlog of administrative issues pending within the government.

As a part of the introduction of the Emergency Exchange Reform Law 25661, the government granted a tax concession to companies realising losses on translating monetary USD items to pesos. This deduction is to be taken over a 5 year period. The loss realised at the point of devaluation in January for MAA this is AR\$(293) million that represents the revaluation of all USD denominated monetary items into Pesos at a rate of 1.4/1.

However under the Fiscal Stability Regime Exchange Losses are fully deductible in the year they are accrued. Therefore the exchange loss of AR\$(293) million is fully deductible in 2002. There also would be a further deduction of AR\$(844.1) million on revaluing the US based monetary assets from 1.4 rate to the assumed exchange rate at 30 June 2002 of 3.00/1 and this is also deductible in this year. Therefore in FY 2002 the full deduction for exchange losses on translating US denominated monetary assets and liabilities to pesos is AR\$(1137.1) million

The issue for MAA is that this deduction would give rise to tax losses of AR\$(958.8) million at 30 June 2002 which must be utilised over a 5 year period or they will expire. The issue is exacerbated by carried forward depreciation. MAA at 30 June 2002 will be carrying forward depreciation deductions of AR\$(777.5) million which are then used to reduce taxable income to zero. The ability to carry forward these depreciation deductions is limited to the useful lives of the underlying assets that are being depreciated.

In relation to the carried forward tax loss arising from the translation of US monetary assets and liabilities to pesos, MAA has until 2007 to absorb the tax loss remaining at 30/06/02 of AR\$(703.5) million. In the current Plan MAA will absorb the losses in years 2003 and 2004.

The depreciation deductions of AR\$(777.5) million would be suspended and applied to taxable profits beyond the above timeframe. MAA is able to absorb these deductions and does so predominantly in years 2004 to 2007.

MAA can elect to utilise the provisions of the Fiscal Stability Regime to lodge returns or apply the Current Income Tax Regime. However MAA must carefully analyse the two options, since the selected regime must be applied in its entirety.

The fundamental differences between the two regimes is as follows:-

Fiscal Stability

- Tax Rate = 30 %
- Interest on foreign loans e.g. Senior Lenders is fully deductible when accrued
- Interest on Shareholder loans is only deductible if accrued and paid prior to the lodgement of the Affidavit. i.e. interest accrued up to June 30 each year will be deductible that year provided payment has been made to the shareholders before November 9 of that year
- Withholding rates on interest is limited to 0 % for interest on financing for importing assets and 12 % for all other interest
- Exchange losses are fully deductible when accrued.

Current Regime

- Tax Rate = 35 %
- Interest on foreign loans is deductible when accrued subject to thin capitalization rules. Thin Capitalization rules restrict deductibility to 60 % of interest accrued if one of 2 criteria is fulfilled. This is the loans subject to thin capitalization do not exceed 2.5 times net equity of the company or the total interest does not exceed 50 % of taxable income base. Interest that is not deductible in a specific year can be carried forward for 5 years.
- Withholding on interest is 15.05 % for listed countries and 35 % in all others
- Exchange losses on translation on monetary items is deferred and deductible over 5 years (20 % each year)

Below are the preliminary results of both regimes being applied. Further detailed work is necessary in checking the tax written down values of the assets and the remaining useful lives to confirm the utilisation of the depreciation deductions under Fiscal Stability. The same is necessary to ensure the accuracy of the depreciation deductions under the current regime. Also it will be necessary to recalculate our prior year tax returns under the current regime to ensure tax losses carried forward are also accurate.

Fiscal Stability

Fiscal Stability		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Taxable Income/(Loss) after Timing	Pes 000's	517	414	251	486	303	861	1,183	808	90	92	-	-	-
Tax Losses Utilised		(517)	(414)	(251)	(486)	(95)	(32)	(29)	(26)	(20)	(25)	-	-	-
Fuel Tax Rebate		-	-	-	-	207	829	1,155	782	70	67	-	-	-
Total Taxable Income		-	-	-	-	207	829	1,155	782	70	67	-	-	-
Tax on Taxable Income	30%	-	-	-	-	62	249	346	235	21	20	-	-	-
Tax Loss Utilisation														
Losses expire after 5 Years														
Opening Balance		(704)	(186)	-	-	-	-	-	-	-	-	-	-	-
Additions	Pes 000's	-	-	-	-	-	-	-	-	-	-	-	-	-
Utilised	Pes 000's	517	186	-	-	-	-	-	-	-	-	-	-	-
Balance	Pes 000's	(186)	-	-	-	-	-	-	-	-	-	-	-	-
Losses Expired after 5 years	Pes 000's	-	-	-	-	-	-	-	-	-	-	-	-	-
Balance Carried Forward	Pes 000's	(186)	-	-	-	-	-	-	-	-	-	-	-	-
Tax Losses (Accelerated Depreciation Deductions)														
Opening Balance	Pes 000's	(777)	(829)	(665)	(487)	(55)	-	-	-	-	-	-	-	-
Additions	Pes 000's	(52)	(64)	(73)	(54)	(40)	(32)	(29)	(26)	(20)	(25)	-	-	-
Utilised	Pes 000's	-	228	251	486	95	32	29	26	20	25	-	-	-
Balance	Pes 000's	(829)	(665)	(487)	(55)	-	-	-	-	-	-	-	-	-
Losses Expired after	Pes 000's	-	-	-	-	-	-	-	-	-	-	-	-	-
Balance Carried Forward	Pes 000's	(829)	(665)	(487)	(55)	-	-	-	-	-	-	-	-	-

Current Regime

Current Regime		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Taxable Income/(Loss) after Timing	Pes 000's	459	356	192	428	303	861	1,183	808	90	92	-	-	-
Tax Losses Utilised		(459)	(356)	(192)	(428)	(301)	(32)	(29)	(26)	(20)	(25)	-	-	-
Fuel Tax Rebate		-	0	-	-	2	829	1,155	782	70	67	-	-	-
Total Taxable Income		-	0	-	-	2	829	1,155	782	70	67	-	-	-
Tax on Taxable Income	35%	-	0	-	-	1	290	404	274	25	23	-	-	-
Tax Loss Utilisation														
Losses expire after 5 Years														
Opening Balance		(675)	(216)	-	-	-	-	-	-	-	-	-	-	-
Additions	Pes 000's	-	-	-	-	-	-	-	-	-	-	-	-	-
Utilised	Pes 000's	459	216	-	-	-	-	-	-	-	-	-	-	-
Balance	Pes 000's	(216)	-	-	-	-	-	-	-	-	-	-	-	-
Losses Expired after	Pes 000's	-	-	-	-	-	-	-	-	-	-	-	-	-
Balance Carried Forward	Pes 000's	(216)	-	-	-	-	-	-	-	-	-	-	-	-
Tax Losses (Accelerated Depreciation Deductions)														
Opening Balance	Pes 000's	(777)	(829)	(754)	(635)	(261)	-	-	-	-	-	-	-	-
Additions	Pes 000's	(52)	(64)	(73)	(54)	(40)	(32)	(29)	(26)	(20)	(25)	-	-	-
Utilised	Pes 000's	-	139	192	428	301	32	29	26	20	25	-	-	-
Balance	Pes 000's	(829)	(754)	(635)	(261)	-	-	-	-	-	-	-	-	-
Losses Expired after	Pes 000's	-	-	-	-	-	-	-	-	-	-	-	-	-
Balance Carried Forward	Pes 000's	(829)	(754)	(635)	(261)	-	-	-	-	-	-	-	-	-

Total tax payable over the life of the operation under Fiscal Stability is AR\$933 million, which compares with the current regime where total tax paid is AR\$1016 million.

Therefore the best option for MAA is to remain with the Fiscal Stability Regime, and this has been assumed in this LOM Plan.

IVA

Following the devaluation in January 2002, MAA was able to continue to seek reimbursement of IVA related expenditure in US dollars. The government temporarily suspended reimbursement of US based claims while it resolved payment terms and exchange rates to be applied to a conversion to pesos. This was resolved in March 2002 and included the following.

- Claims made in US\$ would be payable in 19 equal instalments at the exchange rates prevailing on the 25th day of each month.
- Interest would be payable at 6 % on all approved claims as at January 7, 2002.
- No further claims can be lodged in US\$ after February 2002.
- Peso Claims would be continued to be paid as normal.

For MAA this will result in approximately AR\$22 million (approx.US\$7.0m) that was expected in 2nd half of 2002 being deferred into FY2003.