



**PRELIMINARY ECONOMIC ASSESSMENT  
FOR THE JARDIM DO OURO PROJECT, PARA STATE, BRAZIL**



**Technical Report NI 43-101**

**Submitted by**

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**Effective Date:**

June 28, 2012



**NCL Ingenieria y Contruccion Ltda.**

**June, 2012**

## CERTIFICATE OF QUALIFIED PERSON

I, **Carlos Guzmán**, Mining Engineer do hereby certify that:

1. I am Principal and Project Director with the firm NCL Ingenieria y Construccion Ltda, Santiago, Chile. My address is General del Canto 235, Providencia, Santiago, Chile.
2. This certificate applies to the technical report titled "Preliminary Economic Assessment for the Jardim do Ouro Project, Pará State, Brazil" dated effective June 28, 2012 (the "**Technical Report**") with respect to the Jardim do Ouro Gold-Copper Project in Pará State, Brazil (the "**Property**").
3. I am a practicing mining engineer and a member of the Australasian Institute of Mining and Metallurgy (AusIMM, No. 229036); and a Registered Member of the Chilean Mining Commission (0119).
4. I am a graduate of the Universidad de Chile and hold a Mining Engineer title (1995).
5. I have practiced my profession continuously since 1995.
6. 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.
7. I most recently personally inspected the Property in from March 12<sup>th</sup> to March 15<sup>th</sup>, 2012.
8. I am responsible for the preparation of sections 1 to 3, 13 and 15 to 27 of the Technical Report.
9. I am independent of Serabi Gold Plc as described in section 1.5 of NI 43-101.
10. I have had prior involvement with the Property, namely, I am a "qualified person" responsible for the preparation of portions of the technical report titled "Mineral Resource and Mineral Reserve Estimate for the Palito Mine, Pará State, Brazil, As At 31 March, 2008 ", dated September, 2008.
11. I have read NI 43-101 and the sections of the Technical Report for which I am responsible have been prepared in compliance with that instrument.
12. At the effective date of the Technical Report, to the best of the my knowledge, information and belief, the sections of the Technical Report for which I am responsible contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 28<sup>th</sup> day of June, 2012.

  
**Carlos Guzmán**

## CERTIFICATE OF QUALIFIED PERSON

I, **Rodrigo de Brito Mello**, Geologist, FAusIMM, do hereby certify that:

1. I am a consultant for the firm NCL Ingenieria y Construccion Ltda, Santiago, Chile. My address is Alameda da Serra 500, 315, Nova Lima, MG. My email address is rodrigo.brito.mello@gmail.com.
2. This certificate applies to the technical report titled "Preliminary Economic Assessment for the Palito Project, Pará State, Brazil" dated effective June 28, 2012 (the "**Technical Report**") with respect to the Palito Gold-Copper Project in Pará State, Brazil (the "**Property**").
3. I am a practicing geologist and a Fellow of the Australasian Institute of Mining and Metallurgy (FAusIMM, No. 209332) a registered Geologist with the Regional Council of Engineering, Minas Gerais, Brazil.
4. I am a graduate of the Universidade Federal de Minas Gerais and hold a Geology title (1985).
5. I have practiced my profession continuously since 1986.
6. 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 fulfil the requirements to be a "qualified person" for the purposes of NI 43-101.
7. I visited the Palito property on two occasions: July 2007, 2<sup>nd</sup> to 6<sup>th</sup>, August 2007, 6<sup>th</sup> to 12<sup>th</sup>.
8. I am responsible for the preparation of Sections 4 to 12 and 14 of this report.
9. I am independent of Serabi Gold Plc as described in section 1.5 of NI 43-101.
10. I have had prior involvement with the Property, namely, I am a "qualified person" responsible for the preparation of portions of the technical report titled "NI 43.101 Technical report for the Jardim Do Ouro Project, Pará State, Brazil ", dated December, 2010.
11. I have read NI 43-101 and the sections of the Technical Report for which I am responsible have been prepared in compliance with that instrument.
12. At the effective date of the Technical Report, to the best of the my knowledge, information and belief, the sections of the Technical Report for which I am responsible contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 28<sup>th</sup> day of June, 2012.

  
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**Rodrigo Mello**

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## **1 SUMMARY**

### **1.1 Introduction**

This technical report corresponds to a Preliminary Economic Assessment (PEA) of the Palito Project, located in the Tapajós Region, Northern Brazil. The Palito mine is part of the Jardim do Ouro property (JDO). The JDO property could be considered a Tier 1 property, according to the definition of Corporate Finance Manual, of the TSX.

JDO is a group of claims in the Tapajós valley, in the Brazilian Amazon, famous for its gold endowment. The property is formed by ten claims of different types, totalling 52,945 hectares.

Extraction of the mineral inventory at Palito could potentially be achieved using a selective underground open-stope mining technique. Treatment of the mineral inventory is proposed through an existing processing plant that includes crushing circuit, a milling circuit, and a flotation circuit followed by concentrate filtration and storage facilities. The flotation tailings are fed to a cyanide agitation leaching CIP plant, followed by elution and gold refinement circuits, to produce bullion. The tailings from the CIP circuit flow to detoxification tanks for neutralisation of cyanide, and are eventually pumped to a tailings storage dam situated 1.5km from the process plant.

Throughput rate of 250 tonnes per day is considered. Metallurgical testwork and historical production data indicate very high recoveries of both gold (90.7%) and copper (90%) from Palito mineralization. The projected precious metal production over the life of the Project is 194,000 ounces of gold and 3.5 million pounds of copper, with economic modelling (using the base case metal price assumptions of \$US 1,400 / ounce for gold and \$US 3.0 / pound for copper) indicating that gold is expected to contribute approximately 96% of the projected future revenue stream for Palito and copper the remaining 4%.

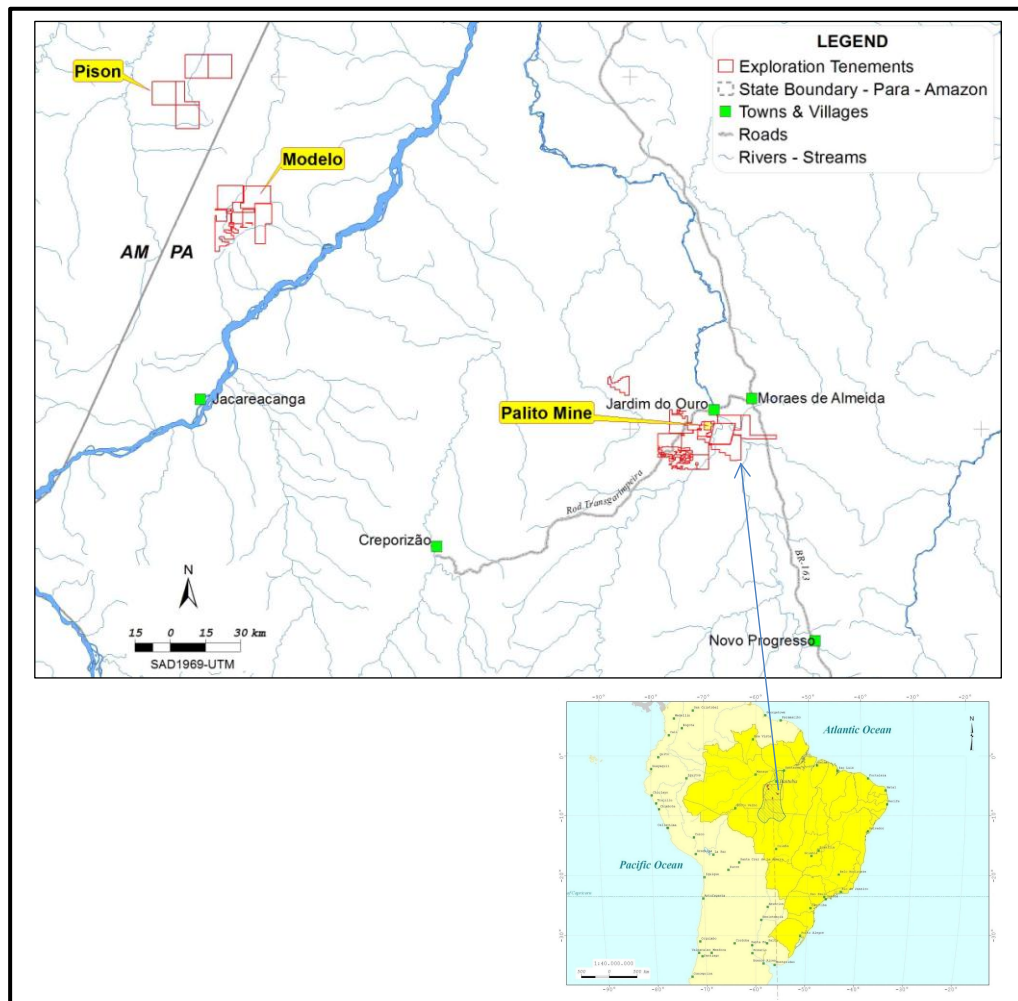
NCL Ingeniería y Construcción Ltda. ("NCL") was responsible for the compilation of information and preparation of the overall study. Significant contributions were also received from Ingeniería y Construcción AJG Limitada. ("AJG"; Metallurgy and Process Plant estimates) and WALM Engenharia e Tecnologia Ambiental Ltda ("Walm"; Tailings Storage Facility).

### **1.2 Property and Location**

The Jardim do Ouro property is located in the Tapajós Mineral Province in the south east part of the Itaituba Municipality in the west of Pará State in central north Brazil, near the eastern municipal boundary with the Novo Progresso Municipality (Figure 1.1).

The most important feature of the property is Palito Mine, which lays some 4.5km south-west of the village of Jardim do Ouro and approximately 15km via road. This village lies on the Transgarimpeira Road some 30km WSW of the town of Moraes de Almeida, located on the junction of the Transgarimpeira and the BR 163 or Cuiabá – Santarém Federal Highway. Moraes de Almeida is approximately 300km south south-east by road of the municipal capital and similarly named city of Itaituba.

**Figure 1.1 - Location and Access Map**



Serabi initially acquired the surface rights to the immediate Palito Mine area through a purchase agreement with the existing “garimpeiros” (artisanal miners) entered into in 2002 and since that time has acquired from other garimpeiros and/or farmers additional parcels of land with the intention of securing the surface rights. It has also entered into agreement with other parties for access rights in return for making monthly rental payments.

In total, these surface rights cover a total area of 981 ha out of the total Jardim do Ouro tenement holding of 52,945 ha. Of these surface rights 865 ha, lie within the mining license.

### 1.3 Geology and Mineralization

The mineralization control of the type found on the JDO property is related to the schematic mega-system of strike-slip faulting and riedel fracture systems of the Tapajós as described by the CPRM (2008) publication “Província Mineral do Tapajós: Geologia, Metalogenia e Mapa preliminar para Ouro em SIG”. The Palito mine veins appear to relate to intersection of “Y” and “P” and/or “R” (sinistral strike-slip) faulting on 305° and 315° and/or 295° orientations respectively within “R” 070° trending structural corridors.

In the Jardim do Ouro project mineralisation, where encountered, occurs as a similar style of veins as the Palito mine; however the host rock varies depending on locality. Mineralisation has been

encountered within the Rio Novo Gabbro, and within and along contacts with the sub-volcanic dikes in addition to the three host granites at Palito.

Bonanza gold grades are associated with massive chalcopyrite-pyrite blowouts within the quartz veins, typically on the on the intersection of “Y” or “P” and “R” veins. The principal vein system at Palito has a strike length in excess of 900m along broadly N306°, however this varies from N300° to N325° locally. Individual veins average widths of approximately one metre, varying between 20 cm and up to 4 m.

Secondary gold deposits are also encountered immediately above the mineralised veins, within the regolith profile. These deposits generally manifest themselves within the residual saprolite and laterite portions of the profile. These deposits are developed through the weathering process and often upgrade the primary gold grades within the narrow weathered vein through a supergene enrichment process, which also enlarges the footprint of the sulphide vein mineralisation.

The secondary deposits contain free primary gold within the oxidised sulphides in the vein material and free gold associated with the secondary iron oxides (goethite, hematite) along fractures and joint planes within the saprolite adjacent to the veins and in pisolites and lateritic cements at the paleo-surface above the vein.

The secondary deposits are generally not high tonnage deposits, as the residual saprolite profile is only around 5-8m depth, underlying up to 5m of barren transported cover. However they can be up to 10 times broader than the source mineralised vein, due to weathering dispersion of the gold

These saprolite deposits were favourably targeted by the garimpeiros (artisanal miners) as they contained enriched gold grades, manifesting as free gold, easily extracted by a gravity process.

#### 1.4 Exploration

Exploration in the Jardim do Ouro Project area commenced with RTDM from 1994 to 1997. Early work focused on testing the depth potential of the near surface garimpeiros in the primary sulphide zones. Six diamond drill holes were completed and the area surrounding the Palito Mine screened with surface geochemistry on surface soil, rock chip and rock grab samples. Preliminary geological mapping covered areas of readily accessible exposures and a broad spaced (300m line spacing) regional aeromagnetic survey was flown.

Serabi commenced exploration in 2002 with surface exploration, mapping, rock chip sampling and the initial stages of diamond drilling and shallow auger drilling. This exploration has been ongoing since 2003 and undertaken and managed by Serabi’s own exploration department. At various times since 2003 Serabi has augmented exploration with various programs of third party contractor drilling, geophysics including both airborne, terrestrial and down hole electrical and/or magnetic surveys. In addition various complementary studies on structure, lineament analysis, satellite imagery and petrology.

Table below is a summary of the exploration completed to date, except drilling which is covered in a later section.

**Table 1.1 - Exploration Summary**

Year	Company/Contractor	Activity
1994	RTDM	1031 spot soil samples
2003	Serabi	147m of post hole auger drilling (TRRN series holes)
2003	Fugro	Terrestrial geophysics including ground magnetics and dipole-dipole IP
2004	Serabi	11,116.78m of shallow auger drilling (TRJD series holes)

Year	Company/Contractor	Activity
2004	Fugro	Terrestrial geophysics including Fixed Loop electromagnetics and IP
2005	Serabi	1,368.47m in underground face sampling and gallery channel sampling
2005	Serabi	18 rock chips
2006	Serabi	1,713m in underground channel sampling
2006	Serabi	3,009.83m in post hole auger drilling
2006	Serabi	69 spot soil samples (35m auger drilling), 43 rock chips
2007	Serabi	590.75m in surface trenching
2007	Serabi	1,513 spot soil samples (756m auger), 7 rock chips
2007	Serabi	Ground magnetic survey
2007	Fugro	Fixed loop EM and down hole EM surveys
2008	Serabi	4,325.79m in underground channel and gallery sampling
2008	Serabi	836 spot soil samples
2008	Serabi	1,244.6m of deep auger drilling for 1206 samples
2008	Geotech/Microsurvey	6,650 line km of heliborne VTEM, magnetic and laser topography
2008	Senografia	Acquisition of SPOT 5 satellite imagery of Jardim do Ouro, Modelo and Pison Project areas
2009	Serabi	413m of surface trenching
2009	Serabi	977.18m of hard rock channel sampling
2009	Serabi	835.3m of auger sampling comprising 729 samples
2009	Serabi	Data compilation and integrated dataset modeling
2010	Fugro	45 line kms of dipole-dipole IP surveying
2010	Serabi	405m of surface trenching
2010	Serabi	168m hard rock channel sampling
2011	Geotech	1,221.28 line kms of heliborne VTEM, magnetic and laser topography covering 8,000 hectares
2011	Geomag S.A. (Fugro Group)	53.25 line km of ground based IP surveying on 200 m spaced traverses
2011	David McInnes (Montana GIS)	VTEM Modelling – profile interpretation and 3D modelling and depth slices
2011	David McInnes (Montana GIS)	IP Modelling – pseudo sections, model stacks, 3D modelling and depth slices
2011	David McInnes (Montana GIS)	Aeromagnetic processing and imaging- splicing and merging of aeromagnetic data, and production of images
2011	Serabi	Trenching/Costeaning – 771.5 metres completed with sampling every 1 metres
2011	Serabi	Augur Drilling comprising 515 metres of traverses at 5 metre spacings
2011	Serabi	Geological mapping – updating and revision of mapping detail surrounding Palito based on drilling and outcrop
2011	Serabi	Sampling of prospective garimpo tailings areas in the Palito valley
2011	Dr. Doug Mason Mason Geoscience	Petrology and Mineralogy – thin section preparation , description and interpretation of 20 drill core samples from the Piaui, Currutela and Copper Hill prospects

Year	Company/Contractor	Activity
2011	Dr. Brett Davies Olinda Gold	Structural geological assessment of the Palito deposit and the Jardim do Ouro project

## 1.5 Mineral Resource Estimation

The following table sets out the Company's Canadian Securities Administrators National Instrument 43-101 ("NI 43-101") compliant measured and indicated mineral resources of 224,000 ounces (gold equivalent) and inferred mineral resources of 444,000 ounces (gold equivalent) estimated as at March 2008 after which time some 22,500 ounces (gold equivalent) were produced from a combination of underground and surface oxide ore. It has been estimated 8,799 ounces of gold from 65,781 tonnes at gold grade of 4.70 g/t was produced from sources inside the mineral resource limits, with the larger balance coming from sources that did not form part of the resource calculation.

**Table 1.2 – Mineral Resources Estimate**

	Tonnage (ktonnes)	Gold (g/t Au)	Copper (% Cu)	Contained Gold (Ounces '000)	Contained Gold Equivalent (Ounces '000)
Measured Resources	97	9.51	0.26	30	32
Indicated Resources	754	7.29	0.23	177	192
Measured and Indicated Resources	851	7.54	0.23	206	224
Inferred Resources	2,088	5.85	0.27	393	444

- 1) Mineral resources are reported at a cut-off grade of 1.0 g/t.
- 2) Equivalent gold is calculated using an average long-term gold price of US\$700 per ounce, a long-term copper price of US\$2.75 per pound, average metallurgical recovery of 90.3% for gold and 93.9% for copper.
- 3) The Mineral Resources as set out in the above table have been estimated by Rodrigo Mello who is a competent person under NI 43-101.
- 4) The Palito Mine is wholly owned by Serabi Mineração SA, an indirectly held, wholly owned subsidiary of the Company. The gross mineral resources detailed above are therefore also the net mineral resources attributable to the Company. Serabi Mineração SA is the operator of the Palito Mine.
- 5) Numbers may not add up due to rounding.

## 1.6 Preliminary Mining Study

This study is based on NCL's March, 2008, mineral resource estimate for Palito Mine which includes Measured, Indicated and Inferred category mineral resources.

*The reader is cautioned that the mining study is part of a preliminary economic assessment that is preliminary in nature and includes Inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. There is no certainty that the preliminary economic assessment will be realized. No Mineral Reserves have been estimated.*

This study is categorised as a Preliminary Economic Assessment (PEA).

In general, Measured and Indicated mineral resources have been depleted as early as possible in the mining schedule and Inferred resources are depleted later in the Project life. The result of this is that the early years of the schedule contains predominantly Indicated resources while the final years are predominantly Inferred.

The mining rate of 250tpd (or 90,000 t/annum) was considered. Metal prices of US\$ 1,400/oz for gold and US\$ 3.0/lb for copper were used for estimating the mineral inventory.

Mining of the narrow, near-vertical gold veins at Palito is expected to be undertaken using a selective underground mining method.

A shrinkage open stoping method will be employed to mine the Palito high-grade mineralized veins underground. As the mineral resources are hosted in near vertical two dimensional tabular veins, the blocks considered for mining have been designed by increasing the vein width to a minimum mining width of 1.2m assuming that any additional material has zero grade. The ore-bodies have been divided into 30 x 30m panels, leaving six metre sill and rib pillars between blocks. This ensures a high degree of accuracy in drilling and blasting of the narrow high grade vein structures, resulting in low dilution and mineral losses.

The Palito gold project will employ a combination of contract and owner-operated underground mining. The selective open stoping will be undertaken by a mining contractor with relevant skills and track record in narrow vein mining.

The mining operations include trackless underground ramps and accesses, with lode development on each of the scheduled veins at 35metre vertical spacing. Sub-horizontal development will be mined by single boom electrohydraulic jumbos. Mining blocks will be developed above and below the block. Footwall drives and draw-points will be excavated to allow extraction of the stope mineralized material. Mucking will be by LHD scooptrams, and loaded into 20 tonne trucks at the ramp loading bays by larger front end loaders. The primary mining equipment will be owner-operated.

The total estimated mineral inventory is 740 thousand tonnes averaging 8.98g/t gold and 0.24% copper.

An underground mine production schedule for 250 tpd was developed, showing mineralized tonnes and grades by year for the life of the mine. The distribution of mineralization contained in each of mining units was used to develop the schedule, thus assuring that criteria such as adequate mineralization exposure, mining accessibility, and consistent material movement were met.

Table 1.3 shows the mine production schedule per year and per main sectors. It also shows the proportion per resource category.

**Table 1.3 – Mine Schedule**

Sector	Year	1	2	3	4	5	6	7	8	9	TOTAL
Palito Main Zone	kt	90	90	90	70	-	-	-	-	-	340
	Au g/t	9.58	8.45	9.96	6.08	-	-	-	-	-	8.66
	Cu %	0.23	0.18	0.21	0.23	-	-	-	-	-	0.21
Palito West	kt	-	-	-	-	-	20	90	2	-	113
	Au g/t	-	-	-	-	-	8.95	11.05	32.20	-	11.13
	Cu %	-	-	-	-	-	0.18	0.25	0.78	-	0.25
Chico da Santa	kt	-	-	-	20	90	69	-	-	-	179
	Au g/t	-	-	-	11.91	6.89	6.61	-	-	-	7.33
	Cu %	-	-	-	0.61	0.28	0.25	-	-	-	0.30
Ruari's Ridge	kt	-	-	-	-	-	-	-	87	21	108
	Au g/t	-	-	-	-	-	-	-	10.72	9.43	10.47
	Cu %	-	-	-	-	-	-	-	0.20	0.30	0.22
TOTAL	kt	90	90	90	90	90	90	90	90	21	740

Sector	Year	1	2	3	4	5	6	7	8	9	TOTAL
	Au g/t	9.58	8.4	10.0	7.4	6.9	7.1	11.1	11.3	9.4	8.98
	Cu %	0.23	0.18	0.21	0.32	0.28	0.23	0.25	0.21	0.30	0.24
	Measured	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%
	Indicated	25%	57%	57%	37%	13%	23%	33%	5%	0%	30%
	Inferred	75%	43%	43%	61%	87%	77%	67%	95%	100%	70%

## 1.7 Mineral Processing and Recovery Methods

The Palito project has a fully implemented process plant that operated continuously producing copper–gold concentrate and bullion for almost five years, from September 2004 until mid-2010. During this period of time, the plant was fed with 575,000 tonnes of ore, of which 85% came from underground portion of the Palito Mine at the Palito Main Zone area. The rest came from small scale near surface open pit mining.

The plant when previously operated had a capacity to process over 600 tpd of sulphide material; however in this PEA process rate is limited to 250 tpd, offering the potential for substantial surplus capacity in the plant. Additional mill feed opportunities are being investigated.

The process flow-sheet comprises a crushing circuit, a milling circuit, and a flotation circuit followed by concentrate filtration and storage facilities. The flotation tailings are fed to a cyanide agitation leaching CIP plant, followed by elution and gold refinement circuits, to produce bullion.

The tailings from the CIP circuit flow to detoxification tanks for neutralisation of cyanide, and are eventually pumped to a tailings storage dam situated 1.5km from the process plant.

## 1.8 Site Infrastructure

**Power Supply** – the Palito mine-site has been supplied with mains grid power to site for over six years. The Power supply is available from the regional electrical utility company, CELPA (Centrais Elétricas do Para) and the immediate area is served by several hydroelectric power plants. A demand requirement in the order of 1.2mW was estimated for 250 tpd throughput rate, some 0.4mW less than when the mine was in production during 2003-2010. The project also has a back-up power plant capable of delivering 1.0mW of power if required.

**Water Supply** - the site has an abundance of water, with adequate water storage for all mining and processing needs in numerous water dams. Mine camp water is drawn from boreholes.

**Camp** - Serabi has established a full mining camp at the Palito Mine. The camp consists of accommodation for the personnel, offices, warehouses, maintenance facilities, and a medical centre operated by qualified personnel. The accommodation facilities consist of four units that can host up to 250 people. Workshops and warehouses are adequate. Fuel is stored on site in storage tanks with an approximate capacity of 90,000 litres of diesel. All of the fuel storage tanks are located in a contained fuel storage area. There is an explosives storage facility located away from the main offices usage of which has been suspended whilst the mine itself has been on care and maintenance.

There is a well-equipped laboratory on site, currently maintained but not in use. The site is self-sufficient for most of the required services. The mine has access to radio telephones (two lines), high speed broadband satellite internet within a secure domain, two telephone land lines and radio communications. Serabi has the facilities to provide catering services for all the personnel.

Serabi contracts its own security service. There is a guard house at the entrance to the mine.

**Access Roads and Air Strip** - the mine is accessed by unsealed road from the nearest town of Jardim do Ouro and delays can be expected during the wet season. An airstrip, suitable for light planes, was implemented in 2006, and is currently fully operative. Serabi owns sufficient bulldozers, front end loaders and trucks which are used for site construction, road building and road maintenance.

## **1.9 Project Implementation**

Subject to project financing, mine development start-up is expected in the fourth quarter of 2012, with ore processing set to commence during the third quarter of 2013.

The project development will begin with the de-watering of part of the existing mine, followed by development of the Palito Main Zone and Palito West sectors. Mine deepening will then follow with subsequent mine development generating an ore stockpile. During the twelve months commencing with the start of the mine de-watering, the existing plant will be refurbished where required, with the main areas of work being renovation of the flotation plant and Cyanide in Pulp plant ("CIP").

## **1.10 Environmental Permits**

During 2007, on submission of the 'Plano de Aproveitamento Econômico' (PAE) to the DNPM, Serabi successfully converted exploration license 850.175/2003 into a mining concession. The mining concession itself is granted for an indeterminate period of time, however the award of a mining concession is subject to certain conditions. It is also required that an annual environmental 'Licença do Operacao' (LO) is obtained. The LO is generally renewed annually subject to compliance with environmental matters.

The Palito Mine has valid operating permits that allow both exploration and operating activities to take place. The key permit, the LO Protocol #2711/2008 issued by Secretaria de Estado de Qualidade Ambiental (SEMA), was last renewed April 27<sup>th</sup> 2012.

The license allows the extraction and processing of gold and associated minerals in the mine license area of 1,712ha up to a maximum rate of 700 tonnes per day.

Other valid permits include:

- 1) Cadastro Ambiental Rural (proof of land ownership and use for industrial purposes) – Protocol # 12787/2010 – issued by SEMA
- 2) Outorga (license to extract water for industrial use) valid until 12/01/2013 and issued by SEMA - #193/2010
- 3) Anexo - Outorga (license to extract water for domestic use) valid until 12/01/2013 and issued by SEMA
- 4) License to Procure, Store, Use Explosives at site - # 1871 issued by Ministry of Defence valid until 31/10/2013

## **1.11 Capital and Operating Costs Estimates**

The total estimated initial capital cost of the Project is US\$ 17.8 million, which comprises i) US\$ 7.6 million to fund the mine de-watering, the acquisition of the necessary mobile fleet, ramp development and stope preparation activities in the first year prior to the start -up of the plant, ii) US\$ 7.9 million for plant replacement/refurbishment and initial tailings management, iii) US\$2.3 million is considered necessary for mine-site overhead costs ("G&A") during this same period.

Sustaining capital expenditure during the operation totals US\$26.4 million, including US\$17.1 million for continued underground capital development, fleet overhaul and replacement, and the overhaul of key some surface infrastructure during the project life. US\$7.25 million is considered for future

tailings management facilities and a US\$2.0 million provision has been included at the end of the project to cover estimated mine closure costs.

Table 1.4 summarize the total initial and sustaining capital expenditure requirements.

**Table 1.4 – Capital Expenditure Summary**

Category	Initial Capital (US\$m)	Sustaining Capital (US\$m)	Total Capital (US\$m)
Underground mining equipment, Development & pre-production operations	7.64	17.13	24.77
Pre-production overhead	2.27		2.27
Plant	7.13		7.13
Tailings Storage Facility	0.75	7.25	8.00
Closure		2.00	2.00
<b>TOTAL</b>	<b>17.79</b>	<b>26.38</b>	<b>44.17</b>

The LOM average operating cash cost is US\$549 per gold equivalent ounce or US\$150 per tonne of ROM. The total cash cost per gold equivalent ounce including refining and treatment costs plus government royalties (CFEM) is US\$738.5. The breakdown of Serabi's mining, processing and general and administration costs are presented in Table 1.5.

**Table 1.5 – Operating Cost Summary**

	US\$ / oz (AuEq)	US\$ / tonne
Mining Ore	257.3	70.0
Process Plant	138.8	37.8
G&A	152.9	41.6
Op. Cash Costs	549.1	149.4
Refining Costs	171.9	
Royalties (CFEM)	17.5	
Total Cash Costs	738.5	

## 1.12 Economical Analysis

The cash flow model is based on the mine production and processing schedule, associated gold grades, metallurgical recoveries and capital and operating costs. The economic analysis assumes delivery of a copper concentrate to an appropriate refinery located outside of Brazil which accounts for approximately 78% by volume of the estimated gold production with the balance being delivered in the form of gold doré to gold traders and refiners located in Brazil. NCL has assumed that overall treatment and refining and insurance charges will account for 9.5% of the value of the concentrate delivered to the refinery whilst a 3% fee has been assumed for the costs of refining gold doré.

The base case economic analysis assumes a gold price of US\$1,400 per ounce and a copper price of US\$3.00 per pound.

The average gross gold revenue per year is US\$32.9 million for the first 8 years of production with copper credits representing additional average annual revenues of US\$1.3 million over the same period. The average annual free cash flow after accounting for taxes and sustaining capital expenditure is estimated to be about US\$11.0 million.

**Table 1.6 – Economical Valuation Results Summary**

Financial Model	US\$ 1,400/oz Au - US\$ 3.0/lb Cu
NPV <sub>0</sub> pre-tax	US \$ 89.0 M
NPV <sub>0</sub> Free Cash flow (after tax)	US \$ 72.2 M
NPV <sub>5</sub> pre-tax	US \$ 64.2 M
NPV <sub>5</sub> Free cash flow (after tax)	US \$ 52.0 M
NPV <sub>10</sub> pre-tax	US \$ 47.3 M
NPV <sub>10</sub> Free cash flow (after tax)	US \$ 38.2 M
IRR pre-tax	78%
IRR Free cash flow (after tax)	68%
Years to payback from start of production (at 0% discount)	1.27
Years to payback from start of production (at 5% discount)	1.37
Years to payback from start of production (at 10% discount)	1.49

(\*) Equivalent gold is calculated using the referred gold and copper prices, average metallurgical recovery of 90.7% for gold and 90.0% for copper.

### 1.13 Conclusions

The project is a return to the initial and successful period of operation for Palito which was undertaken during 2005 and 2006 prior to switching to bulk mining as a means to increase gold production. During these two years the company averaged mining rates of 250 tpd delivering ore to the plant at an average gold grade of 9.35 g/t, very similar to what is envisaged under the PEA.

Highlights of the Palito PEA are as follows:

- After-tax Internal Rate of Return (“IRR”) of 68% at a realised gold price of US\$1,400 per ounce;
- Net after-tax cash flow generated over project life of US\$72.2 million at a realized gold price of US\$1,400 per ounce.
- After-tax Net Present Value (“NPV”) of US\$38.2 million; based on a 10% discount rate and a realised gold price of US\$1,400 per ounce;
- Average Life of Mine (“LOM”) cash operating costs of US\$739 per ounce (gold equivalent) including royalties and refining costs;
- Average annual free cash flow (after tax and sustaining capital expenditure) of US\$11.0 million;

- Average gold grade of 8.98 g/t gold producing a total gold equivalent production of 201,300 ounces;
- Average annual production of 24,400 gold equivalent ounces over the initial 8 year period with ranges between 19,000 to 30,000 ounces gold equivalent per annum;
- Initial capital expenditures of US\$17.8 million prior to production start-up;
- Sustaining capital expenditures of US\$26.4 million to be funded from project cash-flow;
- Measured and Indicated mineral resource inventory of 69,000 gold equivalent ounces, supported by a further Inferred resources of 153,000 gold equivalent ounces from a total geological resource of 224,000 measured and indicated gold equivalent ounces and 444,000 inferred gold equivalent ounces, to be produced by underground open stoping using a cut-off grade of 3g/t gold;
- Total Life of Mine of 9 years;
- Subject to project financing , mine development start-up is expected in the fourth quarter of 2012, with ore processing set to commence during the third quarter of 2013.

#### **1.14 Recommendations**

- Continue the current well balanced drilling strategy of targeted infill drilling to increase resource confidence and extensional resource definition drilling at known prospects to add additional mineral resources;
- Continue mine engineering and planning studies to define and confirm the economic viability of the Project, and move towards development stage;
- Continue mining studies to refine the current mining model and identify the optimum tonnage throughput that yields the best compromise between profitability and practicality;
-

## **2 INTRODUCTION**

During March 2012, Serabi Gold PLC (Serabi) retained the services of NCL Ingeniería y Construcción Ltda (NCL) to prepare a Preliminary Economic Assessment Technical Report (PEA) for its 100%-owned Palito Gold Project (“Palito” or “the Project”), located in Para State, Brazil.

This report is largely based on two previous technical reports produced by NCL and dated September, 2008 and December, 2010. In the 2008 report, reserves were disclosed, based on a mine plan produced by NCL and on metallurgy results routinely obtained in the processing plant. However, during 2008 an unforeseen delay in essential capital equipment severely damaged the company’s ability to properly develop the mine ahead of production. Ultimately this led to the operation requiring a sustained period of mine development by late 2008. This could only be achieved with additional working capital, which was generally unavailable at the time, due to the global financial crisis which had undermined access to new capital. As a result, the decision was taken to suspend mining activities, with the mine put into care & maintenance in December, 2008. These historical reserves are reported for public information and do not comply with the CIM definition for mineral reserves, due to the need of additional studies to assure the feasibility of economic exploitation. The second report published during 2010 was generated to demonstrate the feasibility of the known mineral resources in the Palito mine, as well as the exploration potential of the Jardim do Ouro property, as a whole. The 2008 mineral resources were restated in the 2010 report as the minor production post March 2008 was negligible and largely from outside the mineral resource limits.

The mineral resources reported in this PEA are CIM compliant and continue to restate the mineral resource as stated 31<sup>ST</sup> March, 2008. A mine schedule is presented, to support the assumption that the mineral resources reported have reasonable prospects of economic extraction.

In preparing this report, NCL relied on reports, studies, maps, databases and miscellaneous technical papers listed in the References section of this report. Additional information and data for NCL’s review and studies were obtained from Serabi on site.

### **2.1 Terms of Reference**

The scope of work of the original 2008 and 2010 technical reports included an initial review of the available information, assistance in respect to aspects of sample quality; interpretation (together with the Serabi’s geological team) and preparation of the geological model; resource estimate; mine scheduling; and the preparation of the Report. For the present report, five NCL personnel carried out a full site visit from March 12<sup>th</sup> to March 15<sup>th</sup> 2012. During this visit, the status of all exploration, operational and infrastructure changes since 2008 and 2010 reports were assessed.

NCL have conducted numerous site visits to the property between the period July 2007 and March 2012. Rodrigo Mello, Consulting Geologist and Geostatistician completed the initial site visit from 3 to 7 July 2007. In this visit, besides the familiarization with the geology and site conditions, the laboratory was visited and aspects of Quality Control were discussed. Mr Mello returned to the site in August, 2007, to start up the geological interpretation together with the site geologists. Two other geologists from NCL were also involved, visiting the mine four times. Their main duties were related to work with mine staff in the geological interpretation and 3D model construction, besides database reviews and checks.

A further visit by senior NCL consultants took place during September 24 to 26, 2010. The focus of the visit was to assess the production that took place at the Palito Mine after NCL’s Technical report of September 2008, and to review the current status of the project.

During March 12-16<sup>th</sup> 2012, a team of five senior NCL consultants visited the property, in order to review the status of all geological, exploration, operational and infrastructure changes that have

occurred since the effective dates of the previous technical reports of 2008 and 2010. Database validation, preparation of vertical geological interpretation solids modelling and geostatistical analysis of the drill hole data were conducted. An assessment was also made of the quality of these data relative to industry standard practices. Much attention has been paid to the condition of the mine and plant infrastructure, considering that it has been in care and maintenance for some time.

NCL is not an associate or affiliate neither of Serabi, nor of any associated company, or any joint-venture company. NCL's fees for this Technical Report are not dependent in whole or in part on any prior or future engagement or understanding resulting from the conclusions of this report. These fees are in accordance with standard industry fees for work of this nature, and NCL's previously provided estimates are based solely on the approximate time needed to assess the various data and reach appropriate conclusions. This report is based on information known to NCL as of March 16<sup>th</sup>, 2012.

## 2.2 Frequently Used Acronyms, Abbreviations, Definitions, and Units of Measure

All measurement units used in this report are metric, and currency is expressed in US dollars, unless stated otherwise. The currency used in Brazil is the Real (BR). Frequently used acronyms and abbreviations are listed in Table 2.1.

**Table 2.1 - Frequently used acronyms and abbreviations**

Abbreviation	Meaning
AAS	atomic absorption spectrometry
Ag	Silver
Au	Gold
Cu	Copper
g/t	grams per metric tonne
ha	Hectare
Hg	Mercury
ICMC	International Cyanide Management Code
km	Kilometers
l	liters
m	meters
masl	meters above sea level
oz, koz, Moz	ounces, thousands of ounces, million of ounces
Pb	Lead
ppm	parts per million
QA/QC	quality assurance and quality control
RC	reverse-circulation drilling method
RQD	rock-quality designation
Sb	antimony
°T	degrees relative to true north
t, kt, Mt	tonnes, kilotonnes, million tonnes
t/y	tonnes per year
tpd	tonnes per day
US\$	US Dollars
Zn	Zinc
£	United Kingdom pounds
µm	micrometer
µS/cm	micro Siemens per centimeter

### **3 RELIANCE ON OTHER EXPERTS**

The results and opinions expressed in this report are based on NCL's field observations and the geological and technical data listed in the References (Section 27). While NCL has carefully reviewed all of the information provided by Serabi and believes the information to be reliable, NCL has not conducted an in-depth independent investigation to verify its accuracy and completeness.

The authors have not reviewed any legal issues regarding the land tenure, or Serabi corporate structure nor independently verified the legal status or ownership of the Property. NCL has relied upon opinion supplied by Serabi. The authors have not reviewed issues regarding Surface Rights, Road Access, Permits and the environmental status of the Property and have relied upon opinions supplied by Serabi representatives.

The item concerning metallurgical process have been prepared by NCL, however one should remember that the Palito ore has been subject to several metallurgical test-work programs before and during production. The full scale metallurgical plant at site operated almost continuously at the Palito Mine from Q3 2004 to Q2 2010, during which time approximately 575,000 tonnes of ore processed, and approximately 100 Koz of Au produced and therefore is plenty of hard data on the metallurgical behaviour of the project's mineralized material.

The results and opinions expressed in this report are conditional upon the aforementioned geological, costing and legal information being current, accurate, and complete as of the date of this report, and the understanding that no information has been withheld that would affect the conclusions made herein. NCL reserves the right, but will not be obliged, to revise this report and conclusions if additional information becomes known to NCL subsequent to the date of this report. NCL does not assume responsibility for Serabi's actions in distributing this report.

## 4 PROPERTY DESCRIPTION AND LOCATION

### 4.1 Location

The Jardim do Ouro property is located in the Tapajós Mineral Province in the south east part of the Itaituba Municipality in the west of Pará State in central north Brazil, near the eastern municipal boundary with the Novo Progresso Municipality (Figure 4.1).

The most important feature of the property is Palito Mine, which lays some 4.5km south-west of the village of Jardim do Ouro and approximately 15km via road. This village lies on the Transgarimpeira Road some 30km WSW of the town of Moraes de Almeida, located on the junction of the Transgarimpeira and the BR 163 or Cuiabá – Santarém Federal Highway. Moraes de Almeida is approximately 300km south south-east by road of the municipal capital and similarly named city of Itaituba.

**Figure 4.1 – Location of the Tapajos Mineral Province**



### 4.2 Project Ownership

The Jardim do Ouro Project is formed by 28,346 ha of tenements granted in the Tapajós Province, including 1,150 ha of mining lease. In addition, there are 24,599 ha in mineral exploration license applications or extensions resulting in a total area for this property of 52,945 ha.

To retain the exploration properties, Serabi will need to make an annual payment to the DNPM, which is presently calculated as R\$2.23 per hectare for a granted exploration license, and R\$3.38 per hectare for an exploration license extension. To maintain the mining license, Serabi must comply with the conditions set out by the DNPM in respect to annual reporting and environmental compliances, but no taxes are owed, except those incurred on production.

DNPM legislation allows for the extension of up to three years for exploration properties beyond the period of validity, through a process of report presentation and application for an extension.

Those exploration tenements presently granted as exploration extension licenses, cannot be renewed and must either be relinquished or can be upgraded to a mining concession through submission of an application including a mineral resource statement, economic assessment and mining plan and schedule.

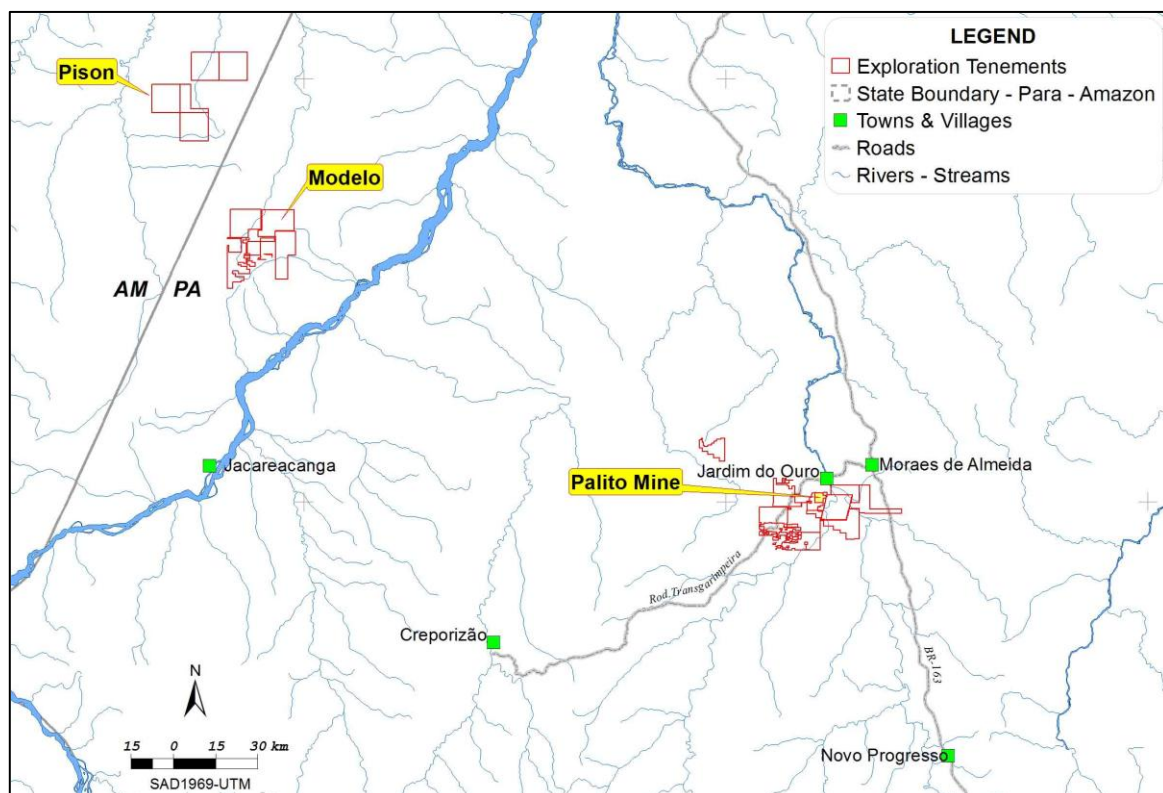
Mining concessions are valid until exhaustion of the resources or cessation of mining. The mining license is valid for an indefinite period. There are no annual fees associated with the maintenance of that license but the holder is subject to paying royalties to the state. The acronym for this royalty is CFEM. The CFEM rates for gold, silver and copper, the primary products of the Palito Mine, are currently 1.0%, 0.2% and 2.0% respectively.

Under applicable mining laws, the holder of a mining license is required to hold an Operating License granted in this case by Secretaria de Estado de Meio Ambiente (SEMA) for the State of Para. This period of validity for such a license is at the discretion of the issuing body. Serabi's current license was issued on April 27, 2012 for a period of one year.

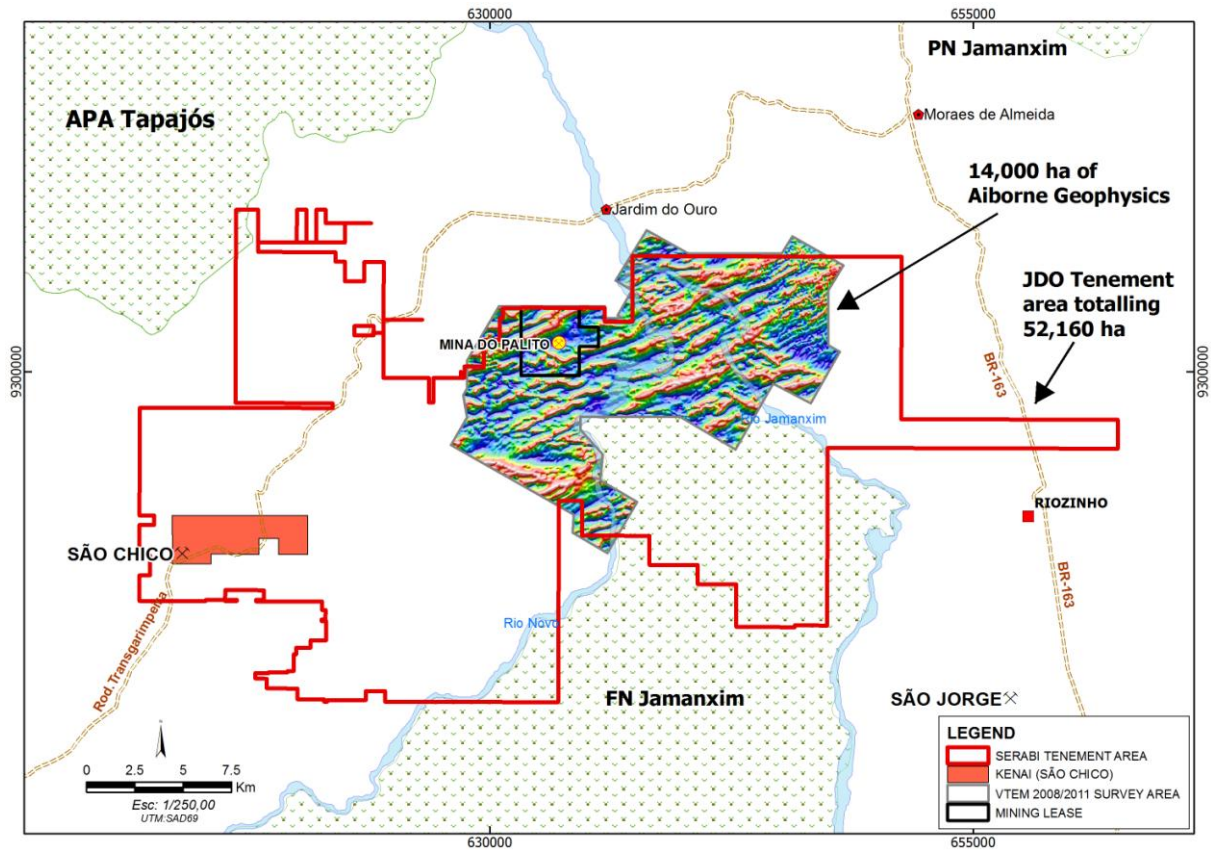
Exploration property boundaries are located by means of geographic coordinates for each vertex, which are published in the DNPM gazette and on the DNPM website. The mining concession is marked by embedded cement filled pylons, at each vertex of the concession, marked in accordance with the published vertices in the DNPM.

The following plans illustrate Serabi's mineral rights and applications in the Tapajós and the Jardim do Ouro Project specifically.

**Figure 4.2 - Serabi Controlled exploration and mining tenements in the Tapajós Province**



**Figure 4.3 - Plan illustrating Serabi's Jardim do Ouro Project Tenements**



Besides the Jardim do Ouro Project, Serabi operates three other separate project areas, in the same Tapajós Province, which are not covered in the Jardim do Ouro Technical Report; the Sucuba Project, in the State of Pará, 10,815 ha comprising two applications for exploration permits, the Modelo Property, in the State of Pará, 40,000 ha comprising four exploration permits and one application, and the Pison Project, in the State of Amazonas, represented by 44,703 ha comprising one exploration permit and four applications.

### 4.3 Surface Rights

Serabi initially acquired the surface rights to the immediate Palito Mine area through a purchase agreement with the existing “garimpeiros” (artisanal miners) entered into in 2002 and since that time has acquired from other garimpeiros and/or farmers additional parcels of land with the intention of securing the surface rights. It has also entered into agreement with other parties for access rights in return for making monthly rental payments.

In total, these surface rights cover a total area of 981 ha out of the total Jardim do Ouro tenement holding of 52,945 ha. Of these surface rights 865 ha, lie within the mining license.

#### 4.4 Exploration licenses and Mining license

Serabi has five exploration licenses granted within the Jardim do Ouro area covering a total of 27,196 ha and has a further four exploration licenses in application covering an area of 24,599 ha.

The annual commitments and expiry dates of these licenses are as follows:

<u>License Number</u>	<u>Licence type</u>	<u>Hectares</u>	<u>Annual Commitment R\$</u>	<u>Potential Commitment R\$</u>	<u>Date of expiry</u>
850.175/2003	Mining concession	1,149.59			
850.643/2003	Exploration license	4,204.76	14,212		07/09/2012
850.386/2004	Exploration license	8,293.27	28,031		28/10/2013
850.174/2005	Exploration license	7,917.47	26,761		07/09/2012
850.192/2002	Exploration license	673.19	2,275		04/07/2014
850.282/2005	Exploration license	6,108.55	13,622		14/02/2014
850.291/2004	Application for exploration licence <sup>(1)(2)</sup>	7,019.86		15,654	
850.495/2005	Application for exploration licence <sup>(1)(2)</sup>	6,368.87		14,203	
850.496/2005	Application for exploration licence <sup>(1)(2)</sup>	9,999.45		22,299	
850.066/2010	Application for exploration licence <sup>(1)(2)</sup>	1,210.32		2,699	

1) The Company is waiting for the publication of the grant of the exploration licences.

2) Until the DNPM grants exploration licenses they remain subject to amendment by the DNPM.

#### 4.5 Environmental Liabilities

The Jardim do Ouro Project contains significant ground disturbance within the Palito Mining lease (850.175/2003), as part of the Palito mining and processing activities. Serabi has complied and is in compliance in all material respects with all environmental regulatory requirements related to the exploration and mining activities pursuant to Brazilian environmental laws, and has taken all necessary actions in order to keep the environmental licenses and permits in force, valid and in good standing.

Within the Jardim do Ouro Project, outside of the Palito Mine lease, ground disturbance has been primarily by garimpeiro activities, restricted mainly to creeks, including shallow water filled pits and small open pits from which saprolitic materials have been hydraulically extracted and processed by gravity separation. Serabi has conducted a small program of diamond drilling outside of the mining lease in exploration lease 850.174/2005, consisting of drill pad placement and access road construction. These have been remediated.

Serabi presented a closure plan to the Brazilian mining authority, as part of its plan of economic usage of the mine, as required for the mining license application. In this plan, a value close to R\$2.5 million was estimated to cover closure costs, spread over a period of three years, following mine exhaustion.

## **5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY**

### **5.1 Accessability and Infrastructure**

Access to the area from Itaituba can be achieved by a part-paved road, crossing the Tapajós River at Itaituba via ferry and disembarking at the village of Mirituba, located on the southern bank of the river, opposite Itaituba. The road continues 30km south of Mirituba along the BR 230 or Transamazonica Road, where the BR 230 terminates at the BR 163. The road continues a further 270km and 43 bridges south along the BR 163 to Moraes de Almeida and a further 30km WSW along the Transgarimpeira via Jardim do Ouro, located on the Jamanxim River. In Jardim do Ouro, a second ferry is required to traverse the river to the western bank. A further 2km west of the village the Palito Mine access road turns south for a further 12km before arriving at the Palito Mine site, located in the Jardim do Ouro Project Area.

Alternatively road access can be gained from Santarém to the NE or from Cuiabá to the south in Mato Grosso state via the BR 163, taking the Transgarimpeira Road at Moraes de Almeida to Jardim do Ouro and on to Palito. It should be noted the BR 163 is now being paved from the southern Pará State border with Mato Grosso up to Itaituba. The BR 163 south of Moraes de Almeida is now virtually all paved.

Year round road access exists to the Palito Mine site, though this can be slightly restricted during the tropical wet season from December to May each year.

Access can also be gained by air from Itaituba or alternate airstrips (Santarem or Novo Progresso) using light aircraft. Palito and Jardim do Ouro have 800m airstrips of compacted earth which are approximately 1 hour flying time from Itaituba or 1.5 hours flying time from Santarem.

Itaituba is a well-established centre with port facilities capable of handling barge transport of heavy equipment and airport facilities for large freight aircraft. The Palito Mine receives much of its supplies and dispatches its copper-gold concentrate product via barges accessed from Itaituba and trucked to site and vice versa.

Electric grid power has been brought to the mine site via a spur line from Novo Progresso. Backup power is supplied by a fleet of onsite diesel fired generators.

### **5.2 Physiography, Climate and Vegetation**

The Jardim do Ouro Project lies in a region termed the Tapajós valley, specifically in the region termed the Rio Novo Basin, located in the central eastern portion of the Brazilian IBGE SB.21.ZA map sheet, on the left margin of the Rio Novo, proximal to the confluence of the Rio Novo and Jamanxim rivers. These rivers in turn drain north into the Tapajós River near Itaituba and then north east into the Amazon River downstream at Santarém.

The Palito Mine lies at an elevation of 260m RL at the approximate coordinates:

Geographic: 55°47' 31.3" W, 6°18' 54.1" S  
UTM: SAD 69, Zone 21S; 633617mE, 9301813 mN

Local physiography consists of a rugged topography forming hills and steep sided valleys in the immediate Palito area, and more subdued undulating hills and valleys in the surrounding project area. There are numerous creeks ("Igarapés") draining the incised topography of the Palito area, all of which drain into the Rio Novo and Jamanxim Rivers located within a few kilometres of the site.

The majority of the immediate Jardim do Ouro Project environment is covered by tropical forest typical of the Amazon region, however north and west of the Palito mine; the forest has been felled to create pastures for the grazing of livestock along the Transgarimpeira Road.

Many of the drainages radiating away from the Palito mine site have been worked intensely in the 1980's by the *garimpeiros* resulting in manmade swamps, permanent wetlands and old forest destruction.

The local climate has two well defined seasons, the rainy season from December to May and the dry season for the remainder of the year. Regional rainfall averages around 1400mm per year although this now fluctuates greatly due to the deforestation effect of local farming.

The temperature does not vary significantly ranging between 24°C and 33°C, with an average of around 26°C. Relative humidity ranges from 70% to 80% depending on the season.

### **5.3 Local Resources**

Within the boundaries of the Palito Mine lease there are no permanent inhabitants however within the greater contiguous tenement holdings in the Jardim do Ouro project there are a number of cleared grazing properties with permanent dwellings and inhabitants.

The nearest community with social services is Itaituba, which has a population of 96,282 (IBGE census of 2007), banking, postal service, health services, communications, education centres, and regular air service to other major cities, including Belém, Manaus and Cuiabá.

Labour employed by the project is preferentially sourced from the local towns and villages, within the State of Pará. Other more job specific professionals unavailable in Pará are sourced preferentially from within Brazil.

Grid electricity is sourced from the neighbouring municipality of Novo Progresso 135km away, and brought to site via a spur line.

Water is in abundance locally and is sourced from small reservoirs and dams constructed on site for industrial purposes and from water wells for potable water requirements.

Fuel and other major supplies are currently brought in via road from Itaituba and/or Cuiabá via the BR 163.

## 6 HISTORY

The Palito deposit is located in the eastern portion of the Tapajós Mineral Province where the presence of gold has been reported as early as 1747 from the Colonial Portuguese era. Gold production in the Tapajós commenced in the mid-20<sup>th</sup> century via artisanal miners (garimpeiros) reaching a peak in the 1970's and 1980's with estimated production of between 15 to 30 tonnes per year, from over 500,000 garimpeiros. Production has since declined. However there remain in the order of 2000 to 5000 garimpos producing in the order of 5 tonnes of gold per year from the region. Total historical production from the Tapajós is estimated at some 15 to 30 million ounces as reported by the CPRM. However, accurate reports do not exist.

Gold mining in the Palito area was initiated by garimpeiros during the 1970's who typically worked alluvial and colluvial gold sources up stream until they came upon the residual source. Generally, the garimpeiros worked the residual mineralised saprolite profile containing free primary and secondary gold. In circumstances where extremely high grade was encountered in fresh rock, the garimpeiros sunk shafts and mined the vein underground by gallery development. The mining method employed traditionally was by hand and hydraulic mining in the saprolite, using basic gravity separation and occasionally mercury amalgamation. In the high grade vein material extracted from fresh rock or deeper open casts, the material was crushed and then gravity separated and/or mercury amalgamated.

Modern exploration was initiated in 1994 by Rio Tinto Desenvolvimento Minerais Ltda (RTDM), a Brazilian subsidiary of Rio Tinto Plc, which conducted surface geochemical sampling, auger drilling, ground and airborne geophysics, and diamond drilling in the Palito area.

The original investors of Serabi commenced operating in Brazil in 1999, with the objective of acquiring, evaluating and mining hard rock gold deposits previously unknown or technically too difficult for the Garimpeiros to exploit.

Having evaluated several opportunities, the group acquired the Palito gold project in 2001, forming the basis for Serabi Mining. In 2002, Serabi purchased RTDM's historical Tapajós exploration database and negotiated access to RTDM's exploration drill core library, following RTDM's decision to withdraw from the Tapajós Province.

Following the acquisition of the Palito Project in 2001, Serabi commenced re-treatment of high-grade gold tailings from the abandoned garimpeiro workings via a small scale milling and CIP plant in late 2002. This plant produced around 3000 ounces of gold bullion in 2003 and provided valuable lessons for operating in the region. Underground mining commenced in late 2003, exploiting fresh rock sulphide bearing ore.

In 2004 gold bullion production ceased during a plant upgrade to process the sulphide ore won from the underground operation. The upgrade to the circuit included the installation of a crushing plant and a flotation circuit. In August 2004 bullion sales resumed and in November 2004 the first copper/gold/silver concentrate was shipped to Europe for processing at UMICORE.

In May 2005, Serabi filed for public listing on the AIM London Stock exchange where it successfully raised £6.9 million net of expenses. In 2005 the Palito operation reached a throughput rate of 150 tonnes per day (tpd) and produced 17,261oz gold equivalent.

In 2006, the Palito Gold Mine's production throughput increased to 340 tpd which resulted in a production of 39,197 oz. gold equivalent for the year.

In 2007 the mining method was changed from shrinkage stoping to bulk longhole stoping, and a further increase in throughput rate to 550 tpd was implemented. However, this led to a decrease in grade of the ROM feed caused by excessive dilution of the narrow vein ore zones from longhole

stopping. The production was that of 33,963 oz gold equivalent. During 2007 the mining methodology was reconfigured to minimise the dilution with long hole stopping heights. Resulting methods were adapted and a new selective mining fleet placed on order for delivery in 2008.

In 2008, the delayed arrival of the new selective mining fleet, severely impacted on development and production rates, and the mine performed well below budget during the year as a result. By midyear it was clear to re-establish Palito to budget production levels, it would be necessary to place the mine into a dedicated phase of development for a period of some 12 months. However, the implications of such a plan on cash flow along with a significant working capital requirement, at a time when the capital markets were in severe decline meant it was virtually impossible for the Company to secure the necessary funding to implement such a plan. Therefore placing the mine into expanded development at that time was not a realistic option for Serabi. In the absence of any viable alternative plan, the decision was taken to suspend underground mining by the end of 2008. Final gold production for 2008 was 19,676 oz. gold equivalent.

Also in 2008, exploration activity focussed mainly upon mine site step out drilling, however, one very positive and noteworthy activity was the flying of a 6000 hectare helicopter electromagnetic (VTEM) survey. The hosting of gold mineralisation in a sulphide host matrix, lends the mineralisation well to geophysical exploration methods. The survey rewarded the company with 18 high priority targets within a 7 kilometre radius of Palito operation, and therefore if ever successfully proven up, a strong likelihood of incorporating such satellite deposits into the current operating infrastructure is clear to see.

The main priority of 2009 for Serabi was to stay in business, the global financial crisis and virtual cessation of access to capital markets made life very difficult for companies with limited revenue. All exploration activity was placed on hold. Following the suspension of the underground operation, a change of mine plan was submitted to the DNPM where the company obtained permission to commence gold production from some oxide ore mining, which had been successfully piloted the previous year. This small scale surface oxide ore mining was restricted largely to the top 20 metres from surface, where the mineralisation has been weathered. Beyond a depth of 20 metres the oxide mineralisation changes into a transition zone, before finally encountering the harder sulphide ore at depth. The oxide ore is very amenable to processing with Serabi's existing Carbon in Leach plant from which it is possible to produce gold in the form of bullion bars. However, in both the transition and sulphide zones the gold is associated with copper (in the oxide mineralized material the copper has been leached away) and can only be treated through flotation, which produces a concentrate.

The reduction in labour costs following the suspension of underground mine production, meant the gold production from oxide mining activity began to generate meaningful though limited revenue which helped meet site costs. It should be noted that the oxide material mined was from outside the declared mineral resource. No official resource estimation has been ever undertaken upon this material.

In fact the company's aim has been to continue mining and processing oxide ore as long as realistically possible to generate sufficient cash flow to cover or part cover the mining and process costs at Palito and, in so doing, maintaining legal operations at site. By the year end the company produced approximately 5,000 gold ounces from oxide mining activities.

At the end of 2009 the company completed an equity financing, raising some US\$4.5 million. These funds allowed the Company to recommence the exploration activity.

In June 2010, Eldorado Gold Corporation subscribed for 12,000,000 Ordinary Shares and in so doing acquired an interest in the company at that time of 26.8% providing further exploration funding and in March 2011 the Company completed an Initial Public Offering of its shares on the Toronto Stock Exchange raising gross proceeds of a further C\$10,488,500 in the process. This working capital has

allowed the Company to advance its exploration of the Jardim do Ouro region and in particular the near-mine opportunities. The exploration activity during 2011 included ground and airborne geophysical programmes and surface geochemistry but the primary activity was a discovery diamond drilling programme totalling 8,200 metres over nine target areas all located within three kilometres of the existing Palito Mine and a further 4,400 metres of follow up diamond drilling programme over the most prospective of these target areas. Of the nine targets drilled, seven encountered gold mineralisation and of these the Company selected two areas, Piaui and Currutela considered the most prospective, for the 4,400 metre follow up drilling programme.

At this time, the Company considers that the potential of both Piaui and Currutela prospects is very good. Based on drilling and geophysical work completed to date, Piaui, which the Company originally considered to have a strike length of 300 metres, could now extend to approximately 1,400 metres parallel to and following the same north-west to south-east trend of Palito. An initial shallow infill and step out drilling programme over 23 drill holes has been completed over two areas with strike lengths of 600 metres and 350 metres within the overall 1,400 metre potential strike length of the prospect. This drilling has continued to intersect broad zones of intense chlorite/silica/sulphide alteration zones in excess of 40 metres.

The Currutela prospect lies some two kilometres to the south-east of the Palito Mine and along strike. Drilling intersected mineralisation that is very similar to that found at the Palito deposit and in common with Palito appears to comprise a number of stacked veins in the same orientation as that seen at Palito. A total of thirteen discovery holes were drilled into the Currutela target on very broad drill spacing over a strike length of around 400 metres and a strike width of one kilometre. The Company undertook an exploratory drill hole some 900 metres to the north-west of Currutela and 750 metres south-east of Palito. This single drill hole intersected gold mineralisation and the bulk mineralised zone returned 17.06 metres @ 1.17g/t Au from 84.25 metres down-hole depth, including 0.88 metres @ 5.25 g/t Au and 0.61 metres @ 10.90 g/t Au. This hole was intended to test the predicted continuity of the Palito host structure along a south-east trending strike towards the Currutela prospect. Again multiple zones of hydrothermally altered granite similar to Palito and Currutela were encountered. The intersection lies approximately midway between Currutela and the Palito Mine's current 224,000 ounce Measured and Indicated (gold equivalent) and 444,000 Inferred (gold equivalent) resource. The implication is that there is a potential strike extension of some 2 kilometres between the existing Palito resource and the most southerly limit of Currutela.

In the fourth quarter of 2011, the Company drilled 20 shallow holes totalling 1,632 metres south of the Palito resource (the Palito South area). There had been limited drilling undertaken by the Company during 2008 with the intention of extending the southerly limit of the existing Palito resource. This 2011 programme continued to in-fill the area towards south-east of Palito. High-grade intersections were recovered from a number of the holes including **0.72m @ 8.91g/t Au, 0.90m @ 21.6 g/t Au, 1.40m @ 43.2 g/t Au, 0.81m @ 8.79g/t Au and 0.93m @ 34.75 g/t Au.**

Management are sufficiently encouraged by these results to consider that Piaui, Currutela and Palito South will between them and in time form a cornerstone of the resource growth that they set out to achieve at the start of 2010. With this in mind the Board has now commissioned a preliminary economic assessment into the viability of re-establishing underground mining operations at the Palito Mine ("the PEA"). The PEA will focus initially on the existing resources but will include evaluation of the recent mine site discoveries. It will consider a selective mining methodology, focused on maximising grade and initially limiting production to levels around 20,000 ounces per annum. Management is hopeful that, if successful, the cash flow from such an operation can be used, at least in part, to fund the future evaluation and development of the Piaui, Currutela and Palito South prospects.

The following tables summarize total historical production and gold production since the March 2008 cut-off date of mineral resource estimate.

**Table 6.1 - Historical production at Palito Mine to June 2010**

Quarter	Tonnes Milled	Head Grade		Plant Total		
		Au (g/t)	Cu (%)	Recovery	Production	
				Au (%)	Au (oz.)	Cu (t)
2005 – Q1	8,222	9.33	0.3	84.2	2,077	22.4
2005 – Q2	14,006	8.63	0.33	88.2	3,427	38.2
2005 – Q3	14,315	12.06	0.68	90.2	5,005	81.0
2005 – Q4	21,415	7.65	0.42	91.8	4,837	74.7
2006 – Q1	25,514	9.31	0.47	91.9	7,017	98.0
2006 – Q2	29,851	9.73	0.43	91.3	8,527	107.1
2006 – Q3	29,462	9.2	0.51	91.4	7,974	139.2
2006 – Q4	32,760	9.37	0.73	91.0	8,980	224.6
2007 – Q1	42,705	6.52	0.31	89.8	8,044	125.6
2007 – Q2	45,245	5.95	0.3	91.1	7,888	127.0
2007 – Q3	45,054	5.36	0.23	90.0	7,021	96.2
2007 – Q4	40,481	5.06	0.29	89.9	5,989	110.4
2008 – Q1	34,040	4.52	0.31	89.0	4,217	85.8
2008 – Q2	36,745	5.1	0.26	89.0	4,963	78.9
2008 – Q3	37,704	4.69	0.26	87.4	4,658	81.1
2008 – Q4	29,174	3.92	0.27	89.4	3,165	66.8
2009 – Q1	17,863	4.03	-	90.5	2,134	-
2009 – Q2	19,151	3.24	-	89.3	1,748	-
2009 – Q3	17,470	2.23	-	89.9	1,018	-
2009 – Q4	15,073	1.26	-	78.7	548	-
2010 – Q1	13,291	1.73	-	85.3	786	-
2010 – Q2	4,803	1.82	-	89.8	265	-

Limited mining occurred after the March 2008 cut-off date for the mineral resource statement, and is set forth in the table below.

It can be concluded from this production data that only 8,799 oz. of gold came from sources within the March 2008 mineral resource, with the remaining 10,486 oz. coming from unreported ore sources outside the declared March 2008 geological resource. As a consequence, the mineral resource has not been materially affected by subsequent production up to June 2010.

**Table 6.2 - Production since March 2008**

<b>2008</b>	<b>tonnes</b>	<b>Grade Au g/t</b>	<b>Au oz.</b>
Oxide ore gold production <u>not included</u> in March 2008 Mineral Resource	21,397	3.58	1,475
Sulphide ore gold production <u>included</u> in the March 2008 Mineral Resource	65,781	4.70	8,799
Sulphide ore gold production <u>not included</u> in the March 2008 Mineral Resource	16,445	5.64	2,512
<i>Total Q2-Q4 2008</i>	<i>103,623</i>	<i>4.62</i>	<i>12,786</i>
<b>2009</b>			
Oxide ore gold production <u>not included</u> in March 2008 Mineral Resource	69,557	2.76	5,448
<b>2010</b>			
Oxide ore gold production <u>not included</u> in March 2008 Mineral Resource	18,094	1.75	1,051
<b>TOTAL MINED + TREATED SINCE Q2 2008</b>	<b>191,274</b>	<b>3.67</b>	<b>19,285</b>

## **7 GEOLOGICAL SETTING AND MINERALIZATION**

The Tapajós Gold Province is located in the western portion of Pará State, central northern Brazil and covers a total exceeding 900,000 square kilometres. The Tapajós is in the southern-central portion of the Amazon Craton, generally termed the Brazilian Shield, as opposed to the northern portion of the Craton referred to as the Guyanian Shield and extends into the littoral countries of the northern South American continent.

The Brazilian Shield is nucleated on the Archaean granite-greenstone terrain of the Carajás-Imataca Province in eastern Pará State, and progressively becomes younger and shallower towards the west, grading into granite dominated then into granite-volcaniclastic terrain of Paleoproterozoic age rocks of the eastern Amazonas State. In the Jardim do Ouro region lithologies are dominated by granitoids of Paleoproterozoic age.

### **7.1 Regional Geology**

The Tapajós province represents a tectonically controlled geological evolution attributed to the Orosirian Proterozoic period, comprising four plutonic events, over a 140Ma period (Coutinho et al 2000).

In the Tapajós Province two main units form the basement, the Paleoproterozoic Cuiú-Cuiú metamorphic suite (2.0-2.4Ga) and the Jacareacanga metamorphic suite (>2.1Ga). The Jacareacanga is considered to be the older suite; however the relationship is not yet well defined.

The Jacareacanga suite is comprised of a sedimentary-volcanic sequence, deformed and metamorphosed to a regional greenschist facies, with units of sericitic and chloritic schists and rare banded iron formations.

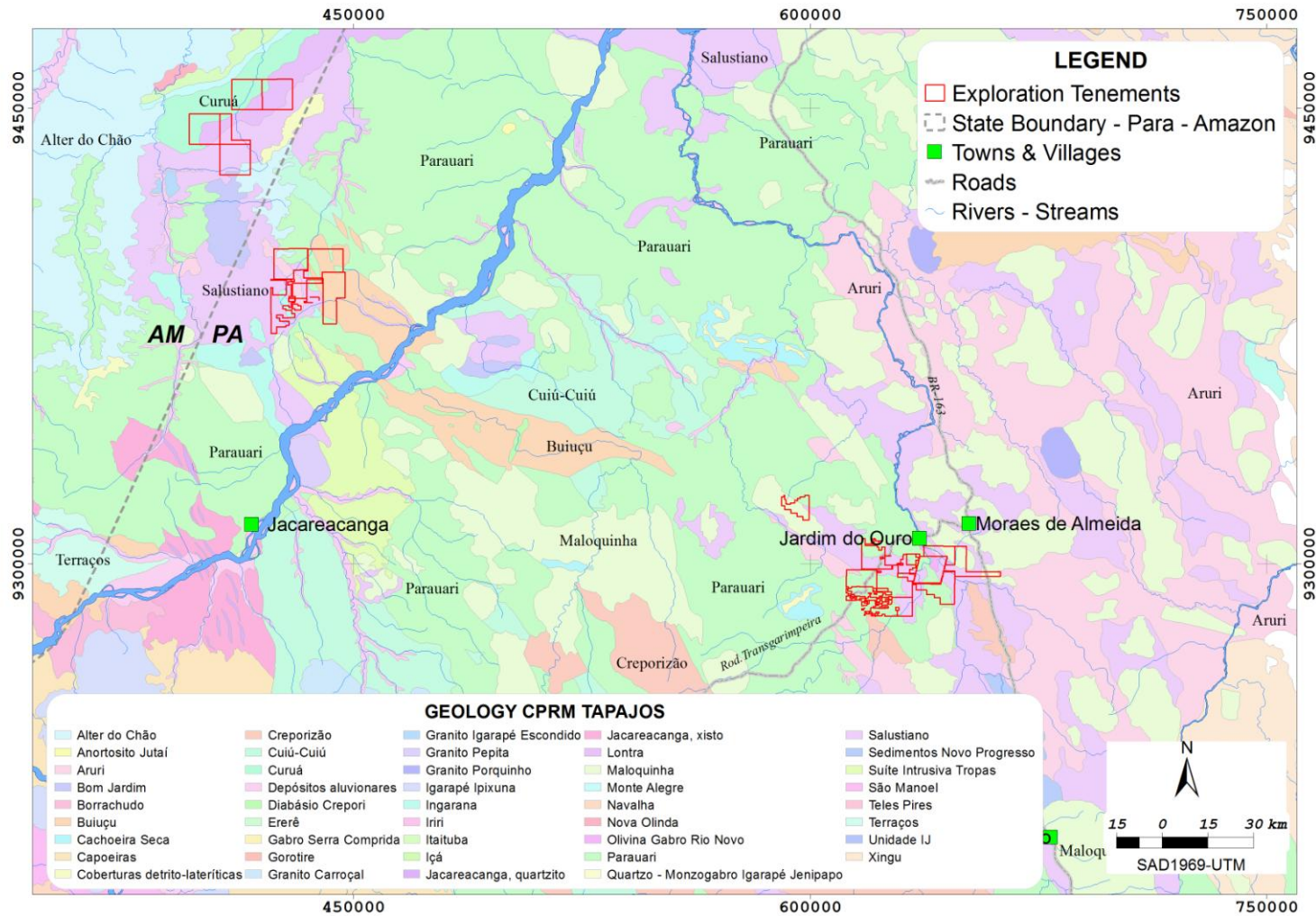
The Cuiú-Cuiú suite, which is the basement for the Palito area, is comprised of orthogneisses of dioritic to granodioritic composition, locally mylonitized, deformed tonalitic granitoids and enclaves or rafts of amphibolites.

Both the Cuiú-Cuiú and Jacareacanga suites are intruded by monzogranites of the Paráuari suite (2000 -1900Ma), tonalites, diorites and granodiorites of the Tropas suite (1907Ma -1898Ma) and granites and granodiorites of the Creporizão suite (1893 -1853Ma). These three intrusive suites are considered to have calc-alkaline affiliations and may be considered remnants of a magmatic back arc system interpreted for the region.

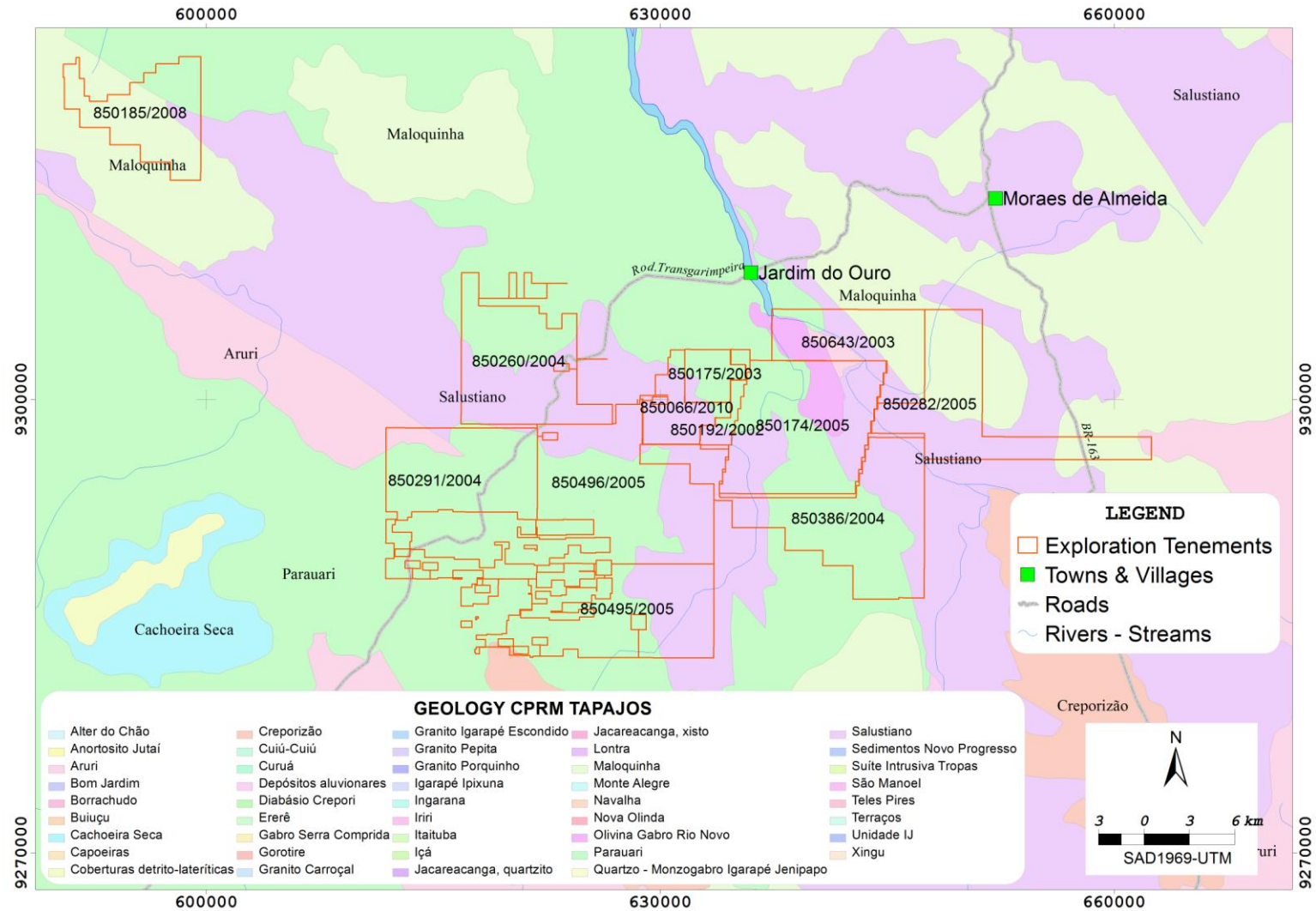
Coeval felsic and intermediate rocks; rhyolites, dacites and andesites of the Bom Jardim and Salustiano Formations (1900 – 1853Ma) and volcaniclastics of the Aruri Formation (1893 -1853Ma) cut through all older units.

The alkaline, anorogenic, Maloquinha Granite suite (1882 - 1870Ma) intrudes throughout the Tapajós and is associated with the strong extensional episode, pre-dating the deposition of the Uatumã Volcanics (Irirí Group, Aruri Formation and Salustiano Formation). The Maloquinha Granites are considered to be the deeper intrusive phase of the Uatumã Volcanics and the source of the gold mineralisation in the Tapajós.

**Figure 7.1 – Regional Geology of the Tapajos Province (Source CPRM) showing Serabi tenement holding as of August 2010**



**Figure 7.2 – Geology of the Jardim do Ouro Project Area (Source CPRM) showing Serabi tenement holdings.**



Younger sedimentary rocks cover the Maloquinha/Uatumã suite of rocks along a NW-SE trending features in the central and western parts of the Tapajós Province.

Regional structural analysis of the Tapajós province has identified various compressive deformation regimes including ductile, brittle-ductile and brittle. The deformation is interpreted to have occurred as two separate events, the first compressive event, with peak deformation around 1.96Ma, resulting in the development of ductile and brittle-ductile deformation regimes. The second event occurring at 1.88Ma, resulted in brittle deformation. These events resulted in major north-south, north west-south east and east-west lineament sets.

The geometry of the lineament and structures are compatible with a combination of Riedel fracturing and strike slip fault systems, where the principle vector of compression is oriented in an east-west and ENE-WSW direction

Gold Mineralisation is not restricted to a particular suite, with deposits located in all suites including; Cuiú-Cuiú Suite (Cuiú-Cuiú), Paráuari Suite (Tocantinzinho, São Jorge and Palito), Tropas Suite (Ouro Roxo), Salustiano and Bom Jardim Formation (V-series deposits, Bom Jardim), Maloquinha Suite (Mamoal). Gold mineralisation associated with quartz and hydrothermal alteration assemblages is reported in all the fracture orientations of the Reidel system, and are dominated by fractures oblique to the principle strike-slip shear orientation.

## **7.2 Local Geology**

The lithology in the area is dominated by alkaline granitoids. In the immediate Palito mine area three dominant types of these rocks occur.

To the east, the Rio Novo Granite, a medium to fine grained, inequigranular quartz-plagioclase granite or syenogranite. The Rio Novo Granite is then sharply contacted against the Palito Granite on its western margin, a quartz-plagioclase granite or syenogranite of fine, inequigranular texture, differing visually from the Rio Novo in phenocryst size and density. Proximal and sub-parallel to the contact between these two granites is the Palito Central Fault Zone (PCFZ), a 70° (magnetic) trending zone of -50° NW dipping, slight offset dextral faults.

To the west, the Palito granite has a chilled contact with a biotite-hornblende-quartz-plagioclase granite, hornblende syenogranite or aegerine-riebeckite granodiorite locally termed the Fofquinha Granodiorite.

Intruded into these alkaline granitoids are feldspar porphyrite dykes and sills of dacitic composition, which occur more prolifically proximal to the PCFZ.

Gabbroic bodies termed the Rio Novo Gabbro are evident in the local area, but are restricted to within the Fofquinha Unit.

The mineralised structures themselves are generally represented as dark grey-green intensely sericite-silica-pyrite-chalcopyrite +/- chlorite, carbonate, pyrrhotite, sphalerite altered granite hosts, that in many circumstances are no longer recognisable as granitoid protolith. This intense hydrothermal alteration forms the lower grade mineralisation selvage and the host to the higher grade quartz-sulphide and massive sulphide zones. Alteration zones range in width from decimetre to metre wide zones. Distal from the structures and intense hydrothermalised zone, the granite hosts are intensely potassically altered, grading in to the regional scale background potassic alteration within 1 to 5m of the mineralised structure.

A description of the lithotypes encountered in the Palito Mine system is given below.

### 7.2.1 Rio Novo Granite

The Rio Novo Granite occurs in the eastern part of the mine and further to the east encasing the Palito Granite. It contains xenoliths of granodiorite (Fofuinha Granite), which indicates it is a later phase of the Fofuinha granite intrusive, which is confirmed by from the satellite image interpretation. This unit cuts the older Paráuari intrusive suites and is overlain by volcanics of the Iri Group.

The Rio Novo granite is porphyritic in texture, of medium grain size, varying slightly to a coarser or finer texture, and varying from a pink to a pink-orange to red or red-greenish colouration depending on the level of hydrothermal alteration. Granophyric textures are also common along with lesser developed miarolitic cavities, silicified broken and brecciated zones which are more intensely hydrothermally and propylitically altered, which gives the rock a grey to greenish coloration. This occurs specifically along the contact with the Palito Granite, in proximity to the contact with the Palito granite, the Rio Novo granite displays a strong red colouration due to potassic metasomatism.

**Figure 7.3 – Novo granite in outcrop**



Zones intensely broken by brittle faulting are also common in these rocks, normally with breccia associations and veins of carbonate and fluorite.

The macroscopic and petrographic characteristics of these rocks are not indicative of affinities with alkaline granites of the Maloquinha Suite, resembling more a late stage of the Parauari Suite, but this is yet to be resolved with further geochemistry.

### **7.2.2 Palito Granite**

The Palito Granite hosts the larger proportion of mineralized structures within the Palito Mine system. In surface exposure it is of limited extent, with exposures restricted to old Garimpo workings. Derived soil horizons are a red - brown colour areno-argillaceous type.

The Palito Granite is pervasively potassic altered and presents an intense red colour. The granite is medium grained, inequigranular, with subtle, finer grained local variations in contact zones with the surrounding granites, due to the cooling effect along the edges of the intrusion. Occasionally the granite presents miarolitic cavities, crystalline quartz and poorly developed granophyric textures. In near surface exposures the granite appears strongly hydrothermalised and shows characteristics of differential weathering, reflecting features relating to phased emplacement or magmatic flow.

### **7.2.3 Fofquinha Granodiorite**

This granodiorite occurs to the north and the northwest of the Palito Mine system and appears as a later stage intrusion into the Rio Novo Granite. Outcrop is scarce and as such the granite/granodiorite has been poorly sampled.

The Fofquinha is of medium to coarse grain size (0.5 to 1.0 mm and rarely 10 mm), is inequigranular to slightly porphyritic in texture and can present up to 15 - 35% of mafic minerals, mainly amphibole and iron oxides, especially magnetite. Its colour varies from grey to green grey and the coarse plagioclase crystals show intense zonation. A possible compositional variation from tonalite to monzodiorite has been observed macroscopically.

In some samples the granodiorite is enriched in magnetite which disappears when the rock shows evidence of the effect of potassic metasomatism, probably related to the intrusion of the Rio Novo or Palito granites.

Based on all the above aspects and macroscopic characteristics, it is possible to classify that these granitoids as members of the Paráuari Suite.

### **7.2.4 Rio Novo Gabbro**

The Rio Novo Gabbro occurs as rounded intrusions varying from 100m to 500m in diameter. The best known occurrence defined to date lies approximately 0.5km directly west of the Palito Mine system and is clearly defined by airborne magnetics. A second possible gabbro occurrence lies approximately 1.2km north of the Palito Mine and west of the Tatu prospect. In the field it is easily identified from the occurrence of dark red clay soils.

The gabbro is affected by brittle faulting and hydrothermal alteration which also affected the surrounding granites. Local zones of brecciation and xenoliths of the Fofquinha granodiorite within the gabbro, demonstrate emplacement post-dating the granodiorite.

The gabbro probably is a unit of the regionally occurring Ingarana Gabbro. This rock type is described in Project PROMIN – Tapajós CPRM (2002) as a stock forming irregularly along NW-SE trending lineaments, intruding into the Paráuari Granite Suite and overlain by the Iriri Group of volcanics. The gabbro is denominated the Rio Novo olivine gabbro by the CPRM.

Regionally the Ingarana Gabbro hosts mineralized (gold and sulphide) vein systems, as seen in the Bom Jardim garimpo and along the course of the Grape Bom Jardim.

### **7.2.5 Sub-volcanic Dykes**

Sub-volcanic rock types were recognized in the drill core as dykes cutting all lithotypes in the area. The dykes locally reach 30m width, but in general rarely exceed 1m width.

These sub-volcanic rocks are grey-pink or light brown, porphyritic, with a very fine to aphanitic matrix and granitic composition. Mirolitic cavities are common, with small concentrations of mafic minerals and sulphides.

These sub-volcanics are clearly hydrothermally altered, including potassic metasomatism, propylitization, sericitization and sulphidization.

Feldspar porphyries of dacitic and rhyodacitic composition form sub volcanic dykes, cutting through all the lithotypes encountered in the Palito area. They are of light and dark grey to pink colour with white phenocrysts of plagioclase and quartz and occasional biotite within a finer matrix of the same minerals.

These dykes are common in the PCFZ region and occur to a lesser extent away from it. They vary in width from less than a metre to up to 30m. They exhibit all the alteration suites affecting their host granites including potassic metasomatism, propylitization, sericitization and sulphidization.

### 7.3 Deposit Geology and Mineralization

The mineralization control of the type found on the JDO property is related to the schematic mega-system of strike-slip faulting and riedel fracture systems of the Tapajos as described by the CPRM (2008) publication "Província Mineral do Tapajós: Geologia, Metalogenia e Mapa previsual para Ouro em SIG". The Palito mine veins appear to relate to intersection of "Y" and "P" and/or "R" (sinistral strike-slip) faulting on 305° and 315° and/or 295° orientations respectively within "R" 070° trending structural corridors.

Mineralisation is best developed in the veins along the "Y" 305° and "P" 315° orientations, however wider zones are encountered where the "Y" and/or "P" orientation intersects with "R" 295° veins, which are mineralised to a lesser extent. It is also characteristic that the greatest densities of "Y", "P" and "R" vein intersections occur within in 070° structural corridors.

Mineralization within the Palito Mine is hosted within all three granitoids encountered in the immediate environment and is intimately associated with vertical to sub-vertical quartz-chalcopyrite-pyrite veins and pyrite disseminations filling the brittle-ductile fault sets. It is postulated that the mineralising fluids intruded into the existing structural architecture and deposited in dilational jogs within the fractured granites.

In the Jardim do Ouro project mineralisation, where encountered, occurs as a similar style of veins as the Palito mine; however the host rock varies depending on locality. Mineralisation has been encountered within the Rio Novo Gabbro, and within and along contacts with the sub-volcanic dikes in addition to the three host granites at Palito.

Bonanza gold grades are associated with massive chalcopyrite-pyrite blowouts within the quartz veins, typically on the intersection of "Y" or "P" and "R" veins. The principal vein system at Palito has a strike length in excess of 900m along broadly N306°, however this varies from N300° to N325° locally. Individual veins average widths of approximately one metre, varying between 20 cm and up to 4 m.

Secondary gold deposits are also encountered immediately above the mineralised veins, within the regolith profile. These deposits generally manifest themselves within the residual saprolite and laterite portions of the profile. These deposits are developed through the weathering process and often upgrade the primary gold grades within the narrow weathered vein through a supergene enrichment process, which also enlarges the footprint of the sulphide vein mineralisation.

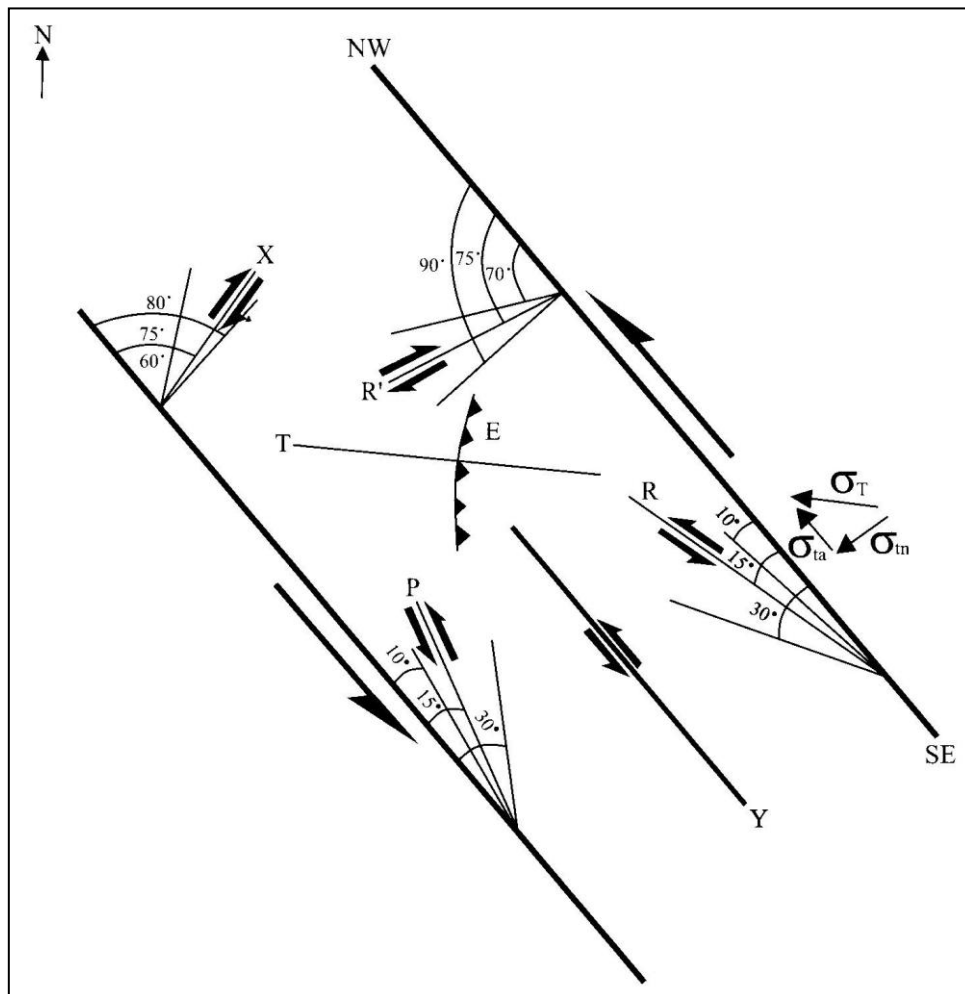
The secondary deposits contain free primary gold within the oxidised sulphides in the vein material and free gold associated with the secondary iron oxides (goethite, hematite) along fractures and joint

planes within the saprolite adjacent to the veins and in pisolites and lateritic cements at the paleo-surface above the vein.

The secondary deposits are generally not high tonnage deposits, as the residual saprolite profile is only around 5-8m depth, underlying up to 5m of barren transported cover. However they can be up to 10 times broader than the source mineralised vein, due to weathering dispersion of the gold

These saprolite deposits were favourably targeted by the garimpeiros as they contained enriched gold grades, manifesting as free gold, easily extracted by a gravity process.

**Figure 7.4: Schematic Representation of the Mega-system of Strike-slip faulting and Riedel system of fracturing**



**Figure 7.5 - Near surface vein at the Palito deposit**



**Figure 7.6– Palito Vein, typical expression**



The paragenesis of the gold mineralisation occurs within pyrite and chalcopyrite associated with sphalerite, argentite and tellurobismuthinite /tetradimite and is typical of deposit types classified as “Au+Ag+Te in syenites, diorites and monzonites with fluorite”.

The principal sulphide composition occurring in the granites is pyrite (30-40%), chalcopyrite (20-25%), arsenopyrite (2-5%) and pyrrhotite (2-10%) with minor occurrences of covellite (2-3%), chalcocite (2-3%), sphalerite and bismuthinite (traces). Electrum occurs as rare inclusions in chalcopyrite and along fractures in the pyrite. Native bismuth and tellurio-bismuthinite / tetradimite also occur as inclusions in the pyrite and chalcopyrite. In the granodiorite the dominant sulphide is pyrrhotite (30-40%) with lesser pyrite and chalcopyrite compared to the granites.

The sulphides occur as segregates in the quartz veins, as disseminated within the grey hydrothermal alteration selvage or as massive sulphide veins of decimetre to metre widths. The veins are 30-35% quartz, with the sulphide making up volume, however this may vary from <10% to 90% on occasion.

The quartz veins feature occasional druses of cubiform pyrite which contain only lower gold grades.

Chalcopyrite formed after pyrite, as the chalcopyrite has enveloped pyrite and infilled and cemented fractured grains of pyrite. Gold is always associated with chalcopyrite in these instances.

Gold occurs as fine grains of 10 to 15 microns confined to the chalcopyrite and arsenopyrite. In many cases the gold grade is highest in zones of hydraulic brecciation, where the alteration zone, sulphides and vein quartz show multiple stages of reactivation.

The nature of the sulphide mineralization at the Palito deposit varies along strike and plunge extents. The deposit is a quartz-sulphide and massive sulphide vein deposit hosted within granites and granodiorites of the Parauari Suite of intrusives. The nature of the sulphides changes across the deposit from being dominantly pyrite and chalcopyrite in the granites to being dominantly pyrrhotite

and pyrite with lesser chalcopyrite in the granodiorite. Within the granodiorites, the pyrrhotite-pyrite sulphides tend to be lower gold grade, due to the lesser occurrence of chalcopyrite, which hosts the gold. This is likely a result of the increased mafic content in the granodiorites affecting the paragenesis of the sulphide deposition.

The hydrothermal alteration of the host rocks is strongly alkaline and has resulted in potassification and ferruginization, which has accentuated the original alkaline character of the host rocks and also resulted in intense silicification.

Hydrothermal alteration associated with mineralisation is intense sericitization and chloritization, where intense potassic alteration has resulted in a rock where the original lithotype is no longer compositionally or texturally identifiable. The alteration zone appears as a dark grey rock formed of relict quartz crystals of 0.5mm - 1mm in a groundmass of feldspar pseudomorphs of sericite, clay minerals and rare grains of epidote and carbonate.

Quartz is the only major mineral preserved, along with rare zircon and apatite from the protolith. Feldspars are totally pseudomorphed by sericite as well as lesser muscovite and biotite. Chlorite occurs as infill of shears and veinlets and as rare aggregated crystal masses and occasionally intercalated with biotite with inclusions of zircon and apatite and prehnite.

Grey hydrothermal alteration is confined to the selvage of the brittle fractures and rarely extends more than 0.5m into the host granite. The alteration is generally always present to some degree along the mineralised structures; however the quartz-sulphide and sulphide veins are not always present. On occasion the structure may appear as a sericite, chlorite, and ankerite vein only several centimetres wide before opening up into a traditional hydrothermal selvage.

Distal to this selvage of hydrothermal replacement, there is a zone of intense potassic alteration extending from 1 to 10m outwards to the background country rock potassic metasomatism. Within the granodiorites this potassic alteration is more restricted.

The mineral reserves estimated and stated in March 2008, and not declared today were at 732 thousand tonnes at 7.34 g/t gold and 0.22 % copper, containing 173 thousand ounces of gold and 188 thousand ounces of equivalent gold. Equivalent gold is calculated using an average long-term gold price of US\$700 per ounce, a long-term copper price of US\$2.75 per pound, average metallurgical recovery of 90.3% for gold and 93.9% for copper. From the total declared contained equivalent gold, 9.5% corresponded to proved reserves in Palito Main Zone and 90.5% to probable reserves.

## 8 DEPOSIT TYPES

Gold deposits within the Tapajós Province can be broadly classified into three main types:

1. Mesozonal deposits;
2. Epizonal intrusion centred or intrusion related and
3. Alluvial, colluvial and supergene enriched saprolitic deposits.

Primary gold deposit types occur as the first two categories of deposit type; (1) mesozonal and (2) epizonal intrusion related. Tapajós deposits are structurally controlled deposits but host rock control is important in locally providing a necessary factor in the metal precipitation process.

Primary deposit types are generally sited in fractured and sheared host environments such as:

1. quartz and quartz sulphide stock work and associated alteration hosted disseminated sulphide;
2. quartz vein,
3. quartz-sulphide veins +/- selvage alteration hosted disseminated sulphide;
4. massive sulphide veins +/- selvage alteration hosted disseminated sulphide;
5. disseminated sulphide within alteration;

Historically in the Tapajós, the third category of deposit types has produced most of the gold won in the region, with a significant contribution from the supergene enriched laterite and saprolite deposits. A large percentage of the gold contained within this category is residual in nature, but physically concentrated along stone lines or weathering fronts, liberated from auriferous veins (quartz, quartz-sulphide or sulphide) nearby and secondarily enriched by redox chemical processes as opposed to being physically transported away from the source.

The exploration potential for the Tapajos province is considered highly prospective for further discovery of primary deposits. A majority of the primary deposits known in the Tapajos are related to the quartz vein and quartz-sulphide veins. The extensive acid to intermediate volcanics intruded by coeval granitic intrusives provides the conditions for formation of mesothermal and epizonal and/or "epithermal" deposits.

The mesothermal granite-hosted systems are associated with a range of deposit types; porphyry (Coutinho et al, 1997, Jacob, 1999), orogenic lode gold (Goldfarb et al, 2001) and intrusion related gold systems (Santos et al, 2001). These granite hosted systems all share many characteristics (Lang and Baker, 2001), with distinction among the genetic models becoming difficult to strictly apply in the region.

Within the regional context of the Jardim do Ouro project, significant granite hosted deposits have recently been discovered that share geological features with the Palito deposit and the Jardim do Ouro project.

The Tocantinzinho deposit is a gold deposit with 2.4Moz in Measured and Indicated categories (M&I) and 0.1 Moz in inferred category, as published by Eldorado Gold Corp. It lies approximately 70km to the NW of Palito, is mineralised intrusive granite. The deposit is some 900m strike length and 200m wide. The granite has intruded into the TZ structure (a NW-SE trending regional supracrustal structure) which also hosts the Palito deposit. The vein arrays within the Tocantinzinho deposit are of similar architecture to that of the veins within Palito. Gold is associated with quartz veins and sulphides (pyrite and chalcopyrite). Hydrothermal alteration of the monzogranites and a series of later stage micro granite and dacitic/rhyolitic dykes are all very similar attributes between the two deposits.

The São Jorge gold deposit (Brazilian Gold), has a NI 43.101 estimate of 0.38 Moz in M&I categories and 0.56 Moz in inferred category. It is composed of a series of vertically dipping quartz-sulphide vein

sets, located approximately 45km SE of the Palito deposit, is another gold mineralised system hosted in hydrothermally altered monzogranites, contained in structurally controlled fracture vein systems, striking some 700m in a NW-SE direction, some 60m wide. This deposit again lies within the TZ structure, in common with Palito and Tocantinzinho. A drilling program is currently being developed there.

The TZ structure also hosts a number of significant prospects in addition to the 2 defined deposits. Magellan's Cuiu-Cuiu, some 150km NW of Palito is a significant mineralised system, which has been subject to significant drilling activity.

In the nearer district to Jardim do Ouro, but located in parallel TZ structures are a number of significant artisanal operations. Mamoa is a large area of garimpo activity approximately 20km NNW of Palito. The area is historically a large producer of saprolite hosted gold, and recent gold prices have reinvigorated the activity in the area.

To the south west (15km) of Palito the Sao Chico garimpo has been acquired by Kenai Resources. The previous owners, Gold Anomaly Limited, had constructed a small Gecko, high pressure jig, gravity gold plant to exploit a series of high grade quartz-sulphide veins. Kenai Resources have suspended this activity and have been undertaking an exploration discovery programme identifying what to date appears to be a small but high grade resource.

Also south west (20km) of Palito, Aurora Gold Corp has recently published a 130Koz Au unclassified estimate (presumably, inferred). It refers to a gold deposit at its São Domingos project. This deposit is a series of narrow high grade veins dipping moderately to the SW and striking NW-SE. The nature of the mineralisation is considered the same as Palito deposit.

Weight of evidence suggests that Palito is not an isolated deposit, but part of a series of deposits in a significantly gold endowed district (both locally and regionally). It is therefore considered that potential for further discovery of significant primary gold deposits in the Jardim do Ouro project is favourable. The nature of the deposits in the district also provides potential for deposit styles other than high grade quartz-sulphide vein type encountered at Palito. Potential for larger intrusive-related deposits such as Tocantinzinho and São Jorge within the Jardim do Ouro project is considered a real possibility.

The information above other than that relating to Palito has been extracted from publicly available material, which NCL has not verified. NCL cautions that this information is not necessarily indicative of the mineralization that may be found at the JDO property.

## 9 **EXPLORATION**

Exploration in the Jardim do Ouro Project area commenced with RTDM from 1994 to 1997. Early work focused on testing the depth potential of the near surface garimpeiros in the primary sulphide zones. Six diamond drill holes were completed and the area surrounding the Palito Mine screened with surface geochemistry on surface soil, rock chip and rock grab samples. Preliminary geological mapping covered areas of readily accessible exposures and a broad spaced (300m line spacing) regional aeromagnetic survey was flown.

Serabi commenced exploration in 2002 with surface exploration, mapping, rock chip sampling and the initial stages of diamond drilling and shallow auger drilling. This exploration has been ongoing since 2003 and undertaken and managed by Serabi's own exploration department. At various times since 2003 Serabi has augmented exploration with various programs of third party contractor drilling, geophysics including both airborne, terrestrial and down hole electrical and/or magnetic surveys which are detailed in the following sections. In addition various complementary studies on structure, lineament analysis, satellite imagery and petrology.

Table below is a summary of the exploration completed to date, except drilling which is covered in a later section.

**Table 9.1 - Exploration Summary**

Year	Company/Contractor	Activity
1994	RTDM	1031 spot soil samples
2003	Serabi	147m of post hole auger drilling (TRRN series holes)
2003	Fugro	Terrestrial geophysics including ground magnetics and dipole-dipole IP
2004	Serabi	11,116.78m of shallow auger drilling (TRJD series holes)
2004	Fugro	Terrestrial geophysics including Fixed Loop electromagnetics and IP
2005	Serabi	1,368.47m in underground face sampling and gallery channel sampling
2005	Serabi	18 rock chips
2006	Serabi	1,713m in underground channel sampling
2006	Serabi	3,009.83m in post hole auger drilling
2006	Serabi	69 spot soil samples (35m auger drilling), 43 rock chips
2007	Serabi	590.75m in surface trenching
2007	Serabi	1,513 spot soil samples (756m auger), 7 rock chips
2007	Serabi	Ground magnetic survey
2007	Fugro	Fixed loop EM and down hole EM surveys
2008	Serabi	4,325.79m in underground channel and gallery sampling
2008	Serabi	836 spot soil samples
2008	Serabi	1,244.6m of deep auger drilling for 1206 samples
2008	Geotech/Microsurvey	6,650 line km of helicopter VTEM, magnetic and laser topography
2008	Senografia	Acquisition of SPOT 5 satellite imagery of Jardim do Ouro, Modelo and Pison Project areas
2009	Serabi	413m of surface trenching
2009	Serabi	977.18m of hard rock channel sampling
2009	Serabi	835.3m of auger sampling comprising 729 samples

Year	Company/Contractor	Activity
2009	Serabi	Data compilation and integrated dataset modeling
2010	Fugro	45 line kms of dipole-dipole IP surveying
2010	Serabi	405m of surface trenching
2010	Serabi	168m hard rock channel sampling
2011	Geotech	1,221.28 line kms of heliborne VTEM, magnetic and laser topography covering 8,000 hectares
2011	Geomag S.A. (Fugro Group)	53.25 line km of ground based IP surveying on 200 m spaced traverses
2011	David McInnes (Montana GIS)	VTEM Modelling – profile interpretation and 3D modelling and depth slices
2011	David McInnes (Montana GIS)	IP Modelling – pseudo sections, model stacks, 3D modelling and depth slices
2011	David McInnes (Montana GIS)	Aeromagnetic processing and imaging- splicing and merging of aeromagnetic data, and production of images
2011	Serabi	Trenching/Costeaning – 771.5 metres completed with sampling every 1 metres
2011	Serabi	Augur Drilling comprising 515 metres of traverses at 5 metre spacings
2011	Serabi	Geological mapping – updating and revision of mapping detail surrounding Palito based on drilling and outcrop
2011	Serabi	Sampling of prospective garimpo tailings areas in the Palito valley
2011	Dr. Doug Mason Mason Geoscience	Petrology and Mineralogy – thin section preparation , description and interpretation of 20 drill core samples from the Piaui, Currutela and Copper Hill prospects
2011	Dr. Brett Davies Olinda Gold	Structural geological assessment of the Palito deposit and the Jardim do Ouro project

## 9.1 Geophysics

The Jardim do Ouro Project is partially covered by a broad 300m line-spaced airborne magnetic and radiometric survey commissioned by RTDM as part of their Sao Jorge survey in mid 1996.

Serabi commissioned several phases of geophysical surveys during the years preceding this report and a number of reviews.

In 2002, Fugro Ground Geophysics was commissioned to undertake a ground magnetic and dipole-dipole induced polarization survey over the immediate Palito Mine area. This survey was undertaken in December 2002 and reported in early 2003. It defined numerous anomalies in the area and defined well the Palito Main Zone mineralization and numerous other anomalies which were subsequently tested by diamond drilling in following years.

In November 2003, Fugro Ground Geophysics was commissioned to undertake a TEM fixed loop electromagnetic survey over two areas over the adjacent mineralized zones and also augment the ground magnetic coverage. This survey was undertaken in late 2003 and early 2004.

In 2006, Fugro Ground Geophysics was commissioned to undertake further TEM fixed loop electromagnetic surveys over the Chico da Santa Prospect area adjacent to Palito Mine and the southern strike extension of the Palito mineralization at the Palito deposit. Due to equipment failure this survey was conducted over the final months of 2006 with a hiatus over the December to February 2007 period resuming in March and completed in April 2007.

In late 2006, GeoDecon were commissioned to review the 2002 Fugro Ground Geophysics surveys utilizing Serabi's improved geological understanding of the mineralization and structures. This report was received in February 2007.

In 2007, as part of the extended TEM electromagnetic survey, Fugro Ground Geophysics also conducted down hole electromagnetic surveys on 14 drill holes within the Palito Main Zone, Chico da Santa, Ruari's Ridge and Palito West prospects.

In April 2007, a terrestrial ground magnetic survey was undertaken in house by Serabi in the Tatu prospect area of the Jardim do Ouro Project, some 2 km NE of the Palito Mine, targeting the magnetic/quartz vein hosted mineralization apparent in that prospect.

In September of 2007, Geotech/Microsurvey were commissioned to undertake a helicopter borne, Vertical Time Domain Electromagnetic Survey over an area of 6,500 hectares within the Jardim do Ouro Project covering the area from the Rio Novo prospect 5 km SE of Palito Mine to 1.5 km NW of the Palito Mine. This survey also included specification for magnetic and laser topography. This survey was conducted at 100 metre line spacing on a NE/SW line direction, perpendicular to the known mineralization trends.

In July 2008, VTEM data processing was completed and reported by David McInnes of Montana GIS, along with the reprocessing of the 2002 Fugro IP data. Significantly, the IP re-processing indicated that the main mineralized vein sets at the Palito Mine could be well constrained in the inversion modeling.

In May 2009, a complete dataset integration (incorporating all geophysical, geological, geochemical and structural datasets) was completed by Serabi. Target generation and appraisal was completed resulting in 18 integrated targets being promoted.

In March 2010, Fugro-LASA-GeoMag geophysics contractors were commissioned to undertake a 45 line km induced polarization survey over three grid areas incorporating 13 of the 18 integrated targets. This data was subsequently processed and modeled by David McInnes in May 2010. This modeling defined nine priority drill targets.

In January 2011, Geotech undertook a further 8,000 hectare helicopter borne, Vertical Time Domain Electromagnetic Survey over contiguous areas to the east and west of the initial 6,500 hectare survey area undertaken in late 2007. A total of 1,221.28 line kilometres were completed using 100 metre line spacing, perpendicular to the main geological trend. Once again the survey included magnetic and laser topography. The results were interpreted by Serabi's Geophysical consultant, David McInnes of Montana GIS.

During August 2011, Fugro-LASA-Geomag geophysical contractors were commissioned to undertake 55 line kms of induced polarisation survey over 2 main areas, firstly infill survey lines to infill between the Piaui and Currutela discoveries and secondly an area to the east of the Rio Novo river. Serabi's geophysical consultant, David McInnes of Montana GIS, once again undertook all interpretation and generated pseudo sections, model stacks, and 3D modelling of the results.

Mr McInnes also collated all aeromagnetic data and successfully modelled the Jardim do Ouro area in 3D.

## **9.2 Geochemistry**

The Jardim do Ouro Project has been partially covered by a range of geochemical sampling techniques and methodologies since reporting on the project area commenced.

RTDM in the period 1994-1997 undertook various ad-hoc sampling programs, including limited stream sediment sampling and rock chip. RTDM also conducted a number of broad regional soil traverses in the region as baseline geochemical orientations.

Since Serabi commenced exploration in 2002, it has completed systematic soil geochemistry coverage over the immediate Palito Mine area and a number of regional soil grids using Serabi exploration crews with either manual or small motorised auger drills.

The soil geochemistry coverage has been completed on a systematic 100m X 50m grid using soil auger holes to either 2.5m or 5m depths, with sampling intervals every 2.5m. Initially the soil geochemistry was analysed at the Palito laboratory facilities using a methyl isobutyl ketone ("MIBK") or di-isobutyl ketone ("DIBK") digest and atomic absorption spectrometry finish to a detection limit of 100 ppb. Geochemical results showed the mineralized areas in the Palito Mine area were defined by a >400 ppb Au in soil result.

Subsequent assessment and evaluation of the soil results in 2007, suggested that re-analysis using a 10 ppb detection limit could prove useful in defining more subtle footprints of yet undiscovered mineralization. As a result, a program to resubmit all available soil sample historical sample pulps was completed at SGS Geosol laboratories. As a result, re-assessment of the soil geochemistry in the Palito Mine and Jardim do Ouro Project area did not significantly change the values for definition of the known mineralization, however a great level of confidence was gained from the results and better definition of the mineralization was achieved.

Since 2007, all soil geochemical sampling conducted away from the immediate Palito Mine area has been analysed using external laboratories and a 10 ppb lower detection limit.

In 2008, a small program of deeper reconnaissance auger drilling was contracted to Explorer Services of Belem, and managed by Serabi's exploration department. This program was designed to confine the saprolite mineralization at the Bill's Pipe prospect NW of the Palito Mine.

Also in 2008, a regional stream sediment geochemistry sampling program was contracted to Explorer Services to complete coverage of the entirety of the Jardim do Ouro Project. This program involved Serabi defining the sample points and Explorer Services collecting a 200 gm < 200 mesh sample and a 3 kg < 2 mm sample which were subsequently submitted to SGS Geosol of Belo Horizonte for analysis using a 10 ppb detection limit.

This program defined a number of anomalous areas outside the immediate Palito Mine area, defined by a greater than detection (>10 ppb) analysis. To date these anomalous areas have not been followed up.

During January – February 2011 Serabi excavated 771m of surface trenches over the Piaui target area, sampling on 1metre spacings. This was followed up with the Piaui diamond drilling programme during March 2011.

### 9.3 Remote Sensing

In 2008, Seniografia was contracted to provide Serabi with a series of Spot 5 Satellite images of the Jardim do Ouro Project, along with the Modelo and Pison Project areas.

Also in 2008, as part of the Geotech/Microsurvey geophysical program, Serabi acquired laser altimetry of the survey area surrounding the Palito Mine and immediate environment.

Serabi have also used in addition publically available Landsat and SRTM terrain images for spatial and lineament analyses.

#### *Structural Geology*

Dr Brett Davis of Olinda Gold was commissioned to undertake a review of aeromagnetic data, Serabi documents and public domain information for Serabi's Jardim do Ouro project in the Tapajós Mineral Province in Brazil in October 2011.

A summary extract from this report is provided below;

- The project area is strongly dissected by several sets of faults. The prevalent faults strike NW-SE and NE-SW subparallel to two pervasively developed deformation fabrics, which may pertain to regionally developed cleavages. The pervasively developed fabrics are interpreted as forming coeval with similarly oriented faults, with NE-SW faults being broadly parallel to NE-SW fabrics and NW-SE structures being broadly parallel to NW-SE fabrics.
- The NE-SW fault set is interpreted as forming synchronous with a set of E-W striking faults. The E-W faults typically have shorter strike lengths and commonly terminate against NE-SW faults. E-W faults are interpreted as strain accommodation features that link the NE-SW faults.
- The boundaries of several ovoid plutons have been interpreted, including inferred unroofed extent of the intrusions. Zones of contact metamorphism are spatially associated with all intrusions. The ovoid shape of the plutons is interpreted to be a product of emplacement at levels suitable for ductile fabric formation (~7km?) and the long axes of the plutons conform to the orientation of NW-SE faults, which represent long-lived basement structures. All fault and fabric populations cross-cut the plutons.
- The NE-SW and E-W fault sets are interpreted as forming synchronous with granite emplacement. These faults have curved geometries around the ends of the plutons and also cut the intrusions. Although the NW-SE fault set is relatively more prevalent at a regional-scale, the event that produced NE-SW structures is considered to be the main episode of deformation and pluton emplacement in the Jardim do Ouro Project area, and likely responsible for gold-bearing hydrothermal systems.
- The Riedel model has been proposed by previous workers to explain the geometries of mineralised structures. Olinda Gold does not consider this model to be appropriate and the correlation of some structural orientations with ideal Riedel orientations is likely coincidental. More work is required to establish kinematic histories and relative ages of structures before such models are invoked.
- An area of potential exploration interest has been identified at the southern end of one of the ovoid plutons. The area is interpreted as a zone of low mean stress that may have been produced during deformation synchronous with gold deposition. In addition, the area hosts a number of

fault intersections for structures considered important for hosting the passage and deposition of gold-bearing fluids.

### *Exploration Strategy*

Serabi has been exploring the Jardim do Ouro Project since 2003 and during this time has gained a robust understanding of the geology, geochemistry and geophysical signatures and controls of the mineralization within the Palito Mine and the Jardim do Ouro Project area.

Serabi believes it has developed a successful formula for the discovery of new deposits in the Jardim do Ouro area, following a tested methodology.

Exploration uses the following process:

- Ground selection – NW-SE structural corridor, with NE-SW breaks
- Remote sensing and remote geophysics, VTEM, magnetic
- Ground geophysics (IP, EM) and shallow geochemical sampling and/or drilling (auger/RAB)
- Diamond drilling based on integrated models and ranking.

Specifically, Serabi believes that exploration should focus on structural corridors parallel to, or extensions of the Palito trend (310°) and specifically where the Palito Central Fault (070°) analogies exist.

Topographic highs or the flanks are considered more prospective due to silicification of the country rock making them more resistive to weathering.

IP is a viable method to delineate drill targets on a prospect scale.

The structural setting of the Palito deposit is not unique as lineament analysis defines several other look-alike settings in the immediate area.

The fluid source for the vein mineralization may be close; hence it is worth considering other mineralization models, such as fertile intrusions (gabbros or discrete granite intrusions).

## **9.4 Exploration Program**

The Company still retains a longer term objective to explore and build Serabi's mineral resource base. However, with the success of the 2011 discovery drilling campaign which has provided strong indications of the resource growth that the Company has targeted and the continued strength of the gold price, the Board has determined that the Company will, in the short term, focus on generating cash flow from the existing resources and use this to at least in part finance the future resource growth. The Company does not therefore expect to engage in significant exploration activity during the forthcoming 12 month period although if funding permits may undertake limited work to enhance its understanding of the Piaui, Currutela and Palito South areas prior to embarking on future resource drilling campaigns.

On a wider regional basis it will also, if funding permits, undertake some preliminary surface exploration activity on other parts of the Jardim do Ouro tenement area and in particular those areas where it has very limited exploration data to date, to determine if these are areas that it should continue to hold.

## 10 DRILLING

Totals for metres drilled at Jardim do Ouro Project including exploration and resource works are shown below.

**Table 10.1 -Drilling Summary**

Sample Type	Total Metres	No. of Assays	Metres Sampled	No. of Holes
2011 Core-Surface	12,606	4,363	4,047.97	72
Core-Surface	85,744	23,183	20,133.63	510
Core-Underground	16,487	5,965	5,062.65	336
Reverse Circulation	4,410	4,036	4,260.2	74
RAB	4,239	1,810	4,198.5	320
Auger	16,353	7,497	16,262.11	4,472
Channel Samples	15,294	15,111	11,795.97	5,724
Total	155,133	61,965	65,761.03	11,508

### 10.1 Diamond Drilling

RTDM completed six diamond drill holes in late 1996 in the initial phase of drilling targeting the mineralization associated with the Palito Main Zone and proximal prospects. This drilling totalled 1610.06m in holes FJO-01 to FJO-06. It successfully intersected the mineralization within the Palito Mine system. However the narrow nature of the mineralization and the lack of a large tonnage low grade potential of the system predetermined that RTDM would not continue to develop the project. Serabi has incorporated this drilling into the database and subsequently re-logged and re-sampled the core for confirmatory analysis.

The resource estimation covers diamond drilling up until the cut off period of March 31, 2008. Subsequent exploration surface diamond drilling has been completed in the Palito South and in the Palito West areas. Underground diamond drilling continued within the mine until suspension of mining activities in December 2008.

Surface diamond drill holes completed up to the end of 2008 not included in the resource estimate are the holes PDD0419 to PDD0454, totalling 8,158m. Significant results from this surface diamond drilling not included in the resource estimation are tabled below.

**Table 10.2 - Significant intercepts on surface core drill holes executed after the March 2008 resource estimate**

Hole	From (m)	To (m)	Interval	Au g/t	Cu %
PDD0421	15.45	16.00	0.55	8.36	0.22
	186.00	189.87	3.87	18.85	0.31
	277.35	278.53	1.18	1.92	0.83
PDD0423	228.43	229.50	1.07	3.22	0.00
PDD0428	101.28	101.89	0.61	1.64	0.10
PDD0432	270.96	274.90	3.94	3.02	0.02
	279.14	282.94	3.80	7.44	0.23
PDD0436	83.08	83.85	0.77	2.1	0.05
	292.10	293.15	1.05	5.61	0.37
PDD0437	31.64	32.82	1.18	3.75	0.42
	90.07	91.02	0.95	6.23	0.01
PDD0444	55.15	56.12	0.97	3.43	0.04
	58.90	59.83	0.93	34.75	0.24
PDD0447	227.70	228.33	0.63	0.36	0.22
PDD0448	175.23	176.33	1.10	0.99	0.12
	180.08	181.00	0.92	1.06	0.01
PDD0450 including	54.25	56.80	2.55	2.43	0.55
	55.65	56.80	1.15	3.56	1.1
PDD0452	75.64	76.55	0.91	5.01	0.04
PDD0424	91.49	92.54	1.05	1.45	0.03
	228.44	229.51	1.07	9.33	0.50
PDD0426	80.41	81.25	0.84	2.39	0.04
	194.85	196.49	1.64	1.91	0.19
PDD0431	65.72	66.30	0.58	22.2	0.05
	114.83	115.39	0.56	15.8	0.06
	140.27	142.00	1.73	6.75	0.09
	275.31	276.48	1.17	2.52	0.06
PDD0445	22.35	23.20	0.85	52.15	0.88
	57.70	58.63	0.93	1.33	0.08
PDD0346Ex	177.17	178.20	1.03	1.52	0.32
PDD0449	15.62	16.28	0.66	9.51	1.74
	93.06	95.20	2.14	9.04	0.16
PDD0451	7.00	8.80	1.80	6.01	0.07
	20.81	22.30	1.49	25.61	0.41
	98.74	99.28	0.54	2.02	0.31
PDD0453	85.84	86.66	0.82	17.1	0.15
PDD0454	79.50	80.45	0.95	11.46	0.11

(1) Assay intercepts are calculated based on a minimum grade 1g/t Au using a 0.5 gm. Au lower cut and a maximum internal waste interval of 1.2m.

Underground diamond drilling not included in the 2008 mineral resource estimate includes drill holes PUD297-PUD334, totalling 2,133m. Significant results from underground diamond drilling not included in the resource estimation are tabled below.

**Table 10.3 - Significant intercepts on underground core drill holes executed after the March 2008 resource estimate**

Hole	From (m)	To (m)	Interval	Au g/t	Cu %
PUD0298	31.32	31.84	0.52	1.77	0.08
PUD0298	34.37	35.75	1.38	13.46	0.21
PUD0300	54.89	55.62	0.73	0.99	0.55
PUD0302	8.61	10.14	1.53	2.70	0.02
PUD0303	27.28	36.54	9.26	2.68	0.2
PUD0303	43.88	45.78	1.90	2.93	0.27
PUD0304	39.00	39.51	0.51	2.56	0.17
PUD0304	52.53	53.62	1.09	1.03	0.02
PUD0298	31.32	31.84	0.52	1.77	0.08
PUD0298	34.37	35.75	1.38	13.46	0.21
PUD0300	54.89	55.62	0.73	0.99	0.55
PUD0302	8.61	10.14	1.53	2.70	0.02
PUD0303	27.28	36.54	9.26	2.68	0.2
PUD0303	43.88	45.78	1.90	2.93	0.27
PUD0304	39.00	39.51	0.51	2.56	0.17
PUD0312	15.29	16.30	1.01	5.01	0.09
PUD0312	29.15	30.06	0.91	1.33	0.01
PUD0313	1.38	3.58	2.20	0.96	0.22
PUD0313	6.05	9.66	3.61	21.31	1.75
PUD0313	13.77	15.44	1.67	18.87	0.02
PUD0313	28.84	29.57	0.73	3.11	0.11
PUD0313	45.42	46.15	0.73	1.60	0.26
PUD0313	48.22	50.07	1.85	22.53	0.67
PUD0313	55.05	55.61	0.56	10.65	1.71
PUD0314	0.42	1.47	1.05	2.88	0.05
PUD0314	3.86	6.70	2.84	2.32	0.10
PUD0314	10.58	11.45	0.87	1.15	0.05
PUD0314	38.55	39.48	0.93	20.39	0.25
PUD0315	7.18	14.10	6.92	0.92	0.11
PUD0315	15.65	24.19	8.54	0.70	0.11
PUD0316	11.54	19.48	7.94	8.43	0.36
PUD0317	17.87	23.43	5.56	13.05	0.59
PUD0317	25.41	26.41	1.00	6.63	1.59
PUD0317	28.73	31.05	2.32	0.52	0.14
PUD0317	43.42	49.29	5.87	0.38	0.74
PUD0317	50.26	56.03	5.77	1.77	0.33
PUD0317	70.77	72.70	1.93	3.80	0.14
PUD0318	6.92	11.72	4.80	12.41	1.31
PUD0318	14.11	18.70	4.59	0.62	0.35
PUD0318	47.03	57.82	10.79	52.29	1.74
PUD0318	67.63	76.56	8.93	2.36	0.13
PUD0319	4.08	4.64	0.56	2.80	0.01
PUD0319	5.91	6.58	0.67	2.79	0.04
PUD0319	12.97	18.93	5.96	26.20	0.18

Hole	From (m)	To (m)	Interval	Au g/t	Cu %
PUD0319	26.27	26.79	0.52	2.09	0.04
PUD0319	30.98	31.48	0.50	14.36	0.02
PUD0319	42.70	44.48	1.78	4.33	0.02
PUD0319	50.71	58.09	7.38	3.93	1.23
PUD0319	60.23	64.88	4.65	3.25	0.10
PUD0320	21.58	23.48	1.90	5.77	0.07
PUD0322	15.29	17.25	1.96	0.66	0.04
PUD0324	16.60	18.64	2.04	1.16	0.03
PUD0324	22.18	26.68	4.50	0.94	0.03
PUD0325	11.40	20.73	9.33	2.02	0.07
PUD0325	21.37	26.59	5.22	0.87	0.07
PUD0331	16.68	17.29	0.61	12.89	0.06
PUD0333	12.56	13.46	0.90	3.84	0.02

(1) Assay intercepts are calculated based on a minimum grade 1g/t Au using a 0.5gm Au lower cut and a maximum internal waste interval of 1.2m

Commencing in December 2010 and completed during November 2011, the Company undertook two further drilling campaigns of 8,214 metres (“the 2011 Phase 1” campaign) and 4,400 metres (“the 2011 Phase 2” campaign). All of the 2011 Phase 1 drilling and 2,600 metres of the 2011 Phase 2 drilling was carried out on satellite targets located in close proximity to (within three kilometres) but not contiguous with, the existing Palito resources.

The first phase was directed at targeting IP chargeability models with either coincident resistivity or conductivity anomalies with additional supporting geochemical, EM or structural interpretation support. The objective of the phase 1 drilling was to intersect the causative body or source of the IP anomalies. The second phase was aimed at infilling those successful targets derived from phase 1 drilling and also to further define existing intersections at Palito South. This drilling was not undertaken on a sufficiently close spacing to allow any geological interpretation to be made with sufficient confidence for any mineralisation identified to be classified as any form of resource.

The remaining 1,632 metres of the 2011 Phase 2 drilling campaign comprised 20 shallow (less than 100 metres) drill holes into the Palito South area extending the area covered by the drilling that had been undertaken in 2008 and which did not form part of the 2008 mineral resource estimate.

Significant results were returned from a number of prospects including Piaui, Currutela, Espeto and Palito South and these are summarised below:

**Table 10.4- Significant intercepts executed during 2011 for the Piauí Discovery**

Hole	From (m)	To (m)	Interval	Au g/t	Cu %
PDD0497	51.50	52.00	0.50	0.94	1.17
	66.69	67.22	0.53	1.14	1.38
PDD0498	40.98	41.70	0.72	3.63	4.17
	49.66	50.57	0.91	3.05	3.22
PDD0499	110.57	115.78	5.21	3.25	3.73
<i>including</i>	110.57	111.56	0.99	4.13	4.84
<i>including</i>	114.54	115.78	1.24	8.81	10.03
	130.88	131.93	1.04	0.63	0.77
PDD0500	50.96	51.75	0.79	0.74	0.84
PDD0501	44.94	45.75	0.81	1.35	1.41
	69.04	69.54	0.50	0.80	0.90
PDD0504	45.14	45.90	0.76	2.17	2.65
	70.94	71.44	0.50	2.16	2.54
PDD0505	36.61	37.39	0.78	0.85	0.80
	57.85	60.79	2.94	0.58	0.65
	62.61	64.30	1.69	0.50	0.56
PDD0506	12.05	13.10	1.05	0.60	0.68
	40.57	41.44	0.87	2.48	3.09
	56.81	60.21	3.40	5.88	6.49
	57.81	58.75	0.94	16.69	17.90
	62.40	62.90	0.50	0.54	0.68
PDD0507	19.83	20.56	0.74	0.81	- <sup>(2)</sup>
PDD0508	8.77	9.45	0.68	0.96	1.20
	12.60	13.82	1.22	0.62	0.63
	15.50	20.30	4.80	2.01	2.72
	16.69	17.58	0.89	8.59	9.48
	50.21	51.09	0.88	0.53	0.58
	63.33	64.43	1.10	2.57	2.72
PDD0509	14.40	14.92	0.52	1.07	- <sup>(2)</sup>
	20.50	23.20	2.58	0.92	- <sup>(2)</sup>
	38.19	38.94	0.75	0.77	0.86
PDD0510	8.10	10.29	2.28	1.18	- <sup>(2)</sup>
PDD0511	23.64	24.30	0.66	1.34	- <sup>(2)</sup>
	39.57	40.20	0.63	0.51	0.72
	64.18	66.18	2.00	7.00	8.91
	65.10	66.18	1.08	10.22	12.25
	72.12	73.20	1.08	0.31	0.28
	73.20	74.13	0.93	2.12	3.12

Hole	From (m)	To (m)	Interval	Au g/t	Cu %
PDD0512	52.85	54.00	1.15	0.27	0.28
PDD0514	0.00	0.80	0.80	17.38	– <sup>(2)</sup>
PDD0515	36.16	36.91	0.75	0.93	1.12
	43.11	43.71	0.60	1.66	1.83
PDD0457Ext	161.50	162.47	0.97	1.26	1.35
	182.73	183.58	0.85	0.53	0.50

**Note:**

(1) Reported intercepts are calculated based on a minimum weighted average grade of 0.5g/t Au using a 0.5g/t Au weighted average lower cut and a maximum internal waste interval of 1.2m based on ALS reported analyses. All assays completed by ALS used a 30gm Fire Assay charge with an AAS analysis. Where initial Au results exceed 10g/t, analysis is done with a gravimetric charge. All assays completed by Serabi's on-site laboratory used a 30gm DIBK aqua regia digest with an AAS analysis. Serabi's on-site laboratory is not certificated for analysis.

(2) This sample was recovered from weathered near surface (saprolite) material. Saprolite samples are not submitted for independent analysis.

**Table 10.5 - Significant intercepts executed during 2011 for the Currutela and Espeto discoveries**

Hole	From (m)	To (m)	Interval	Au g/t	
PDD0464	65.41	66.86	1.45	0.40	
	184.66	185.42	0.76	5.30	
	226.35	227.21	0.86	0.74	
PDD0465	208.54	210.68	2.14	12.92	
<i>including</i>	<i>208.54</i>	<i>209.54</i>	<i>1.00</i>	<i>25.60</i>	
PDD0466	182.99	183.58	0.59	1.35	
PDD0470	84.25	85.01	0.76	1.14	
	89.50	93.82	4.32	1.58	
	<i>including</i>	<i>90.98</i>	<i>91.86</i>	<i>0.88</i>	<i>5.25</i>
	97.78	101.31	3.53	2.89	
	<i>including</i>	<i>100.70</i>	<i>101.31</i>	<i>0.61</i>	<i>10.90</i>

**Table 10.6 - Significant intercepts executed during 2011 for the Palito South discovery**

Hole	From (m)	To (m)	Interval	Palito Au g/t	Palito Cu %	ALS Au g/t	ALS Cu %
PDD0519	4.80	5.65	0.85	0.54	0.00	_(2)	_(2)
	96.39	97.11	0.72	9.26	0.40	8.91 <sup>(3)</sup>	0.76
PDD0521	0.80	1.43	0.63	0.88	0.00	_(2)	_(2)
	11.90	12.87	0.97	0.90	0.00	_(2)	_(2)
PDD0522	100.25	100.75	0.50	0.75	0.00	0.87	0.00
	104.86	105.76	0.90	20.60	3.56	21.60	4.63
PDD0523	8.90	9.90	1.00	0.71	0.00	_(2)	_(2)
	71.21	72.57	1.36	48.07	2.64	43.24	2.92
	<i>Including</i>	<i>72.00</i>	<i>72.57</i>	<i>0.57</i>	<i>103.94</i>	<i>6.04</i>	<i>90.90</i>
PDD0525	0.00	0.60	0.60	0.84	0.00	_(2)	_(2)
	37.94	38.57	0.63	0.98	0.03	1.515	0.01
	72.45	73.45	1.00	1.18	0	1.02	0.00
	76.26	77.26	1.00	2.29	0.01	2.18	0.01
PDD0526	66.15	68.01	1.86	4.3	0.09	5.22	0.15
	<i>including</i>	<i>66.15</i>	<i>66.96</i>	<i>0.81</i>	<i>6.89</i>	<i>0.13</i>	<i>8.79</i>

**Note:** (1) Reported intercepts are calculated based on a minimum weighted average grade of 0.5g/t Au using a 0.5g/t Au weighted average lower cut and a maximum internal waste interval of 1.2m based on ALS reported analyses. All assays completed by ALS used a 30gm Fire Assay charge with an AAS analysis. Where initial Au results exceed 10g/t, analysis is done with a gravimetric charge. All assays completed by Serabi's on-site laboratory used a 30gm DIBK aqua regia digest with an AAS analysis. Serabi's on-site laboratory is not certificated for analysis.

(2) This sample was recovered from weathered near surface (saprolite) material. Saprolite samples are not submitted for independent analysis.

(3) Fire assay with AAS finish returned an analysis of >10g/t, however final analysis determination via gravimetric finish reported a grade <10g/t.

## 10.2 Reverse Circulation Drilling

Reverse Circulation ("RC") drilling has been undertaken by Serabi on two occasions. In 2006, Wilemita Ltda, was commissioned to undertake a drilling program on the Bill's Pipe, Chico da Santa and Ruari's Ridge prospects.

In 2007, GeoLogica Sondagens were contracted to undertake a program of RC drilling on the Chico da Santa prospect.

In both circumstances the use of RC was attempted to expedite the drilling programs and provide a rapid turn-around for diamond drill planning and to assess the potential of the shallower, saprolite and oxide mineralization in the near mine environment.

Due to the shallow, limited extent of the saprolite and weathered profile in the region, RC proved to be less effective than anticipated, due mainly to the depth of the regolith profile encountered and because of the hard abrasive nature of the granites, production was not significantly faster than that of diamond drilling.

In the period May to early July 2009, a small program of 393.6m of RC drilling was conducted to explore for shallow oxide mineralization over existing identified lodes. The program was executed by

Serabi's crawler underground drill rig which completed a series of shallow drill holes prefixed with PRC in and around the Palito West and G3 south lodes. The rig was operated by Serabi personnel.

The results of the PRC drilling are not included in the resource estimation as they were completed post the March 31, 2008 cut-off for the estimation.

### **10.3 RAB Drilling**

RAB or Rotary Air Blast drilling was undertaken by Serabi in 2009 to test a series of soil geochemistry anomalies in the immediate Palito Mine area. This RAB drilling program was contracted to GeoLogica Sondagens of Belo Horizonte.

The use of RAB drilling was again undertaken to expedite the assessment of soil geochemistry anomalies, which was previously conducted by Serabi's exploration team using auger drilling. Ground conditions and logistical issues proved to be limiting and the RAB drilling was less effective and slower than anticipated.

It should be noted that RAB drilling was used purely as an exploration tool and no RAB results are included in the resource estimation.

### **10.4 Topographic Surveys**

#### *Surface Surveys*

Surface surveys are carried out by the Serabi survey department using total station and theodolite optical equipment. Surveys include opening lines for soil and drill traverses, marking topographic reference stations, pre-location of programmed drill collars, relocation of collars and alignment of drill azimuths after drill pad or earthwork preparation, pick up of earthworks, roads and other infrastructure.

#### *Underground Surveys*

Underground surveys are carried out by the Serabi survey department using total station and theodolite optical equipment. Underground survey encompasses marking up of planned developments and pick-ups of actual developments, surveying of stopes, drives, raises, winzes and ramps, location and alignment of drill holes and collars.

All active headings are surveyed at 3 day intervals. Gradient lines are extended to the active faces on developments.

Waste development is controlled by survey through the setting of direction lines and gradient using back and fore sights and a bearing.

Survey pickups are processed with the Topograph software package and exported to an Autocad package where they are appended to the archives.

#### *Drill Collar & Down Hole Surveys*

All drill collar positions are surveyed in using a theodolite and maintained in the Serabi database.

Drill holes are surveyed down the hole using a Reflex E-Z shot tool, which records the dip and azimuth at selected intervals down the hole, (nominally 30m intervals). These surveys are then recorded by the geology department and maintained along with all relevant surveys in the Serabi database.

#### *Topography*

In addition to the locally surveyed collars and topography surrounding the Palito Mine infrastructure, Geotech/Microsurvey completed a laser altimetry survey in conjunction with the airborne geophysical survey over the Jardim do Ouro Project in January 2008.

This survey was completed on 100m spaced 30° angled traverses, collecting altimetry readings, of the altitude of the helicopter in relation to the ground every 0.1 seconds. These altimeter readings were then levelled, through synchronization with helicopter flight altimeter and used to create a digital elevation map of the area surveyed.

## **11 SAMPLING METHODS AND APPROACHES**

### **11.1 Sampling Methods**

#### **11.1.1 *Drill Core Sampling***

Drill sampling is undertaken at the geological core logging facilities at the Palito mine site. Every drill core is cut and sampled. Sampling protocol is such that sample intervals are a minimum of 0.5m and a maximum of 1.2m, although there are a small amount of exceptions to this within the database.

Sample selection is based on geological intervals, if the interval exceeds 1.2m it is divided equally, but not less than 50cm, into sample intervals covering the zone of interest. Should a zone of interest sampled be less than 50cm, then the sample interval is extended to exceed the zone of interest, incorporating the country/gangue rock. All exploration drill core is half core sampled, with the samples placed in a plastic bag, clearly marked with the appropriate sample number and sealed. They are then placed into larger 50 litre bags, which are in turn sealed, marked and dispatched to the laboratory.

Part of the core samples, 22% of the total core samples, were analysed at the Palito laboratory. They are in majority underground core drillholes, whose necessary turn-over period is shorter than regular surface core holes. The remainder, 88% of the samples (20311 samples within a total of 26137 samples) were sent to either the ALS Chemex, with preparation at Goiás and assaying at Brisbane, in Australia, or to the SGS Geosol laboratory, with preparation at Itaituba and assaying at Belo Horizonte, Brazil. Both laboratories used standard 30g fire assay fusion and aqua regia analysis for gold and copper. Both laboratories are reputed commercial laboratories certified. Once Palito established an onsite analytical laboratory in 2005, all samples were primarily quarter cored, with quarter core samples sent to the Palito laboratory for analysis via MIBK, which was then changed to DIBK in mid 2006, for gold and aqua regia for copper analysis.

To improve turnaround times, cost saving on analysis, and provide agility to drill hole programming, only half core samples of those intervals returning anomalous gold or copper grade from the Palito mine site laboratory were dispatched to SGS Geosol for fire assay and copper analysis.

In 2007 this process of quarter and half core analysis was abandoned, due to the establishment of a core preparation facility in Itaituba by SGS Geosol, which improved turnaround time on analysis and also due to the limited capacity of the Palito laboratory to process exploration drill samples due to the increase in mine production and mill samples assuming a higher priority to those of exploration at the site laboratory.

In October 2007 under advice received from NCL Brasil, Serabi began sample preparation of half core samples at the onsite laboratory and dispatch of prepared samples to SGS Geosol for analysis. This process continued until February 2008, when again the increased production of drill samples exceeded the preparation facilities of the laboratory and all samples were again dispatched to SGS Geosol via Itaituba for analysis.

In May 2008, Alex Stewart Analytical assumed management of the Palito mine site laboratory facilities completing a re-design and updating of the laboratory facilities, aimed at enabling certified assays to be undertaken on site without the requirement to send samples offsite for regular analysis. In August 2008, Alex Stewart passed management of the laboratory back to Serabi, having completed the redesign and reappointing of laboratory facilities.

In respect of the discovery drilling campaign that was started in December 2010 and concluded in November 2011, Serabi has utilised the analytical services of Eco Tech Laboratory and ALS Minerals and their laboratories located in British Colombia, Canada (ALS Minerals acquired Eco Tech

Laboratory during 2011). Sample preparation was performed by Serabi using its laboratory facilities located at the Palito Mine.

All underground BQ size drill core is whole core sampled, and has undergone the same evolution of sample analysis as the exploration core. All underground drill core is held for a period of 3-6 months post drilling and then disposed as landfill.

#### **11.1.2 Reverse Circulation Drill Sampling**

Reverse circulation sampling was conducted on a metre by metre basis for the entire hole with the exception of the RC program completed in 2009.

All samples were passed through a Jones Rifle Splitter quartering the entire sample and repeating until a <2kg sample weight was achieved. The samples were placed in a plastic bag, clearly marked with the appropriate sample number and sealed. They were then placed into larger 50 litre bags, which were sealed, marked and dispatched to the laboratory. When the drill sample was too moistly or wet to pass through the riffle splitter, the sample was dried either by sun drying or by oven warming until sufficiently dry to pass through the splitter.

The samples were prepared and assayed by SGS Laboratories by 30g charge fire assay for gold and aqua regia for copper or via a combination of preparation and analysis at Palito Laboratory via aqua regia for gold and copper with pulps submitted to SGS for 30g fire assay gold and aqua regia analysis.

The 2009 RC program was collected on 1.2m intervals and composited to 2.4m sample intervals. The samples for this program were only prepared and analysed at the Palito laboratory.

#### **11.1.3 Channel Sampling**

Channel sampling was routinely completed as grade control for the mining operation. These samples are both faces and back samples collected along the development drives and mining fronts.

The samples are collected using a similar protocol to the diamond drill sampling protocol with a minimum length of 50cm and a maximum length of 1.2m.

The channel to be sampled is marked up by the geologist or mining technician using aerosol paint. The channel is then sampled by taking a continuous line of chip samples, using a hammer or hammer and chisel, which are collected in a bucket. The chips are then transferred into a plastic bag and marked with the appropriate sample number then sealed. Generally 2-5kg of chips for the channel sample is collected. The samples are then delivered to the Palito laboratory where they are prepared and analysed for gold and copper by aqua regia.

#### **11.1.4 Rab & Auger Drilling & Soil Sampling**

Serabi has completed over 4200m of RAB (Rotary Air Blast) drilling and 16,300m of soil auger drilling (both manual and motorised) in both post hole and spot auger soil sampling. RAB and auger results were not used in the resource estimation, they are considered as just an exploration tool. RAB, auger and soil sampling coverage in the Jardim do Ouro project covers the entire Palito mine system and greater region and in local grids in the Rio Novo prospect area. Samples are collected from the following intervals: 0 -0.5m depth in the spot soil samples and 0 – 2.5m and 2.5m to 5m (or bottom of hole) depth in the post hole auger drilling. The total sample is collected on a plastic sheet in the field and homogenised by manual mixing, then quartered manual by dividing the sample pile into quarters. The selected quarter is then transferred into a plastic bag marked with the appropriate sample number and sealed. Analysis for Au and Cu is then completed by Palito Laboratory with pulps sent to SGS Geosol for re-assay at 10ppb level detection limit.

## **11.2 Sample Preparation, Analysis and Security**

### ***11.1.5 Analytical Methods and Quality Assurance***

Quality assurance during the assaying process is established at the laboratory with well defined protocols for two different types of analytical methods as described below, depending on the types of samples.

#### **DRILL CORE METHODS**

Serabi has utilized the analytical services of SGS Geosol for all its drill core samples that comprise the mineral resource. The laboratory is located at Belo Horizonte, with the sample preparation facility in nearby Itaituba. In respect of the discovery drilling campaign that was started in December 2010 and concluded in November 2011, which comprises drillholes outside the mineral resource estimate, Serabi has utilised the analytical services of Eco Tech Laboratory and ALS Minerals and their laboratories located in British Colombia, Canada (ALS Minerals acquired Eco Tech Laboratory during 2011). Sample preparation was performed by Serabi using its laboratory facilities located at the Palito Mine.

#### **METHOD OF SAMPLE PREPARATION FOR ASSAYING**

When samples arrive at the SGS Geosol sample preparation facility, they are placed into trays and dried at 110° C. When dry, the entire sample, usually about 2-3 kilograms, is crushed to minus 2 mm size and a 1 kilogram sample split is taken from the crushed product by means of a Jones splitter. This split sample is then ground to a -150 mesh pulp, and a 125 grams-size homogenized fraction removed: 50 grams of which are used for the analysis and 75 grams of which are stored in a marked envelope for future reference.

Prior to sample preparation, samples which have been marked specifically because visible gold had been observed during the rough logging of the full core are handled slightly differently from the normal samples. The entire sample is crushed and ground to -150 mesh. The sample is then passed through a 150 mesh screen. The undersize, the bulk of the sample, is weighed and treated exactly as a normal sample, with 125 grams extracted, 50 grams of which go for fire assay and 75 grams are stored for future use. The oversize is then collected, weighed, pulverized, and treated as a separate sample. Both analyses are reported separately but the laboratory calculates a weighted average of the two results in its final report. This reported single value is ascribed to the sample interval.

#### **METHOD OF GOLD ANALYSIS BY FIRE ASSAY/AA FINISH**

- a. 50 grams of the pulverized sample is weighed into a crucible which contains a combination of fluxes such as lead oxide, sodium carbonate, borax, silica flour, baking flour or potassium nitrate. After the sample and fluxes have been mixed thoroughly, a silver inquart and a thin layer of borax is added on top.
- b. The sample is placed into a fire assay furnace at 2000° F for one hour. At this stage, lead oxide is reduced to elemental lead and slowly sinks down to the bottom of the fusion pot or crucible collecting the gold and silver along its way to the bottom of the melt.
- c. After one hour of fusion, the crucible is removed from the furnace and its contents poured into a conical cast iron mould. Elemental lead, which contains the precious metals, sinks to the bottom of the mould and any unwanted materials, the glassy slag, floats to the top. When cooled, the cone is removed from the mould and by hammering the glass is eliminated and a "lead button" formed.
- d. The lead button is then put onto a preheated cupel made of bone ash and reintroduced into a furnace for a second stage of separation at 1650° F. The lead button becomes liquefied and

- reacts with and is absorbed by the cupel. The gold and silver which have higher melting points remain on top of the cupel.
- e. After 45 minutes of cupellation, the spent cupel is then taken out of the furnace and cooled. The doré bead which contains the precious metals is then transferred into a test tube and dissolved in hot Aqua Regia solution heated by a hot water bath.
  - f. The amount of gold in solution is determined with an Atomic Absorption spectrometer (AA). The gold value, in parts-per-billion, or grams-per-tonne, is calculated by comparison with a set of known gold standards.

#### CHANNEL SAMPLES ASSAYING

The channel samples are assayed at the Palito laboratory where they are prepared and analyzed for gold and copper by aqua regia (DIBK).

With the objective of checking the results of the Palito lab, a group of channel sub-samples was chosen by NCL and sent to the SGS laboratory, in Belo Horizonte. The criteria adopted was to select the samples contained in the ore body models, thus not considering the samples located in waste zones nor mined out areas. For the proposed list of samples, 99 sub-samples were taken from coarse rejects and 1075 sub-samples were collected from pulp rejects. The former is intended to check the sample preparation, and the latter to check the analytical accuracy and precision of the Palito Lab, as compared to a “true” value, as it is here considered the SGS labs results, for practical purposes.

The conclusions of such study are that the Palito lab Au results presented poor repeatability and a moderate bias when compared with SGS results. However, to put these results into context, most of the problems are related to results below 0.7 g/t Au. This seems to be related to a detection limit of the Palito Lab higher than expected. If we consider values above this threshold, the repeatability improves significantly, reaching the generally accepted limits of variance (90% of the samples with  $HARD < 20\%$ ). Most of the bias also is eliminated using this procedure. For resource estimation, it was decided to transform the grades of the Palito lab, reducing any grade below 0.7 g/t to 0.01 g/t. Although conservative, this procedure has little impact on the average grade of the ore (2% reduction in the grade of the dataset analyzed) and is effective in the improvement of the quality of the information. This procedure also showed improved quality of the coarse rejects results.

But for copper, the Palito lab shows results so different than SGS’ results that it is recommended not to use the copper results of the Palito Lab until the procedures used for this metal are reviewed and new tests ensure a better repeatability of results, comparing with a commercial laboratory.

These recommendations were accepted by Serabi and adopted: the gold values obtained from the Palito Lab and below 0.7 g/t were transformed to 0.01 g/t, and the copper values from the same lab were deleted from the database used for the present resource evaluation. These measures affect only the channel samples, which have limited sphere of influence, being as they are located within excavations.

## 12 DATA VERIFICATION

### 12.1 Quality Control Measures and Results

A wide range of standards has been purchased from Rocklabs (NZ), for inclusion into all batches dispatched for analysis at both SGS Geosol and Palito labs. Blanks are inserted at the start of each batch of samples submitted for analysis and a standard and blank are then alternated every 10 samples, giving approximately 10% of samples submitted as quality control/quality assurance. Historically standards were inserted for each 20/30 samples submitted to the labs, but this regime was changed in mid 2007 for tighter control.

Blanks are sourced from a granite outcrop on site and are submitted routinely with each batch.

In addition to standards submitted by Serabi to the labs, the labs report on their own internal standards and blanks. Lab reports also contain duplicates, repeats and lab check results.

The current range of standards used by Serabi is tabled below.

**Table 12.1 – List of reference standards**

Standard Code (Rocklabs Certificated)	Expected Value (ppm Au)
OxA59	0.08
SE29	0.60
SF23	0.83
SG14	0.99
SJ10	2.64
SJ22	2.60
SJ32	2.64
SL34	5.89
SN16	8.37
SN26	8.54
SP17	18.13
SP27	18.1

#### SGS Standards Performance

The SGS laboratory results for standards are generally within an acceptable difference with the certified grade. Results of the vast majority are within 2 standard deviations from the expected mean, if considering the population of results from the round robin test realized by Rocklabs.

Figure 12 1 demonstrates the SGS analysis of the SE29 – 0.60ppm Rocklabs standard reporting a calculated mean of 0.58ppm.

**Figure 12.1- Performance of SGS Laboratory using Rocklabs SE29 – 0.60ppm standard.**

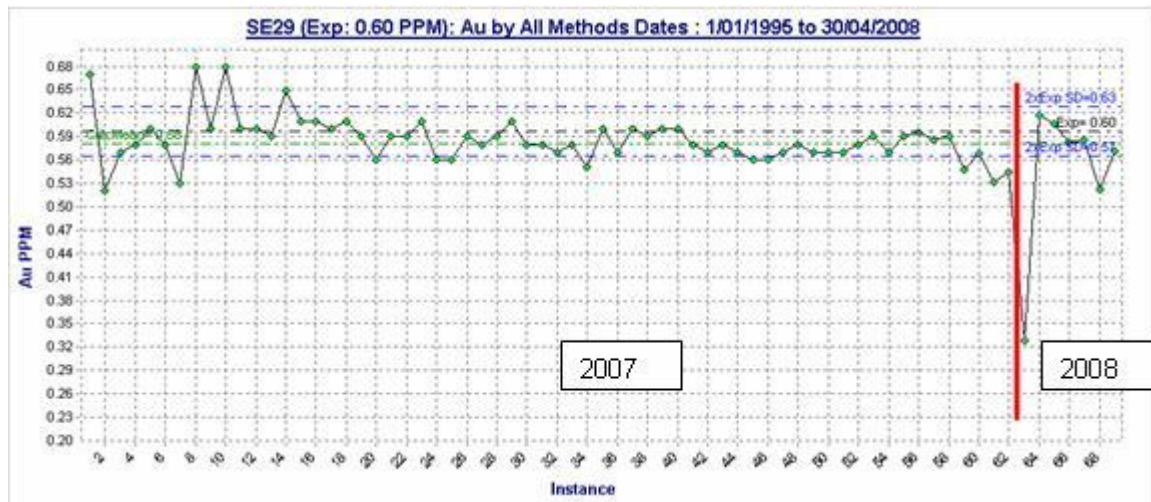
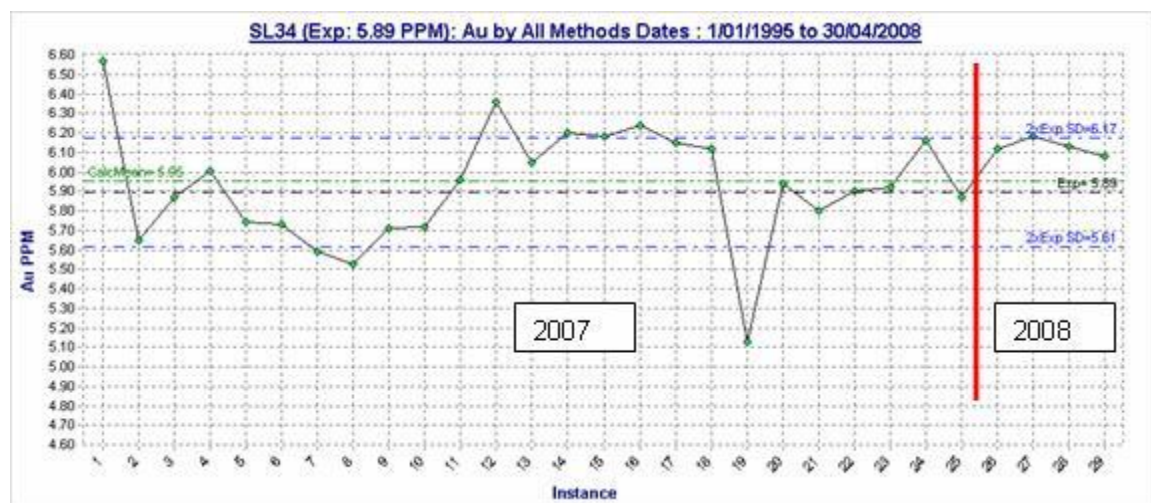


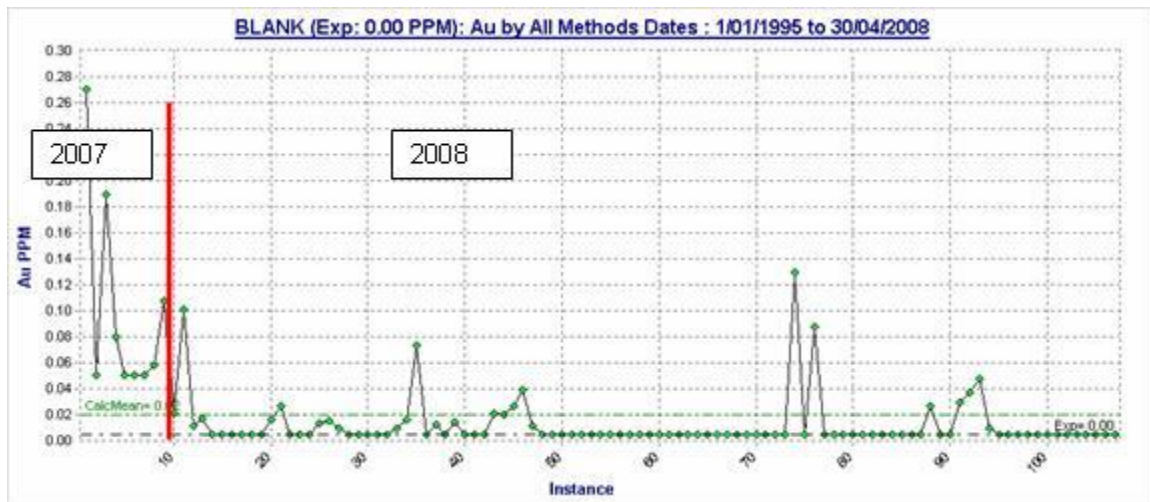
Figure 12 2 demonstrates the SGS analysis of the SL34 – 5.89ppm Rocklabs standard reporting a calculated mean of 5.96ppm. Most data plotted on the graph is within 2 standard deviations from the mean.

**Figure 12.2 – Performance of SGS Laboratory using Rocklabs SL34- 5.89ppm standard.**



The reporting of blanks sourced from local granite reflects a calculated mean of 20ppb, with a majority of the blanks reporting lesser than detect limit of 10ppb (Figure 12 2).

**Figure 12.3 – Graph of blanks (granite outcrop) submitted for contamination detection.**



### 13 MINERAL PROCESSING AND METALLURGICAL TESTING

The mineralized material from the Palito Mine was subject to several metallurgical testwork programs from 2004 to 2007, and a full scale metallurgical plant has been operating continuously at the Palito Mine since Q3 2004 for almost five years. With approximately 575,000 tonnes of ore processed, and approximately 110 Koz of gold equivalent produced, there is plenty of empirical data on the metallurgical behaviour of the mineralized material.

#### 13.1 Metallurgical Tests

Metallurgical tests have been conducted upon comminution, flotation, cyanide leaching, dense media separation and gravity separation. Most of the testwork results had been carried out at AMMTEC Australia and Knelson Research and Technology Centre, Canada.

The project has a fully implemented process plant that operated continuously producing copper–gold concentrate and bullion for almost five years, from September 2004 until mid 2010. During this period of time, the plant was fed with 575,000 tonnes of ore, of which 85% came from underground portion of the Palito Mine at the Palito Main Zone area. The rest came from low scale near surface open pit mining.

The plant when previously operated had a capacity to process over 600 tpd of sulphide ore. The process flowsheet consists of a crushing circuit, a milling circuit, and a flotation circuit followed by concentrate filtration and storage facilities. The flotation tailings are fed to a cyanide agitation leaching CIP plant, followed by elution and gold refinement circuits, to produce bullion.

The tailings from the CIP circuit flow to detoxification tanks for neutralisation of cyanide, and are eventually pumped to a tailings storage dam situated 1.5km from the process plant.

By the end of 2008, a circuit to process oxidized ore from the near surface open pit mining was implemented. This circuit consists of feeding the ore directly to two dedicated Hammer mills that discharge to the main ball mills, from where the ore bypasses the flotation circuit, to go directly to the CIP, elution and gold refinement circuits to produce bullion.

The first phase of the Palito plant was built in 2004 using mainly second hand equipment, and was gradually expanded to reach the current configuration. The plant is in good condition and is currently maintained on a “care and maintenance” basis.

#### 13.2 Metallurgical Recoveries

The following tables summarize total historical production

**Table 13.1 - Historical production at Palito Mine to June 2010**

Quarter	Tonnes Milled	Head Grade		Plant Total		
		Au (g/t)	Cu (%)	Recovery	Production	
				Au (%)	Au (oz.)	Cu (t)
2005 – Q1	8,222	9.33	0.30	84.2	2,077	22.4
2005 – Q2	14,006	8.63	0.33	88.2	3,427	38.2
2005 – Q3	14,315	12.06	0.68	90.2	5,005	81.0
2005 – Q4	21,415	7.65	0.42	91.8	4,837	74.7
2006 – Q1	25,514	9.31	0.47	91.9	7,017	98.0
2006 – Q2	29,851	9.73	0.43	91.3	8,527	107.1
2006 – Q3	29,462	9.2	0.51	91.4	7,974	139.2

2006 – Q4	32,760	9.37	0.73	91.0	8,980	224.6
2007 – Q1	42,705	6.52	0.31	89.8	8,044	125.6
2007 – Q2	45,245	5.95	0.3	91.1	7,888	127.0
2007 – Q3	45,054	5.36	0.23	90.0	7,021	96.2
2007 – Q4	40,481	5.06	0.29	89.9	5,989	110.4
2008 – Q1	34,040	4.52	0.31	89.0	4,217	85.8
2008 – Q2	36,745	5.1	0.26	89.0	4,963	78.9
2008 – Q3	37,704	4.69	0.26	87.4	4,658	81.1
2008 – Q4	29,174	3.92	0.27	89.4	3,165	66.8
2009 – Q1	17,863	4.03	-	90.5	2,134	-
2009 – Q2	19,151	3.24	-	89.3	1,748	-
2009 – Q3	17,470	2.23	-	89.9	1,018	-
2009 – Q4	15,073	1.26	-	78.7	548	-
2010 – Q1	13,291	1.73	-	85.3	786	-
2010 – Q2	4,803	1.82	-	89.8	265	-

### 13.3 Process Description

#### Crushing

Stockpiled ROM ore is fed to the crushing circuit at an average rate of 23.1tph using a front end wheel loader. The ore is fed to a jaw crusher using a vibratory grizzly where it is crushed to a nominal size of 60mm. A conveyor transports the primary crushed ore to a double deck vibrating screen with a top deck screen size of 30mm and a bottom deck screen size of 10mm. The +30mm material reports to the secondary crusher, which is set to produce a product of less than 16mm. The -30mm+10mm material reports to two tertiary crushers operating in parallel. These crushers are set to produce a product of less than 10mm. A conveyor transports the secondary and tertiary crushed material back to the primary conveyor for re-screening. The less than 10mm product produced by the crushing circuit is transported via a stacker conveyor to crushed ore stockpiles.

Due to the high variability of the Palito ROM ore, material from each front and stope in the mine is crushed separately on a batch basis and stockpiled individually. The crushed ore product from each batch is sampled as it falls onto the product conveyor. After analysis of each sample, the separate stockpiles are blended using a front end wheel loader in such a way as to produce a consistent mill feed blend. The ore is blended as it is loaded into trucks, which in turn transport the blended ore to a mill feed stockpile.

#### Milling

The blended crushed ore is fed, using a front end wheel loader or by truck direct tip, into a mill feed silo. A conveyor removes ore from the base of the silo and transports it to a distributor at an average rate of 21.0tph. The distributor splits the feed proportionally to three operating mills. The Palito milling circuit contains four mills of which three are operated at any one time and one is kept as a reserve to be brought on-line when maintenance is required on one of the other mills. Mills 1, 2 and 3 have a nominal capacity of 5.5tph each and Mill 4 has a nominal capacity of 12.4tph.

The three operating mills are run in parallel. The mill discharge material is pumped to a nest of three 150mm cyclones. Cyclone underflow material is split proportionally and returned to the mills.

Cyclone overflow material, with an 80% passing size of 106 $\mu$ m and a pulp density of 45% solids, is fed to a trash screen and then pumped to the flotation circuit.

### Flotation

The flotation circuit consists of two conditioning tanks, with a total capacity of 7.2m<sup>3</sup>, followed by rougher, scavenger, and cleaner cells. A thionocarbamate collector for selective copper flotation is added to the conditioner tank feed. Lime is added within the grinding circuit to increase the pH of the pulp to between 10 and 11. MIBC frother is added to the feed of the first cell.

The flotation cells consist of three duplex cells, each with a capacity of 3.2m<sup>3</sup> and two product launders. The product from the first launder of the rougher cell is regarded as the rougher concentrate stream, whilst the product from the second launder is regarded as a scavenger stream and reports to a recycle hopper and pump. Rougher tails are refloated in the scavenger cell with products from both scavenger launders reporting to the recycle hopper and pump. Rougher flotation concentrate flows to the cleaner cell. Total cleaner cell volume is only 1.6m<sup>3</sup> as only the first part of the duplex cell is operated. The cleaner concentrate product flows to a final concentrate holding container and the cleaner tails report to the recycle hopper and pump. The recycle pump returns all recycle streams back to the conditioner tank feed. Scavenger tails are pumped to the CIP circuit.

Concentrate from the holding container is pumped, using a diaphragm pump, to two Netzche filter presses, each with a capacity of 300kg/hr. The pressed concentrate falls via a chute into poly weave bags, which are each filled to 1 metric tonne wet weight. Typical moisture content of the concentrate is 7%. The bagged concentrate is shipped as 20 tonne lots to Umicore, Belgium for refining.

### CIP

The CIP circuit consists of two mechanically agitated leach tanks, each with a capacity of 185m<sup>3</sup>, and six mechanically agitated adsorption tanks, each with a capacity of 74m<sup>3</sup>. Total residence time of the circuit is 20 hours. Cyanide and oxygen are added to the first leach tank. Oxygen is produced by a BOC gases designed PSA plant. Air is added to the remaining leach tank to maintain the dissolved oxygen content of the pulp.

Carbon is retained in adsorption tanks 1-6 by the use of intertank screens. Loaded carbon from adsorption tank 1 is removed every 12 hours and transferred to elution for removal of gold. After elution the barren carbon is returned to adsorption tank 6 and the carbon is advanced counter-currently to the pulp with the use of airlifts.

### Elution and Gold Refining

Loaded carbon is passed over a screen and washed free of pulp with the pulp being returned to adsorption tank 1. The washed carbon is transferred to an elution column, with a nominal capacity of 500kg.

Elution is carried out by the Zadra process. Strip solution containing 1% caustic and 0.15% cyanide is heated to 100°C and pumped through the elution column, stripping the gold from the carbon. The pregnant solution then passes through an electrowinning cell where the gold precipitates onto steel wool cathodes. The barren solution from the electrowinning cell returns to a holding tank where it is recirculated back through the process until elution is complete. Each elution cycle is typically 8 hours.

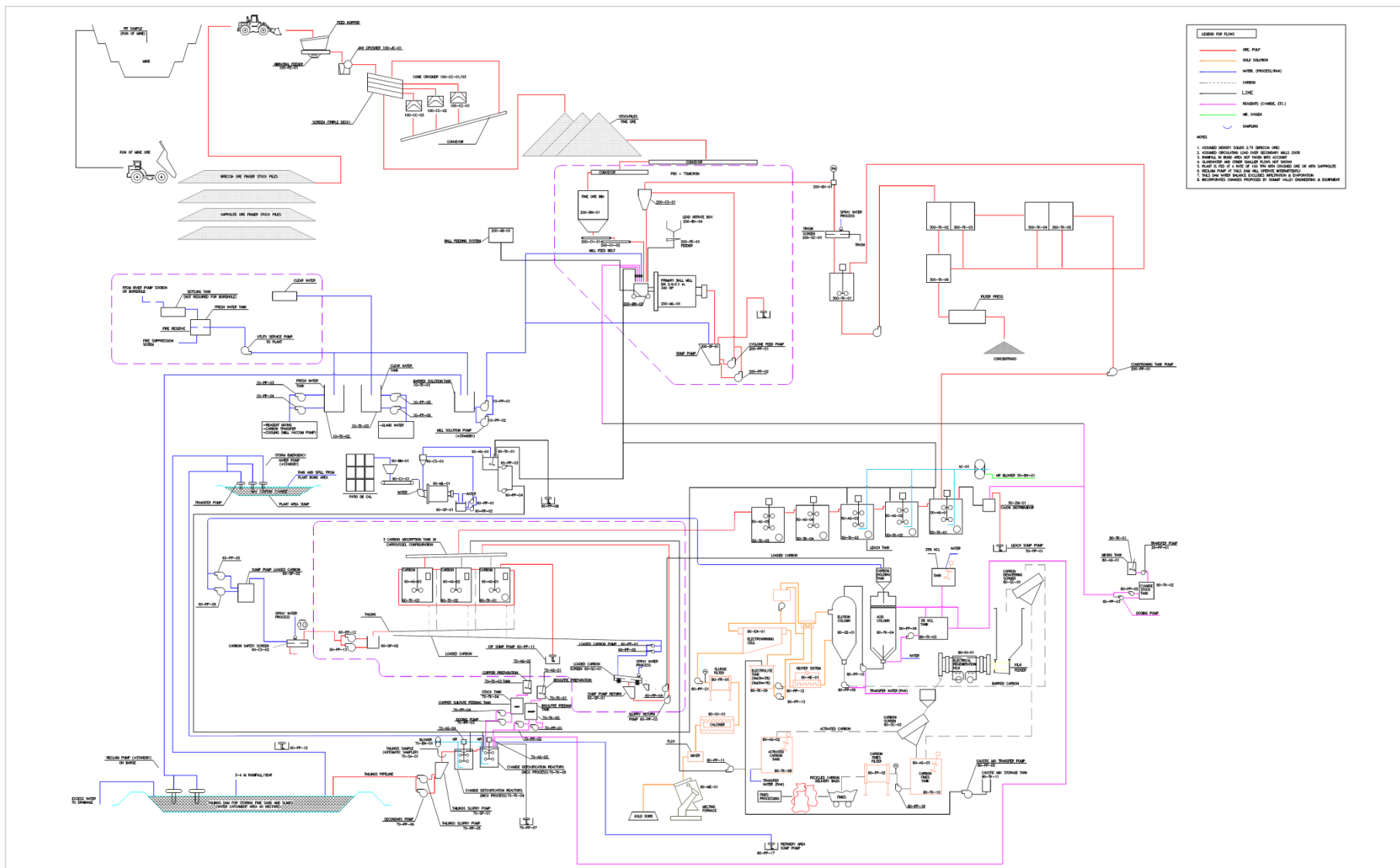
The barren carbon is removed from the elution column and washed with a dilute hydrochloric acid solution. After acid washing the carbon is rinsed with water a number of times and returned to the adsorption circuit.

Periodically, during each month, the steel wool cathodes are removed from the electrowinning cell for gold refining. Gold and silver contained on the cathodes are solubilised using aqua regia. The gold bearing solution is removed from the cathode sludge and sodium bisulphate is added to precipitate the gold. The gold precipitate is removed and sodium chloride added to the remaining solution to precipitate silver. The gold precipitate is smelted separately to the silver to produce gold bars grading 99% Au.

#### Tailings Management

The tailings from the CIP circuit flow to two detoxification tanks, each with a capacity of 42m<sup>3</sup>. Ferrous sulphate is added to the feed of the first tank for neutralisation of cyanide. The tailings from the detoxification tanks are pumped to and deposited in a tailings storage dam situated 1.5km from the process plant.

Figure 13.1– Overall Flow-sheet



## 14 MINERAL RESOURCE ESTIMATES

### 14.1 General Considerations

In March, 2008, NCL prepared a resource estimate for the Palito gold deposit, using 3D modelling and geostatistics. This model has not been updated, although additional drilling was available and limited mining has occurred. The additional drilling information can be obtained in the chapter 10 and the resource depletion information can be verified in the chapter 16. Both sources of change in the mineral resources are relatively of low impact, therefore this resource estimate can be considered as representative of the updated mineral resources of the Jardim do Ouro property.

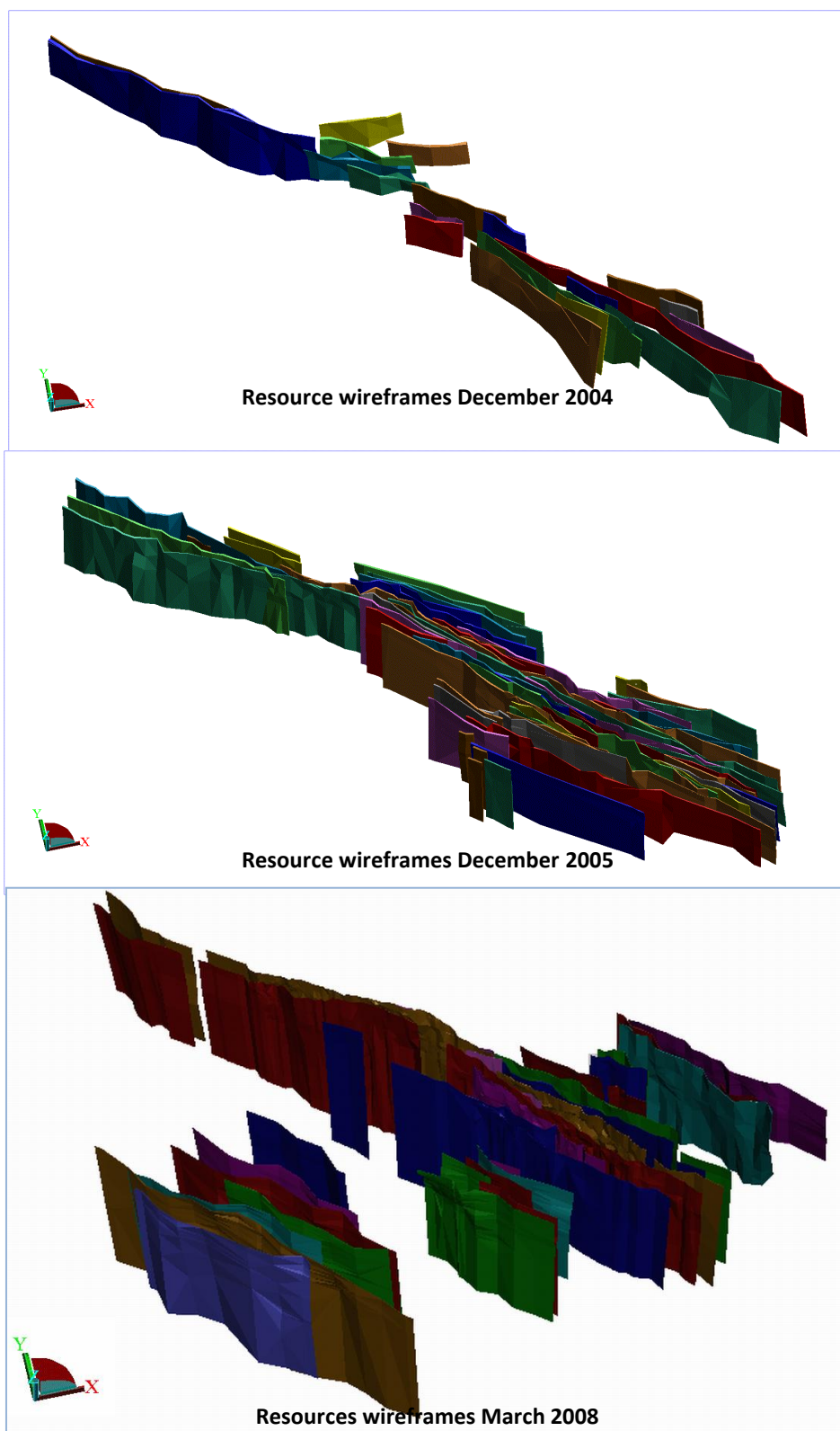
In this chapter, the resource evaluation performed in March, 2008 is reported. Only a single ore type was considered in this evaluation, the fresh rock ore formed by hydrothermally altered granite, termed “veins”, amenable to the CIP process. Four different deposits were evaluated separately, Palito Main Zone (PMZ), Chico da Santa, Palito West and Ruari Ridge. The list of the veins comprising each Block Model is detailed in Table 14 1.

**Table 14.1– Veins constituting each block model**

VEIN NUMBER	VEIN NAME	BLOCK MODEL
100	G1	PMZ
200	G2	
300	G3	
400	CL	
310	CEDRO	
320	JATOBA	
330	MUNGUBA	
800	295	
600	GUARUBA	CHICO DA SANTA
610	ANGELIM	
620	MOGNO	
630	UXI	
640	IPE	
700	PIPOCA	PALITO WEST
710	FARIAS	
720	VERDE	
730	JASTES	
740	RODRIGUES	
750	MEIRELLES	
500	BARRICHELO	RUARI
510	FITTIPALDI	
520	MASSA	
530	PIQUET	
540	PIZZONIA	
550	SENNA	
560	ZONTA	

Mineral resources reported herein were estimated and classified according to the Canadian Institute of Mining, Metallurgy and Petroleum (CIM).

**Figure 14.1– Evolution of the orebody modelling for the Palito deposit**



## 14.2 Software Used

The modelling and Geostatistical analysis of these deposits were made using three different software packages: Gemcom (modelling, kriging and block model construction), Excel (exploratory data

analysis, model validation) and GSLIB (variography and exploratory data analysis). The reserve estimation and developing and production schedules were also performed using Gemcom and spreadsheets.

### 14.3 Data Base

The data was provided by Serabi in MS-Access (channel and drillhole data) and DXF format (topography, excavation and mined out areas). They were validated using the standard tools from Gemcom. A few problems were detected and reported to Serabi, being promptly corrected. The methodology used by Serabi for data entry and validation was checked and found to be robust.

The basic stats of the database received for resource evaluation are as shown in Table 14 2.

**Table 14.2 – Drilling database basic stats**

Sample Type	Nr of samples	Metres drilled	Nr of Holes
Channel	9947	8776	4167
Diamond Drilling	26303	94536	787
RAB	593	626	6
Reverse Circulation	3839	3935	48
Auger	795	1707	49
Total	<b>41477</b>	<b>109580</b>	<b>5057</b>

### 14.4 Specific Gravity

Serabi provided a database with 1048 measurements of specific gravity, mainly composed of hydrothermally altered granite, which is the typical ore from the mine. Only fresh rock samples were evaluated. The method used is the accepted method for these measurements, considering the observed lack of porosity and voids of the ore and waste granite. After extracting one spurious value the simple average of 2.675 g/cm<sup>3</sup> was calculated. This average remained the same, even after trimming the 10% tails. This value was used for both, ore and waste.

For competent, non-porous rocks the following simple buoyancy method was used:

- Allow the sample to dry, at ambient temperature.
- Weigh the sample to determine the dry mass (M<sub>s</sub>).
- Place the specimen in a basket and weigh it, suspended from a balance, in water. Subtract the weight of the basket in water, to determine the weight of the sample in water (M<sub>s</sub> in water).

The Dry Bulk Density ( P<sub>d</sub> ) is calculated as the mass of sample in air divided by the difference between the mass of the sample in air and the mass of the sample in water. Hence:

$$P_d = \frac{M_s}{M_s - M_{s \text{ in water}}}$$

### 14.5 Selection of Representative Samples

Given the difficulty in creating a solid enclosing all the representative samples, vertical sections were used for constructing the solids, however this resulted in samples further away from the section position not being correctly captured. For this reason, the samples representative of these solids

were selected individually. Each interval selected was assigned a Lithological code, as previously detailed in Table 14.1. In several places, sub economical intervals were selected based on the geology, in order to maintain the continuity of the vein.

#### 14.6 Exploratory Data Analysis (EDA)

Using these lithological codes NCL summarized statistics for gold and copper on the raw data samples for each lithological unit as shown in Table 14.3.

**Table 14.3 – Exploratory Data analysis for samples within the veins**

	Palito Main Zone	Chico da Santa	Palito West	Ruari Ridge
<b>Au</b>				
Nr of Samples	4138	151	126	210
Minimum (g/t Au)	0	0.01	0.01	0.01
Maximum (g/t Au)	718.00	66.69	181.00	68.11
Average (g/t Au)	11.93	5.39	10.02	3.08
Standard Deviation	39.20	11.11	26.33	8.73
Coefficient of Variation	3.29	2.06	2.63	2.84
<b>Cu</b>				
Nr of Samples	4,140	152	127	210
Minimum (% Cu)	0	0	0	0
Maximum (% Cu)	21.10	4.70	4.50	2.80
Average (% Cu)	0.16	0.30	0.19	0.12
Standard Deviation	0.85	0.74	0.51	0.34
Coefficient of Variation	5.25	2.48	2.76	2.93

#### 14.7 Compositing

After statistical analysis of the length of the original samples, 0.7 m was chosen as the length for compositing the samples in order to have all values at a similar support. The reason is that the mode of the distribution of lengths is very close to this number, therefore preserving the detail obtained in the sampling, while still having a good agreement between the basic statistics of the samples and composites. No top cut was done before compositing, only after it. Composites with length less than 0.15m (20 % of the chosen composite length) were discarded, representing less than 2 % of loss of the samples, in terms of length sampled.

**Table 14.4 – Exploratory Data analysis for composites**

	Palito Main Zone	Chico da Santa	Palito West	Ruari Ridge	Total
<b>Au</b>					
Nr of Samples	6,591	220	156	291	7258
Minimum (g/t Au)	0.00	0.00	0.00	0.00	0.01
Maximum (g/t Au)	700.00	66.69	181.00	68.11	68.11
Average (g/t Au)	12.05	4.73	8.55	3.40	3.40
Standard Deviation	35.60	9.19	23.75	8.67	8.66
Coefficient of Variation	2.96	1.94	2.78	2.55	2.54
<b>Cu</b>					
Nr of Samples	2,350	195	137	208	292
Minimum (% Cu)	0.00	0.00	0.00	0.00	1
Maximum (% Cu)	21.10	4.70	4.50	2.80	2.80
Average (% Cu)	0.39	0.26	0.20	0.11	0.08
Standard Deviation	1.27	0.61	0.51	0.30	0.26
Coefficient of Variation	3.26	2.37	2.50	2.65	3.19

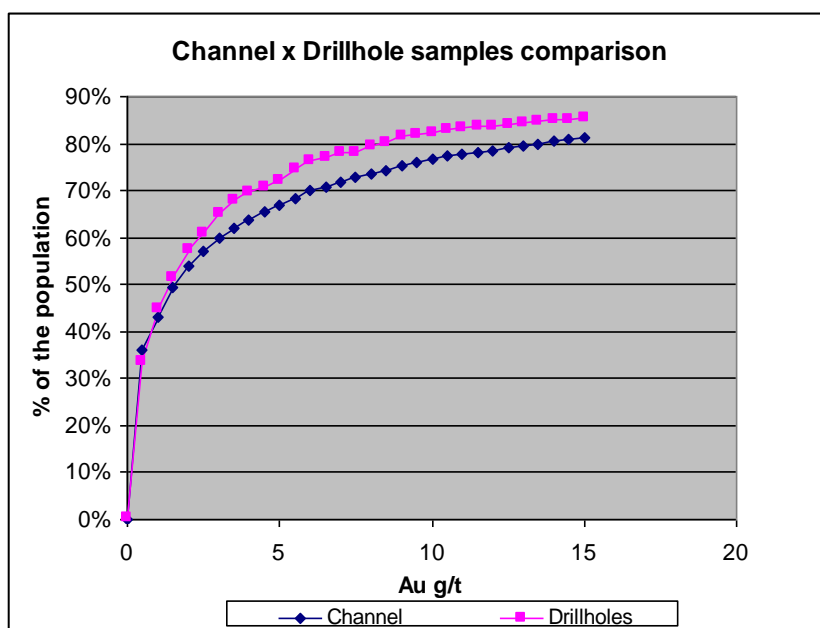
## 14.8 Sample Types Comparison

Channel samples were compared to the drillhole samples in order to investigate for possible biases. A group of samples was selected using the region around the excavations in the PMZ area (veins G1, G2 and G3), where both types of samples are similarly distributed. The mean grades of Au and Cu for the two types are depicted below, and the Figure 14.2 is the accumulated histogram used to better compare the two populations.

**Table 14.5 – Sample Types Comparison**

	Mean Grade		Number of composites
	Au g/t	Cu %	
<b>Channel</b>	13.32	0.53	4405
<b>Drillholes</b>	8.67	0.46	556

**Figure 14.2 – Comparison between Channels and Drillholes from PMZ**



To identify if a possible sampling or assaying error exists, an extensive test was planned. The conclusion of this test is that the results over 0.7 g/t are adequate, with good repeatability and no bias. As a conservative measure, all channel gold values below 0.7 g/t were reduced to 0.01 g/t. The copper values from the Serabi lab were deleted from the dataset used.

After considering this information, NCL alerted Serabi about the risk involved in the evaluation using channel sample assays. However, Serabi showed plant results with better reconciliation with the channel samples than with the drillhole samples. A possible explanation is the observed presence of isolated higher grade ore shoots, which have higher probability of being captured and sampled by the channel samples, than drill holes alone, which would result in a higher global grade.

Considering this hypothesis, the test done demonstrating the lack of bias, and also the reconciliation figures, NCL decided to use the channel samples in the resource evaluation. The risk is restricted to the areas in the vicinity of the excavations.

## 14.9 3D Models

Four types of solids were used in the construction of the block model:

1. Orebodies: strictly speaking, interpretation of zones representing the material with reasonable prospects of being mineralized
2. 3D excavations: Surveyed tunnels and mined out zones
3. 2D excavations: mined out zones where no survey was available. The 2D lines were put in 3D and extruded, to form a solid whose intersection with the orebodies mark the mined out zones in these
4. Topographic surface based on survey data.

To draw the solids containing the mineralization, the geology and the grade were used, as observed in the drillholes and excavations. The thickest interval was used, comparing the thickness indicated by either the granite hydrothermally altered (acronym: ZAH) or the gold mineralization, as defined by gold grades above 0.7 g/t. The other factor taken into account in the selection of the intervals was the minimum true thickness of 0.7 m.

The interpretation and modelling of the four main orebodies was a result of teamwork between Serabi and NCL geologists. The other solids or strings used, regarding, excavations and mined out outlines were made available by Serabi in Gemcom format.

### Block Model Parameters

The block size used was 5 x 5 x 3 m, based on discussions with NCL to assist Serabi in the underground mining planning. It is recognized that a larger block would allow less conditional bias. However, a block of this size would be inadequate for mine planning. For global estimates, it is expected that no significant problem would occur using a block size in the order of one tenth of the drill density, but for grade control, it is recommended that a larger block should be used.

Since the models were produced in local coordinates, where the orebodies were aligned with the South-North axis, no rotation was necessary for all models.

Below, in Table 14 6, are the specific parameters for each block model, in the Gemcom convention (Minimum X and Y, Maximum Z):

**Table 14.6– Block model parameters**

Palito Main Zone (PMZ)	Origin	Block Size (m)	NR BLOCKS
X	9950	5	80
Y	19900	5	300
Z	1335	3	130
Chico da Santa (CS)	Origin	Block Size (m)	NR BLOCKS
X	10190	5	50
Y	19800	5	100
Z	1335	3	130
Palito West (PW)	Origin	Block Size (m)	NR BLOCKS
X	9800	5	30
Y	20150	5	60
Z	1335	3	130
Ruari Ridge (RR)	Origin	Block Size (m)	NR BLOCKS
X	9430	5	76
Y	20250	5	146
Z	1335	3	130

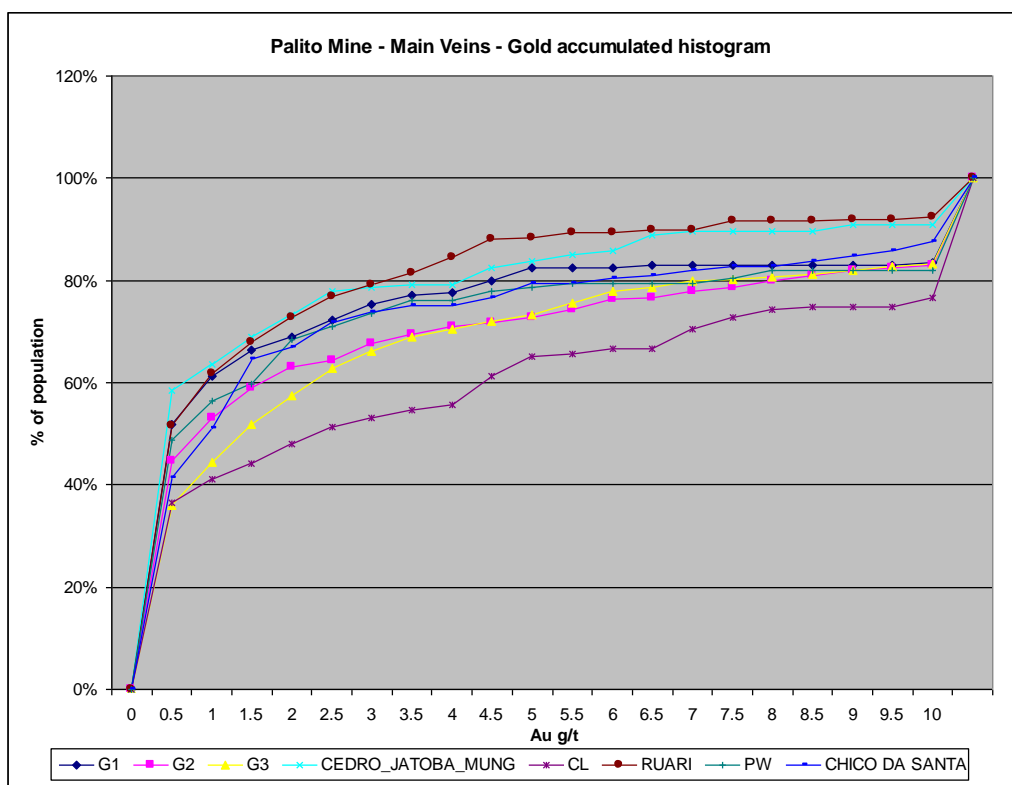
### Population Analysis

Using the composites for each vein, similarities between them were sought in order to improve the variography and kriging. If two veins were found to be similar in terms of geology, mean, variance and shape of the accumulated histogram (showing thus a similar behaviour in all ranges of the population), they were grouped and treated as a single population. Figure 14 3 shows the main veins histograms for gold. The main conclusion is that the most important veins, G2 and G3 have basically the same statistical behaviour, allowing them to be treated together, for variography purposes.

Other conclusions of this study:

- Chico da Santa and Palito West have similar behaviour, constituting a single population
- The smaller veins of the PMZ area, G1, Cedro, Munguba, Jatobá, could be grouped together, representing a lower grade population, as well as the RR vein.
- The Compressor Load vein (CL) is a completely different vein, with grades significantly higher. Veins of this type may be an interesting exploration target.

**Figure 14.3– Accumulated histograms – Au**



## 14.10 Variography

Three different types of software were used to carry out the variogram analysis, GSLIB, MS-Excel and Gemcom. For anisotropy analysis, the GSLIB Varmap program was used to generate a cloud of points that was analyzed in Gemcom, interpreting it in a 3D environment. An Ellipse was adjusted around the points after filtering the ones showing lower variance. However, a better result was obtained through calculating the variogram at intervals of 10° increment in the dip, adjusting the strike to the general attitude of the veins.

Standard semi-variogram was also tested, but the correlogram showed better structure in most situations. Therefore, only correlograms were used for modelling. To establish the nugget effect, down-the-hole correlograms were used.

Only the population G2-G3 had enough number of pairs in order to safely establish a variogram model. The other areas produced variograms too noisy, even when grouping several veins as allowed by the population analysis. The G2-G3 variogram parameters (nugget, variogram model, sill and range) were adopted for the other veins, but rotating to adjust to each individual vein attitude, as listed in the Table 14.7.

**Table 14.7 – Variogram parameters for gold & copper. All veins**

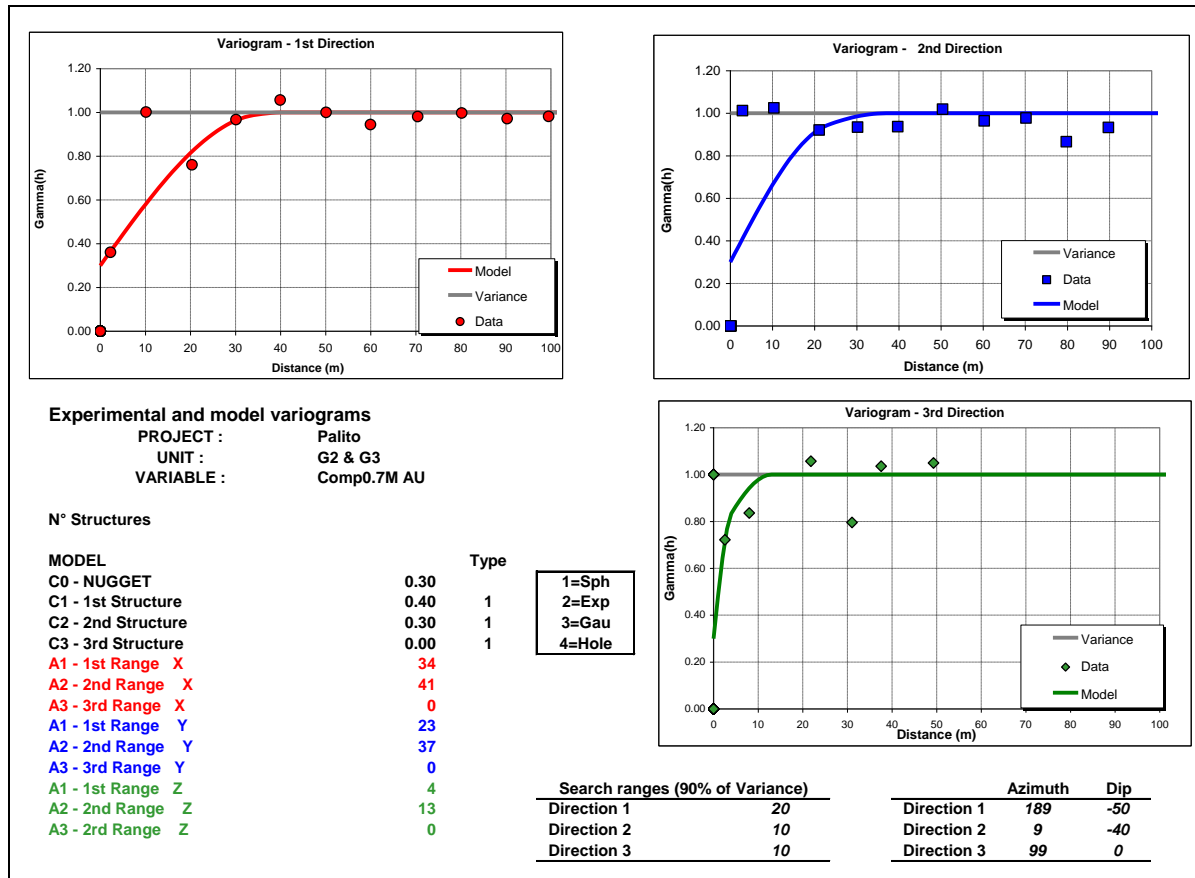
GOLD VARIOGRAM MODEL				
	Gamma (h)	X (m)	Y (m)	Z (m)
Nugget	0.3			
First structure	0.4	34	23	4
Second structure	0.3	41	37	13
Third structure				
Search Ratio		20	10	10

COPPER VARIOGRAM MODEL				
	Gamma (h)	X (m)	Y (m)	Z (m)
Nugget	0.2			
First structure	0.68	10	5	3
Second structure	0.12	70	20	10
Third structure				
Search Ratio		20	10	10

ROTATIONS			
	Principal Azimuth	Principal Dip	Intermediate Azimuth
PMZ	189	-50	9
CS	188	-50	8
PW	180	-50	0
RR	180	-50	0

Variograms are shown in the Figure 14.4. The figure presents the three variograms, the first in the direction with best continuity, and the third to the poorest. All variograms were calculated with a lag separation of 10 m, and using a tolerance on azimuth and dip of 30°. All models are spherical. Search ratios normally are equivalent to 80% of the range of the variogram.

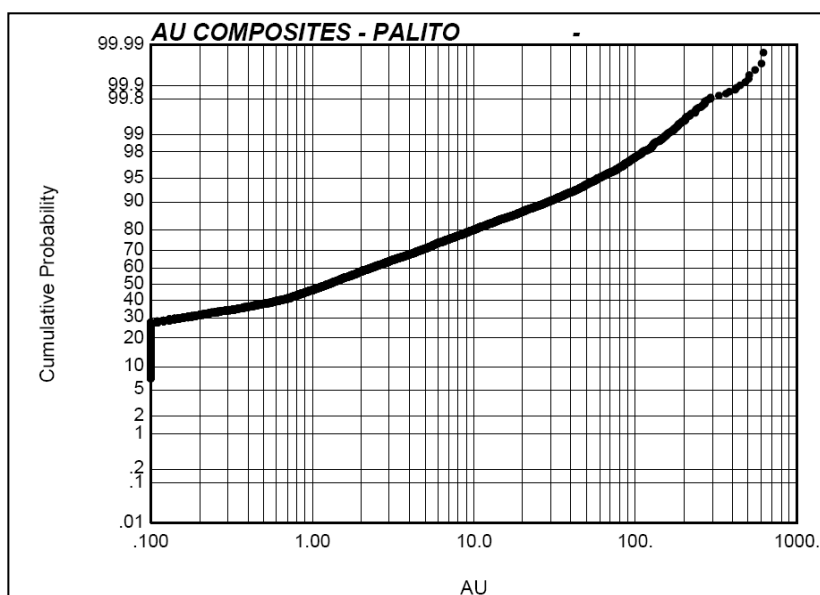
Figure 14.4 – Correlogram of gold, G2-G3



## 14.11 Outlier Analysis

Figure 14.5 corresponds to the probability plot for gold used to define the threshold to cap the outliers of the population. The objective is to limit the influence of very high values on the interpolation of grades. If the high values stay in the expected position (a straight line in the high end of the probability graph) they may be considered part of the population and used in the estimate. Otherwise, they may be capped, to have their value reduced to a selected threshold. A common threshold is the one where 99% of the samples have grade less than that, but it depends on many other factors, like the adherence of the kriging values to the moving average, the geology of the vein, etc. For the Palito samples, a natural threshold would be around 300 g/t, where a kink in the probability curve can be observed. To be conservative, NCL used 200 g/t as a limit. Therefore, the samples above this value (0.7% of the samples) had their value reduced to 200 g/t.

**Figure 14.5 – Probability plot – Gold**



### 14.12 Kriging Strategy

Initially, the stationarity of the deposit was investigated through a moving window technique. The conclusion is that the deposits are non-stationary i.e. the average and variance change according to the position in the deposit, therefore simple kriging cannot be used. It was decided to use ordinary kriging instead.

The kriging strategy was common to all veins, only with the attitude of the search ellipsoid changes, as listed by vein in the previous items. To avoid repetition, only the PMZ parameters are detailed in Table 14.8 below.

The objective was to have a good first pass, where the measured and most of the indicated resources occur, and to extrapolate the dimensions of the search variogram to interpolate the grade of the inferred blocks.

**Table 14.8 – Kriging strategy for PMZ**

	All Veins		
	Pass 1	Pass 2	Pass 3
X	20	60	75
Y	10	40	50
Z	10	40	50
Search type	octant	octant	octant
Min Nr octants	4	4	1
Max per octant	8	8	8
Min N Comp.	6	6	2
Max N Comp	64	64	64
Nr of discretizations	2x2x2	2x2x2	2x2x2

### 14.13 Block Model Construction

Besides the modelled veins, the excavations were also modelled (drifts and stopes). The sequence of block model construction in the Gemcom software is the following:

1. Modelling and kriging of the mineralized veins
2. Add the modelled excavations (3D representations)
3. Add the extruded 2D excavations. This step was necessary in some veins in cases where the excavation had not been surveyed.
4. Extract the blocks eventually above the topographic surface.
5. Classification of the resources by categories

It was used a GEMCOM percent format, where the blocks contain a parameter representing the percentage of the block within a certain vein. Each vein was interpolated using samples with the same Rock Code.

### 14.14 Mineral Resource Classification

The classification methodology was based on discussions between NCL and the exploration team. The criteria established were as follows:

- **Measured Resources:** Measured resources are the portions of the orebody that are well sampled by channel samples (spacing 3-5 m) and close to mined areas. For practical purposes, an outline was designed around mined drifts and stopes, and expanding it by 20 m, which is a distance the team considers that a well defined vein can be extrapolated with confidence. Any indicated block contained in that outline is transformed to measured.
- **Indicated resources:** As detailed in the Pass 2 of the Table 14.8, blocks which have at least two mineralized intercepts in the defined neighbourhood. The adopted neighbourhood is an ellipsoid measuring 60 m down the plunge and 40 m in the two other directions, which is seen as an adequate given the continuity of the mineralization. The vein code of these intercepts must be same as the block being classified, and the intercepts must be from different octants (required four octants minimum). NCL interpreted the results and where necessary, changed the category of portions of the block model at the geologist's judgment. The idea was to allow a more critical review of the block model, increasing or decreasing the confidence in zones where other geological factors surmount the amount of drilling in order to estimate confidence. Isolated blocks of indicated category were reclassified as inferred, and isolated blocks within major indicated blocks were turned to indicated.
- **Inferred resource:** As in the third pass, in the Table 14.8, the search range has a limited enlargement (75 m down the plunge and 50 m in the other two directions), but for this category, a single drillhole is enough for the definition of inferred resources.

The **measured resources** were defined only for PMZ. Only the veins G1, G2 and G3 had enough excavations in order to define measured resources.

An example of the distribution of the classified blocks in relation to the mineralized intercepts is shown in Figure 14.6.

**Figure 14.6 – 3D View of the G3 vein, with block model, classified. View to NW**



Important note: Resources were considered only if the grade of the block is above 1.0 g/t Au. This marginal cut off was defined using only mine and processing cost ( US\$ 34/ton), gold price of US\$ 1200 / oz and metallurgical recovery of 93%.

Part of the veins, in zones with lower grade, would not be considered mineral resources, since the possibility of being economical is minimal

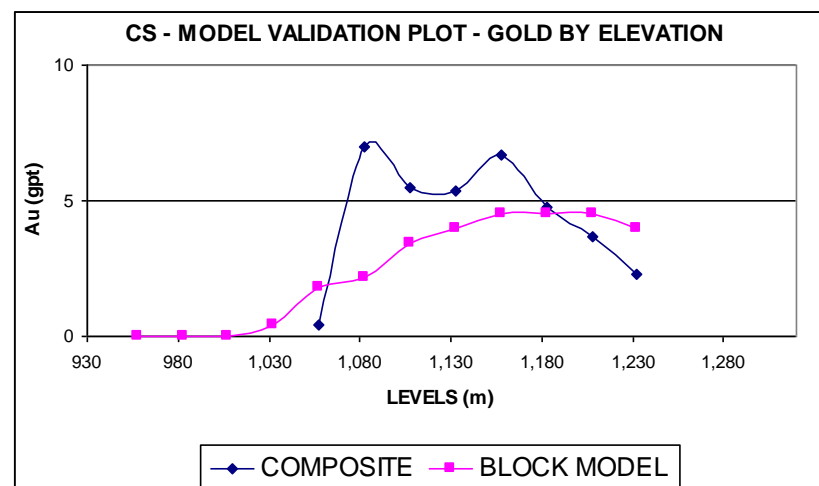
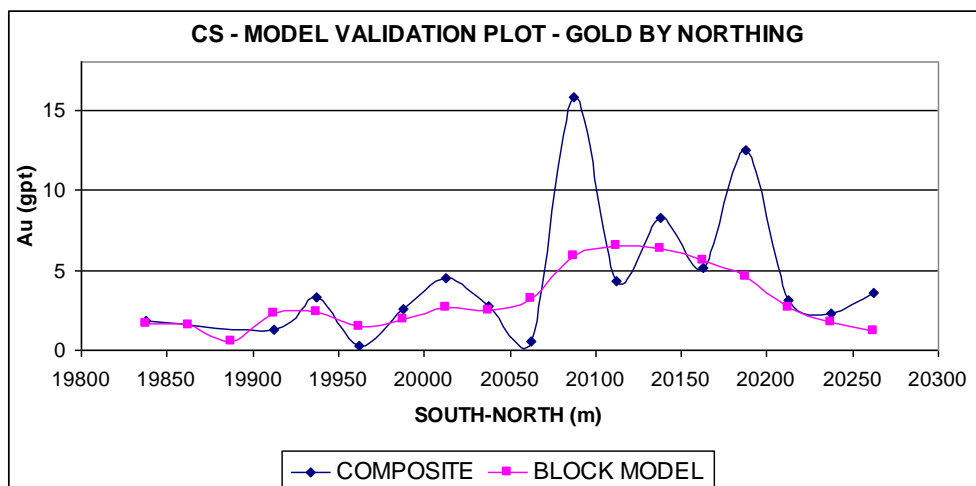
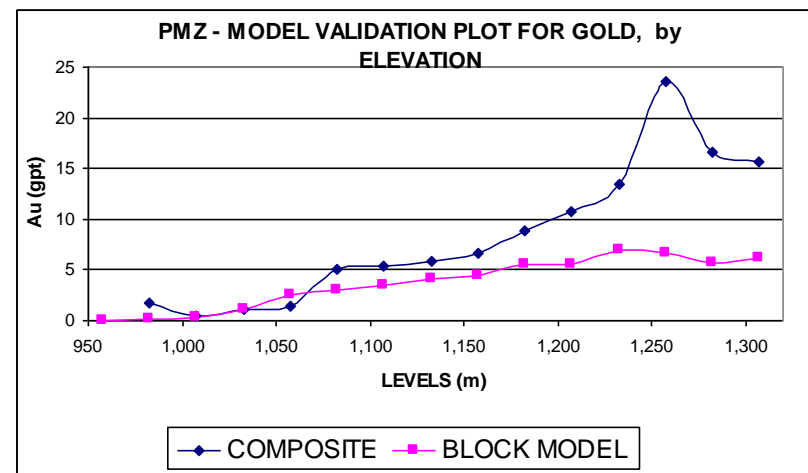
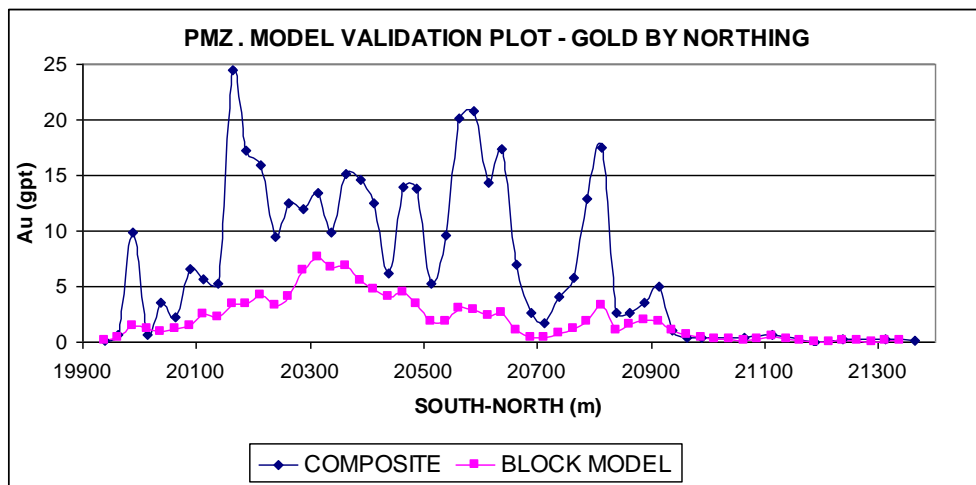
#### 14.15 Model Validation

To verify the results of the estimates, a set of checks were made on the model for each area:

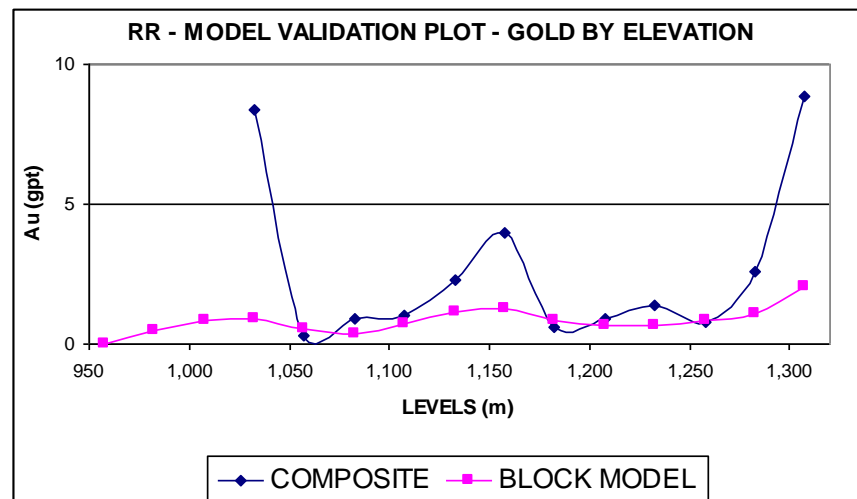
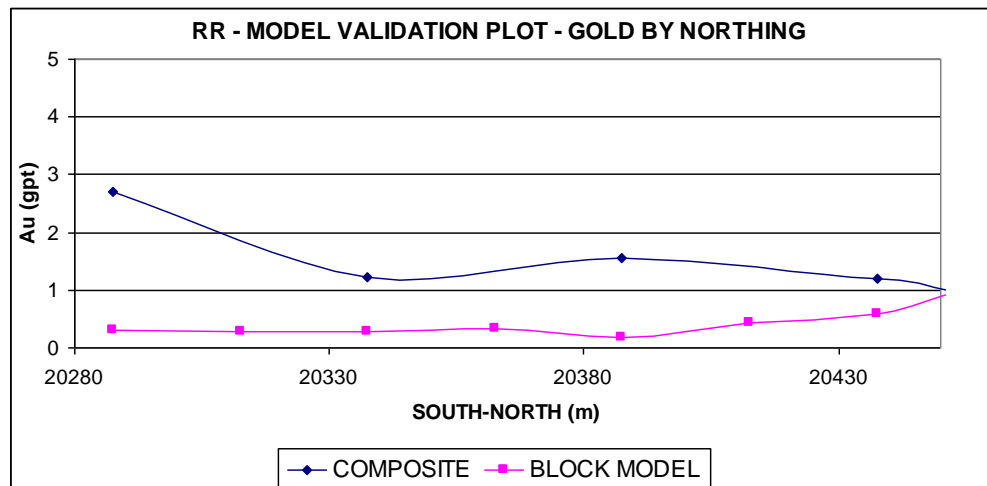
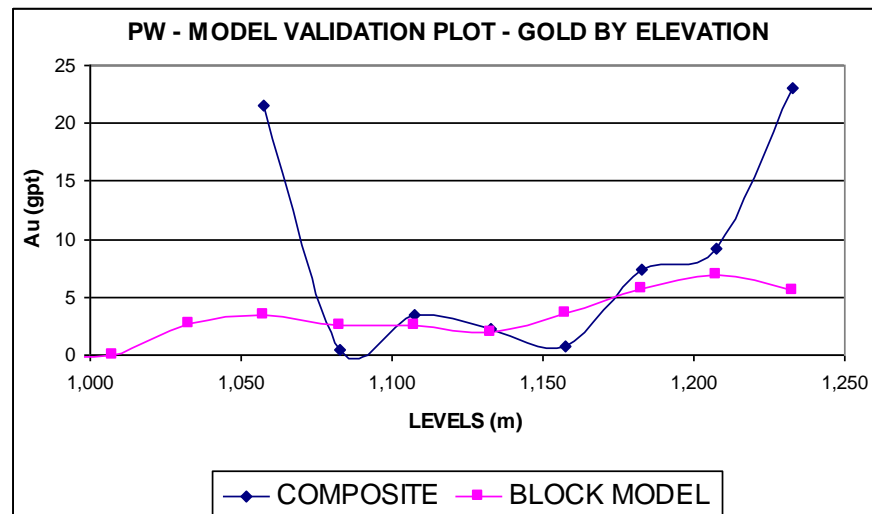
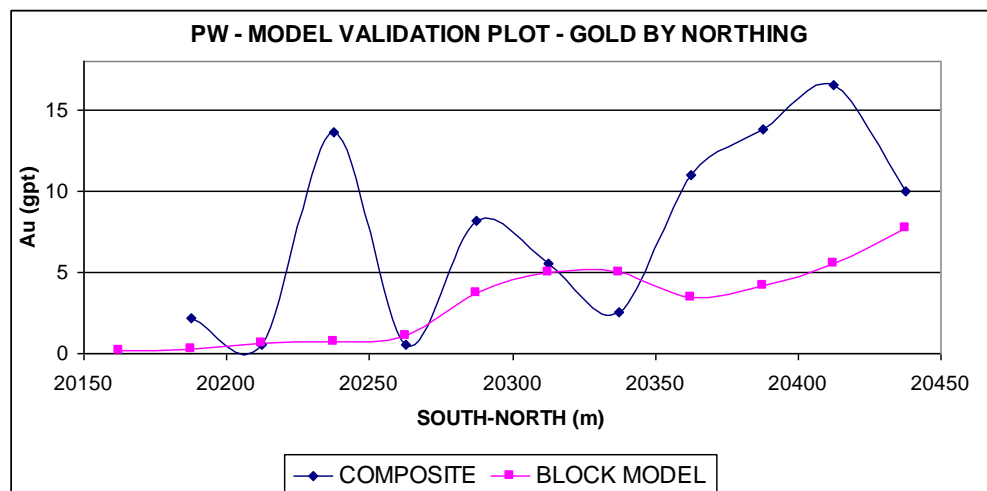
- Visual validation of grades and classification. Comparison with the previous sections and tabulations was extensively used.
- Comparison between the moving window average grade of composites and kriged values (Figures 36 to 39, in the Appendix). Since the orebodies are flat aligned with the Y axis, inspection along the northing and elevation are enough to check adherence of block grades to sample grades.
- Comparison between the kriging results and the declustered mean

In all tests the models were considered consistent and robust.

**Figure 14.7 – PMZ and CS Model Validation plots**



**Figure 14.8 – PW and RR Model Validation plots**



## Results

Table 14.9 summarizes the mineral resources estimated for 1.0 g/t Au cut-off for each area. Figure 14.9 and Figure 14.10 show the grade/tonnage curve for multiple cut-offs.

**Table 14.9 – Mineral Resources Estimate**

Mineral Resource Estimate as March 31, 2008	tonnage (ktonnes)	Gold (g/t Au)	Copper (%Cu)	Contained Gold Ounces ('000)	Contained Gold Equivalent Ounces ('000)
<b>Measured Resources</b>					
Palito Main Zone (PMZ)	97	9.51	0.26	30	32
Palito West (PW)					
Chico da Santa (CS)					
Ruari Ridge (RR)					
<i>Total Measured Resources</i>	<i>97</i>	<i>9.51</i>	<i>0.26</i>	<i>30</i>	<i>32</i>
<b>Indicated Resources</b>					
Palito Main Zone (PMZ)	593	7.15	0.23	136	149
Palito West (PW)	47	13.16	0.26	20	21
Chico da Santa (CS)	79	5.91	0.23	15	17
Ruari Ridge (RR)	35	4.85	0.22	5	6
<i>Total Indicated Resources</i>	<i>754</i>	<i>7.29</i>	<i>0.23</i>	<i>177</i>	<i>192</i>
<b>TOTAL Measured + Indicated</b>	<b>851</b>	<b>7.54</b>	<b>0.23</b>	<b>206</b>	<b>224</b>
<b>Inferred Resources</b>					
Palito Main Zone (PMZ)	821	6.04	0.18	160	173
Palito West (PW)	200	8.22	0.23	53	57
Chico da Santa (CS)	435	6.01	0.23	84	93
Ruari Ridge (RR)	631	4.74	0.43	96	121
<i>Total Inferred Resources</i>	<i>2,088</i>	<i>5.85</i>	<i>0.27</i>	<i>393</i>	<i>444</i>

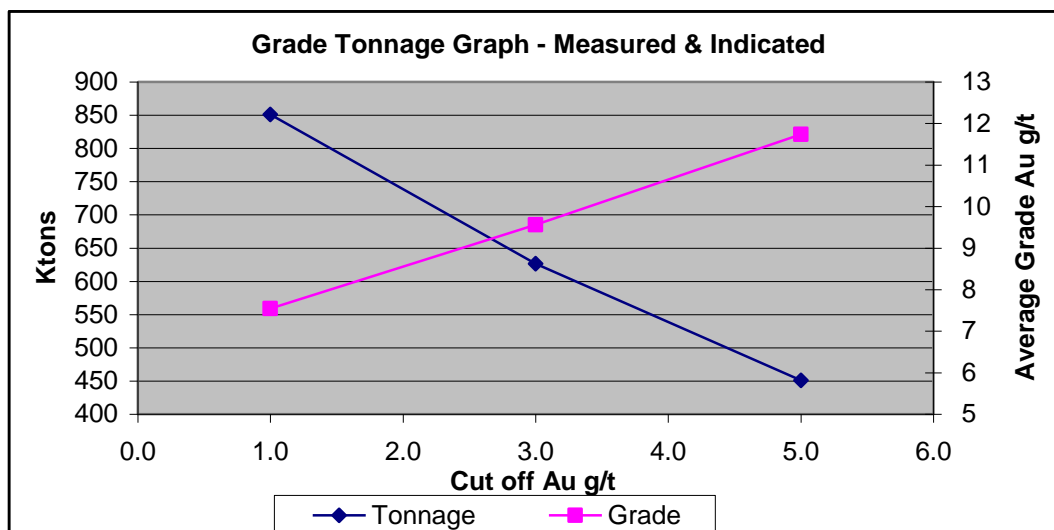
Mineral resources are reported at a cut-off grade of 1.0 g/t

The Mineral Resources as set out in the table above have been estimated by Rodrigo Mello who is a competent person under the JORC Code. The Mineral Resources are classified as Measured, Indicated and Inferred, in compliance with the JORC Code.

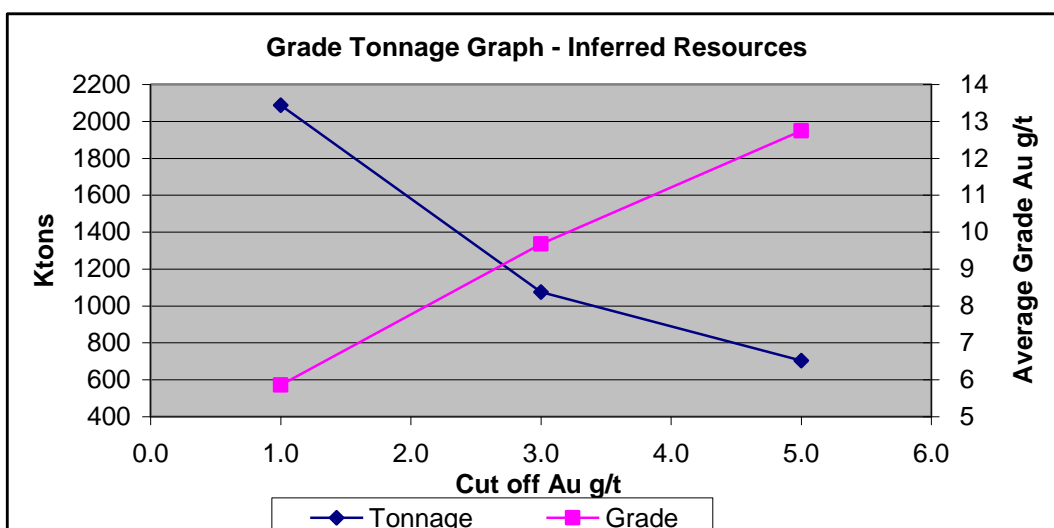
Numbers may not add up due to rounding.

Equivalent gold is calculated using an average long-term gold price of US\$700 per ounce, a long-term copper price of US\$2.75 per pound, average metallurgical recovery of 90.3% for gold and 93.9% for copper

**Figure 14.9– Measured & Indicated - Grade tonnage curves**



**Figure 14.10– Inferred resources - Grade Tonnage Curves**



**14.16 Conclusion and Recommendations**

A min

eral resource estimate for the areas Palito Main Zone, Chico da Santa, Palito West and Ruari Ridge has been completed (twenty five different mineralized structures). Each vein has been interpreted and builds a 3D representation. The samples contained within those hard boundaries were selected and ordinary kriging was used to interpolate a block model grades. The models for the different areas were validated by the NCL and Serabi staff, who concluded that the models are consistent with the available geological data.

Possibly a more refined geostatistical study would probably enhance mine reconciliation and risk analysis. Tools that should be tested are ones like multiple indicator kriging (investigating different pulses of mineralization) and mathematical tools giving more rigorous approach for resources classification. Suggestions to obtain a better classification of resources are to use conditional simulation or error measurement based on kriging variance. Complete surveying of the excavations would also enhance the determination of measured resources. The question of using the channel samples should also be reviewed, because the proper understanding of the differences in grade between channel and drillhole samples should decrease the risk of lack of precision in the resource estimation.



## **15 MINERAL RESERVE ESTIMATES**

No mineral reserves are reported presently for the Jardim do Ouro property.

## 16 MINING METHODS

### 16.1 Summary

This study is based on NCL's March, 2008, mineral resource estimate for Palito Mine which includes Measured, Indicated and Inferred category mineral resources.

*The reader is cautioned that the mining study is part of a preliminary economic assessment that is preliminary in nature and includes Inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. There is no certainty that the preliminary economic assessment will be realized. No Mineral Reserves have been estimated.*

This study is categorised as a Preliminary Economic Assessment (PEA).

In general, Measured and Indicated mineral resources have been depleted as early as possible in the mining schedule and Inferred resources are depleted later in the Project life. The result of this is that the early years of the schedule contains predominantly Indicated resources while the final years are predominantly Inferred.

The mining rate of 250tpd (or 90,000 t/annum) was considered. Metal prices of US\$ 1,400/oz for gold and US\$ 3.0/lb for copper were used for estimating the mineral inventory.

Mining of the narrow, near-vertical gold veins at Palito is expected to be undertaken using a selective underground mining method.

A shrinkage open stoping method will be employed to mine the Palito high-grade mineralized veins underground. As the mineral resources are hosted in near vertical two dimensional tabular veins, the blocks considered for mining have been designed by increasing the vein width to a minimum mining width of 1.2m assuming that any additional material has zero grade. The ore-bodies have been divided into 30 x 30m panels, leaving six metre sill and rib pillars between blocks. This ensures a high degree of accuracy in drilling and blasting of the narrow high grade vein structures, resulting in low dilution and mineral losses.

The Palito gold project will employ a combination of contract and owner-operated underground mining. The selective open stoping will be undertaken by a mining contractor with relevant skills and track record in narrow vein mining.

The mining operations include trackless underground ramps and accesses, with lode development on each of the scheduled veins at 36m vertical spacing. Sub-horizontal development will be mined by single boom electrohydraulic jumbos. Mining blocks will be developed above and below the block. Footwall drives and draw-points will be excavated to allow extraction of the stope mineralized material. Mucking will be by LHD scooptrams, and loaded into 20 tonne trucks at the ramp loading bays by larger front end loaders. The primary mining equipment will be owner-operated.

The total estimated mineral inventory is 740 thousand tonnes averaging 8.98g/t gold and 0.24% copper. The summary by sector is shown in Table 16.1.

**Table 16.1 – Mining Inventory – Summary by Sector**

Sector	KTONNES	Au(g/t)	Au(koz)
Palito Main Zone	340	8.66	94.7
Palito West	113	11.13	40.3
Chico da Santa	179	7.33	42.2
Ruari's Ridge	108	10.47	36.4
<b>TOTAL</b>	<b>740</b>	<b>8.98</b>	<b>213.6</b>

## 16.2 Underground Mining

The most common mining methods employed in mechanized (steep dipping) narrow vein deposits are either open stoping with pillars or cut and fill (normally employed where the mineralization is high grade or the ground is unstable).

The method finally adopted for Palito is a shrinkage open stoping agreed between NCL and Serabi.

Geotechnical input for this study corresponds to previous experience at Palito from initial and successful period of operation during 2005 and 2006, when open stoping was applied with local and global stability achieved.

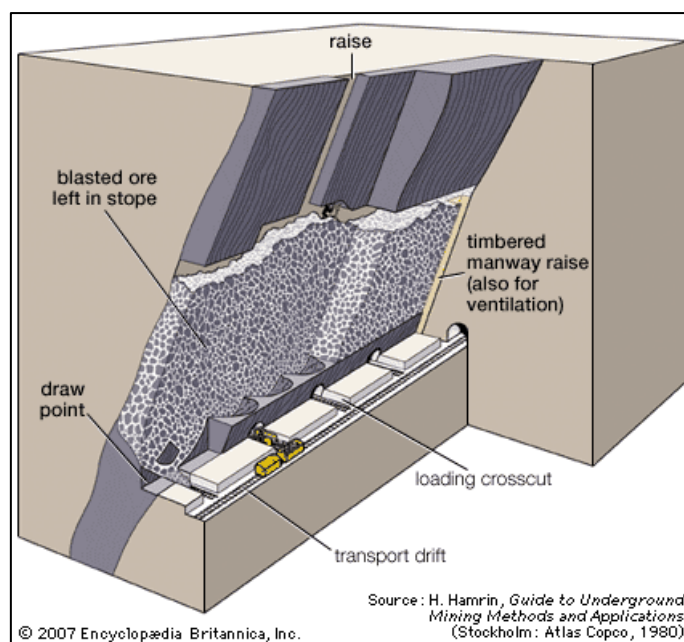
The main reasons for the adopting this mining method are:

- The mineralized veins are subvertical and average 0.7m in width. Mineralization is high grade and maximum extraction is desirable.
- Veins are narrow and typically undulate on dip and strike necessitating very accurate drilling and blasting to minimize dilution and loss of mineralization.
- There is a substantial amount of waste development associated with mechanized mining of narrow vein deposits. This waste is most suitable for back-filling the stopes and in so doing reduces the cost of transporting it to surface and stockpiling it.
- Geotechnical knowledge is currently limited to previous experience.
- Experience at other mines with similar deposits.

Description of the shrinkage open stoping method to be used at Palito:

- The mineralized horizon will be accessed from surface from the existing decline haulage, which will be extended using 4 x 4 m section to the new sectors at 12% from the horizontal.
- Each stope is planned to be 30m long by 30m high and by the width of the vein, considering a minimum width of 1.2m, assuming that any additional material has zero grade (dilution).
- At 36m intervals (vertically), a horizontal (3m x3m) crosscut will be driven from the ramp to intersect the mineralized body.
- The vein will be exposed along its strike length by a 3m gallery 'on-lode'.
- Economic sectors of the mineralized zone will be prepared for stoping by mining a 3m footwall drive with drawpoints to extract the broken stope material (Figure 16.1).
- Cross-cut access to one end of proposed stope.
- Undercut or complete bottom slice of the stope. Minimum width of 1.2m, assuming that any additional material has zero grade (dilution).
- Cross-cuts from footwall drive to bottom of proposed stope
- One main raise at the middle of the stope up to the main level above, to provide access and ventilation to the stope
- Two timbered end raises, from the end cross-cuts up, together with the advance of the slices.
- Mining proceeds from the bottom upwards, in horizontal slices, with the majority broken material being left in place for miners to work from.
- Because blasted rock takes up a greater volume than in situ rock (due to swell factor), some of the blasted ore (approximately 40%) must be removed to provide working space for the next slice.
- Once the top of the stope is reached all the mineralized material is removed from the stope.

**Figure 16.1– Shrinkage Stopping Layout**



### 16.3 Dilution

As mentioned above, the mining units were designed considering a minimum mining width of 1.2m, assuming that any additional material has zero grade.

The added material represented a 20% dilution and Table 16.2 shows the average values per main sectors.

**Table 16.2 – Dilution**

Palito Main Zone	22%
Palito West	24%
Chico da Santa	16%
Ruari's Ridge	21%
TOTAL	20%

### 16.4 Mining Inventory

In order to determine the mining inventory at Palito the Measured, Indicated and Inferred mineral resources were divided into mining units. Mining units that were determined to produce a positive value when mined, were included into the mining inventory.

The criteria used in determining the size of mining units is generally grade variability and mining method.

The mining units used for this study are one mining level high (30m) and 30 m along strike. The width of each mining unit is determined individually by adding dilution to the resource width with a minimum width of 1.2 m, assuming that any additional material has zero grade.

The volume, contained tonnage and grades (Au and Cu) for each mining unit were calculated.

Mining units with a grade greater than the cut-off grade are selected for initial consideration, estimated as 3.0g/t Au.

In order to be worth mining, mining units must support the cost of the drives directly associated with mining it. For this study this cost was estimated at US\$ 4000 per metre.

The selected mining units were tested against these criteria and those still returning a positive value were included into the mining inventory.

Table 16.3 summarized Palito mining inventory by sector and by vein. The total inventory is 740 thousand tonnes at an average grade of 8.98 g/t gold and 0.24 % copper.

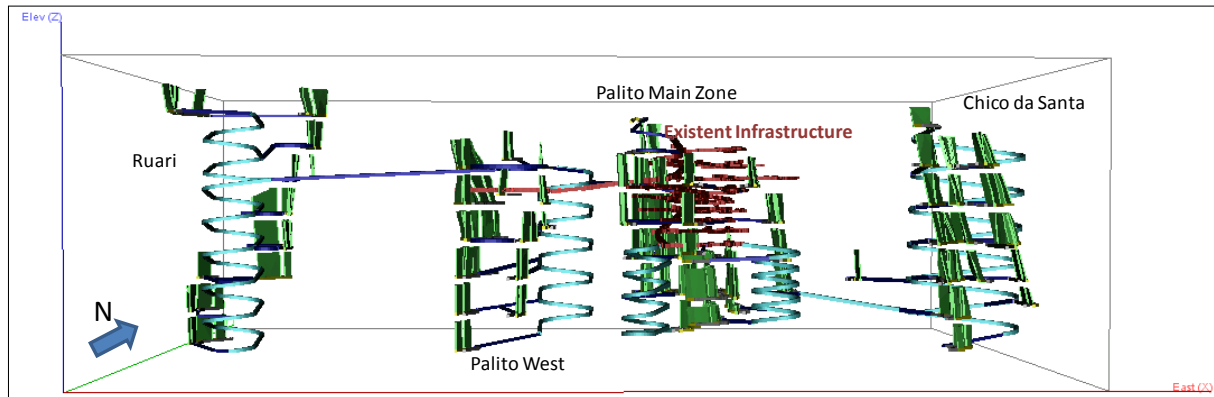
**Table 16.3 – Mining Inventory – Summary by Sector and Vein**

Sector / Vein	KTONNES	Au(g/t)	Au(koz)	Cu(%)	Cu(Klb)
<b>Palito Main Zone</b>	<b>340</b>	<b>8.66</b>	<b>94.7</b>	<b>0.21</b>	<b>1,588</b>
100	26	7.12	6.0	0.09	54
200	48	12.49	19.2	0.34	363
300_1	14	4.72	2.1	0.12	38
300_2	18	6.47	3.7	0.19	75
300_3	16	6.07	3.2	0.27	96
CEDRO	11	4.91	1.8	0.11	28
DESVIO	6	3.64	0.7	0.16	21
JATOBA	55	6.48	11.5	0.26	319
PLANCL	145	9.95	46.4	0.19	594
<b>Palito West</b>	<b>113</b>	<b>11.13</b>	<b>40.3</b>	<b>0.25</b>	<b>611</b>
FARIAS	9	6.65	1.9	0.17	34
MEIRELE	10	13.82	4.6	0.25	57
PIPOCA	74	12.65	30.1	0.29	476
VERDE	19	5.92	3.7	0.10	45
<b>Chico da Santa</b>	<b>179</b>	<b>7.33</b>	<b>42.2</b>	<b>0.30</b>	<b>1,194</b>
ANGELIM	3	4.28	0.4	0.01	0
IPE	74	4.60	10.9	0.25	409
MOGNO	79	9.38	23.9	0.37	647
UXI	23	9.37	7.0	0.27	137
<b>Ruari's Ridge</b>	<b>108</b>	<b>10.47</b>	<b>36.4</b>	<b>0.22</b>	<b>516</b>
FITIPALD	24	16.52	12.6	0.18	92
PIQUET	24	14.44	11.0	0.33	171
PIZZONIA	21	6.00	4.1	0.09	41
SENNA	39	6.88	8.7	0.25	212
<b>TOTAL</b>	<b>740</b>	<b>8.98</b>	<b>213.6</b>	<b>0.24</b>	<b>3,909</b>

The reader is cautioned that the mining study is part of a preliminary economic assessment that is preliminary in nature and includes Inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. There is no certainty that the preliminary economic assessment will be realized. No Mineral Reserves have been estimated.

Figure 16.2 corresponds to a general layout of the different sectors and the planned underground infrastructure.

**Figure 16.2– General Layout**



#### 16.4.1 Mine Production Schedule

An underground mine production schedule for 250 tpd was developed, showing mineralized tonnes and grades by year for the life of the mine. The distribution of mineralization contained in each of mining units was used to develop the schedule, thus assuring that criteria such as adequate mineralization exposure, mining accessibility, and consistent material movement were met.

Careful grade control will be required during the mining operation to minimize losses due to the inclination of the mineralized body. Grade control efforts will require taking advantage of all the experience of selective mining to assure the mineralization classes are properly selected and processed.

The most accessible areas have been considered early in the schedule and those with a higher proportion of Measured and Indicated resources, leaving the purely Inferred zones for final years of production. The mine schedule begins in Palito Main Zone, which requires the extension of the existing infrastructure, then to Chico da Santa, followed by Palito West and finally to Ruari's Ridge.

Table 16.4 shows the mine production schedule per year and per main sectors. It also shows the proportion per resource category.

**Table 16.4 – Mine Schedule**

Sector	Year	1	2	3	4	5	6	7	8	9	TOTAL
Palito Main Zone	kt	90	90	90	70	-	-	-	-	-	340
	Au g/t	9.58	8.45	9.96	6.08	-	-	-	-	-	8.66
	Cu %	0.23	0.18	0.21	0.23	-	-	-	-	-	0.21
Palito West	kt	-	-	-	-	-	20	90	2	-	113
	Au g/t	-	-	-	-	-	8.95	11.05	32.20	-	11.13
	Cu %	-	-	-	-	-	0.18	0.25	0.78	-	0.25
Chico da Santa	kt	-	-	-	20	90	69	-	-	-	179
	Au g/t	-	-	-	11.91	6.89	6.61	-	-	-	7.33
	Cu %	-	-	-	0.61	0.28	0.25	-	-	-	0.30
Ruari's Ridge	kt	-	-	-	-	-	-	-	87	21	108
	Au g/t	-	-	-	-	-	-	-	10.72	9.43	10.47
	Cu %	-	-	-	-	-	-	-	0.20	0.30	0.22
TOTAL	kt	90	90	90	90	90	90	90	90	21	740
	Au g/t	9.58	8.4	10.0	7.4	6.9	7.1	11.1	11.3	9.4	8.98
	Cu %	0.23	0.18	0.21	0.32	0.28	0.23	0.25	0.21	0.30	0.24
Measured		0%	0%	0%	1%	0%	0%	0%	0%	0%	0%
Indicated		25%	57%	57%	37%	13%	23%	33%	5%	0%	30%
Inferred		75%	43%	43%	61%	87%	77%	67%	95%	100%	70%

## 17 RECOVERY METHODS

### 17.1 Introduction

The Palito project has a fully implemented process plant that operated continuously producing copper–gold concentrate and bullion for almost five years, from September 2004 until mid-2010. During this period of time, the plant was fed with 575,000 tonnes of ore, of which 85% came from underground portion of the Palito Mine at the Palito Main Zone area. The rest came from small scale near surface open pit mining.

The plant when previously operated had a capacity to process over 600 tpd of sulphide material, however in this PEA process rate are limited to 250tpd, offering the potential for substantial surplus capacity in the plant. Additional mill feed opportunities are being investigated.

The process flow-sheet comprises a crushing circuit, a milling circuit, and a flotation circuit followed by concentrate filtration and storage facilities. The flotation tailings are fed to a cyanide agitation leaching CIP plant, followed by elution and gold refinement circuits, to produce bullion (Figure 17.1, same flow-sheet is shown in a bigger scale in Appendix A).

The tailings from the CIP circuit flow to detoxification tanks for neutralisation of cyanide, and are eventually pumped to a tailings storage dam situated 1.5km from the process plant.

As part of the PEA study NCL retained the services of Ingeniería y Construcción AJG Ltda, Chilean consultants in processing, to develop a preliminary study for the replacement/refurbishment for the re-opening of Palito plant to operate at a rate of 250 tpd.

### 17.2 Diagnostic of Current Process Plant Installations

AJG carried out a complete diagnosis of the different areas of the Palito plant in order to have a basis for estimation of the replacement/refurbishment capital and operating costs.

#### 17.2.1 Crushing, Grinding & Flotation

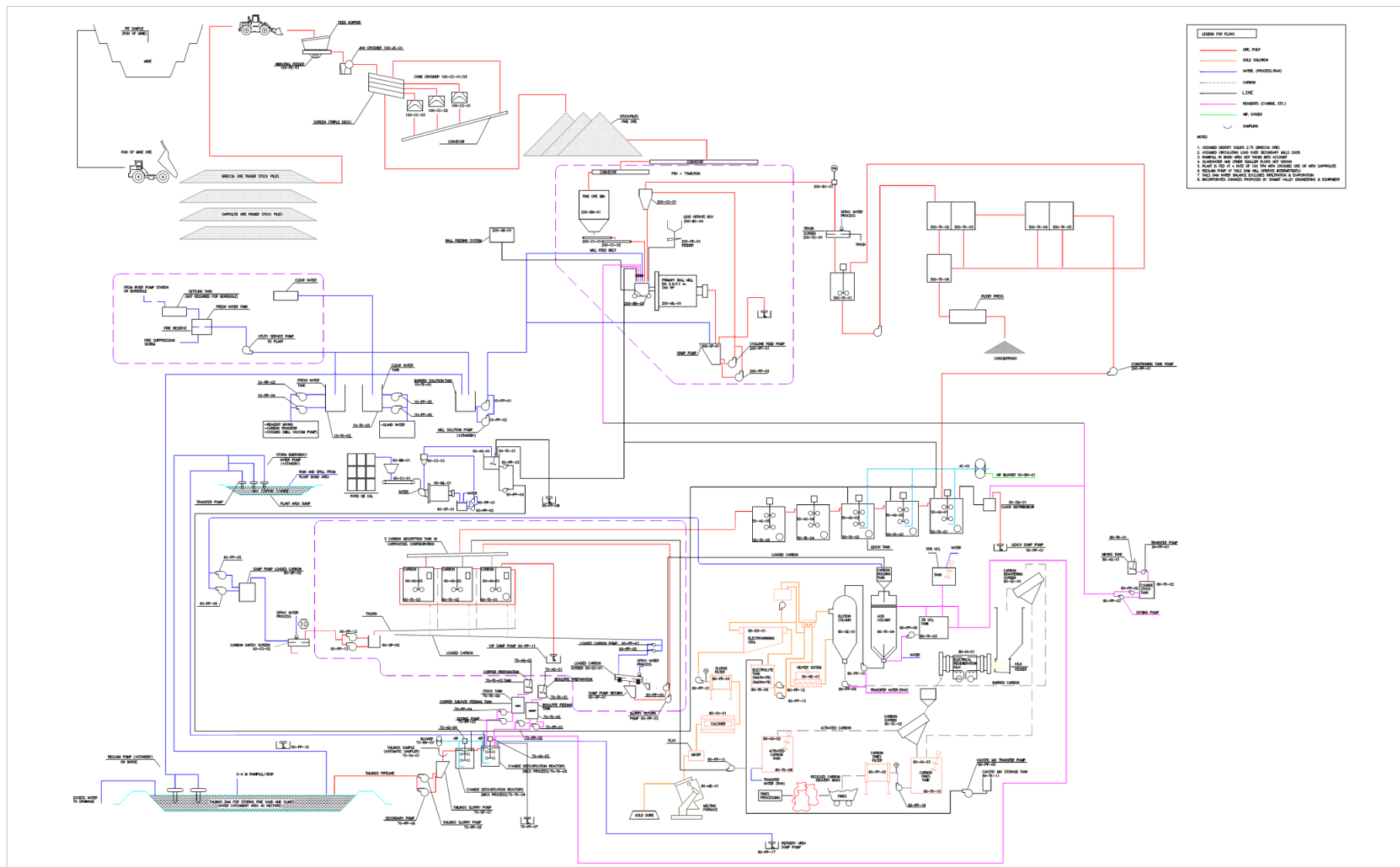
- The crushing plant operational, though it needs some refurbishment. The conveyor system must be repaired completely and all the belts should be replaced.
- The crushing plant structures require improvement and can be done in-situ.
- The foundations of the crushers need a redesign, with some structural changes (wooden for concrete).
- The grinding plant has four mills, one of 340 Kw and other three of less power. All can be remediated in-situ.
- Most of the piping needs replacing and redesign.
- The flotation plant is in poor condition. Because it is not mounted, it is probably desirable to buy new equipment or search options for external refurbishment.
- The concentrate filter plant is in good condition. It seems feasible to repair and refurbish the filters in-house. However, a redesign is needed for the feeder system to the filters and packaging system of the concentrates.
- In general safety conditions are substandard. A complete improvement of platforms, structures and decking is required.

#### 17.2.2 Leaching / CIP / Refinery / Laboratory

- The leach plant has the agitators mounted and apparently being recovered. Tanks are all repairable at low cost.
- The CIP plant and cyanide destruction circuit are in the same condition.

- The leaching and CIP agitation tanks require re-design to recover the pulp, baffles and oxygen injection feed and discharge systems. In general, re-design is required to improve process efficiencies (hydraulic and electric) and provide the system with some degree of instrumentation.
- The oxygen generating plant apparently is also recoverable and should be relocated and refurbished. It is important to achieve high leaching recoveries.
- The elution column was built in-situ. It requires certified welding and stainless steel.
- All ADR piping should be redone with stainless steel.
- The boiler used for heating the solutions needs a review and probably major changes.
- The electro winning cell needs a major repair, deformation was observed.
- The system to recover the gold from the electro winning mud is recommended to be reviewed.
- The cyanide detox plant is in good condition.
- The sample preparation laboratory for fire assay is operational and equipment in good condition.
- The sample preparation facility needs ventilation and a dust collector. The AA equipment is in good condition and with all the required accessories.
- In general, laboratories are equipped with all required equipment and components for process control and metallurgical testing to support the operation.

Figure 17.1– Overall Flow-sheet



## **18 INFRASTRUCTURE**

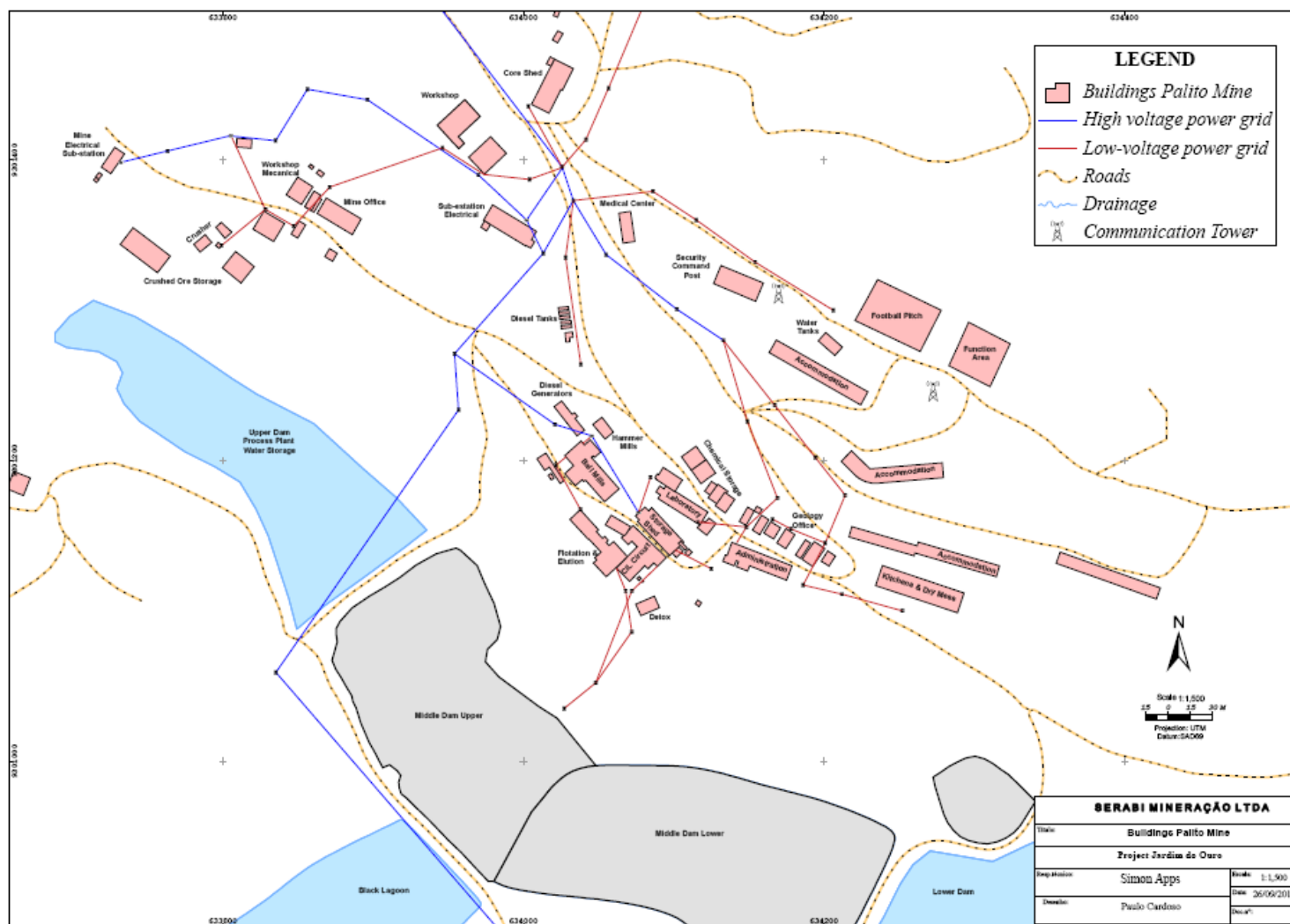
### **18.1 General Infrastructure**

The infrastructure includes:

- Underground Mine at the Palito Main Zone
- Ore Processing Facilities
- Tailings Storage Facilities
- Power Supply
- Water Supply
- Mine Camp (accommodation, offices, workshops and warehouses)
- Access Roads and Air Strip

Figure 18.1 shows a general layout of the site infrastructure.

**Figure 18.1– General Site Layout - Infrastructure**



## 18.2 Palito Underground Mine

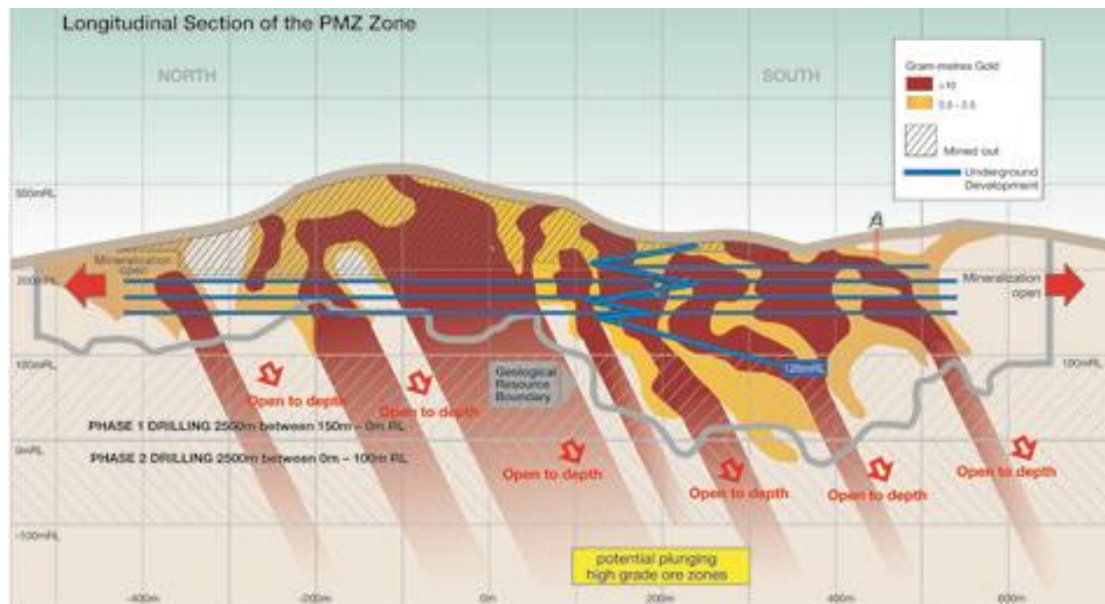
Underground mining at the Palito Mine began in 2004 with production at a rate of 150 tpd, increasing gradually to approximately 600 tpd in year 2008. Total underground mine production during this period was approximately 460,000 tonnes.

Following a successful period of selective mining using a shrinkage stopeing method, in an effort to increase production, a more mechanised bulk mining method (long hole open stopeing method) was introduced. However, levels of dilution were higher than expected, giving rise to lower than planned head grades. Efforts were made in 2007 to manage dilution and plans established to put in place a more selective mining method albeit still mechanised. New equipment was ordered but was some 6-12 months late in being delivered and commissioned. Essential mine development was consequently delayed, hence when the equipment arrived in mid-2008, the Company found it impossible to recapture this lost development fast enough and with the markets in rapid decline and little access to additional working capital, the underground mining operation was suspended at the end of 2008 and the mine placed on care and maintenance.

The underground portion of the Palito Mine consists of an access ramp located at the footwall of the mineralized structures, providing access to the veins on 12m vertical intervals. The ramp portal is located at elevation 235 masl, and the total ramp development is of the order of 1,000m of ramp, the deepest level being 114m. The mine is currently flooded up to level 178m.

After the underground portion of the Palito Mine was placed in care and maintenance, most of the underground mobile equipment fleet, and part of the stationary mine equipment was sold. The cost and time frame to re-habilitate the underground portion of the Palito Mine has been estimated to be US\$ 7.6 million, as detailed in Section 21.1.

**Figure 18.2 - Palito Mine Long Section**



## 18.3 Ore Processing Facilities

The project has a fully implemented process plant that operated continuously producing copper-gold concentrate and bullion for almost five years, from September 2004 until mid 2010. During this

period of time, the plant was fed with 550,000 tonnes of ore, of which 85% came from underground portion of the Palito Mine at the Palito Main Zone area. The rest came from low scale near surface open pit mining.

The plant has a capacity to process over 600 tpd of sulphide material, though is in some need of refurbishment, as detailed and costed in section 21.1. The process flowsheet consists of a crushing circuit, a milling circuit, and a flotation circuit followed by concentrate filtration and storage facilities. The flotation tailings are fed to a cyanide agitation leaching CIP plant, followed by elution and gold refinement circuits, to produce bullion.

The tailings from the CIP circuit flow to detoxification tanks for neutralisation of cyanide, and are eventually pumped to a tailings storage dam situated 1.5km from the process plant.

By the end of 2008, a circuit to process oxidized ore from the near surface open pit mining was implemented. This circuit consists of feeding the ore directly to two dedicated Hammer mills that discharge to the main ball mills, from where the ore bypasses the flotation circuit, to go directly to the CIP, elution and gold refinement circuits to produce bullion.

The first phase of the Palito plant was built in 2004 using mainly second hand equipment, and was gradually expanded to reach the current configuration. The plant is on a “care and maintenance”, and is in need of some refurbishment totalling US\$ 7.1m.

#### **18.4 Tailings Disposal Facilities**

The final section of the process facility consists of two detoxification tanks for neutralisation of cyanide, from where the tailings are pumped to and deposited in a tailings storage facility situated 1.5km from the process plant.

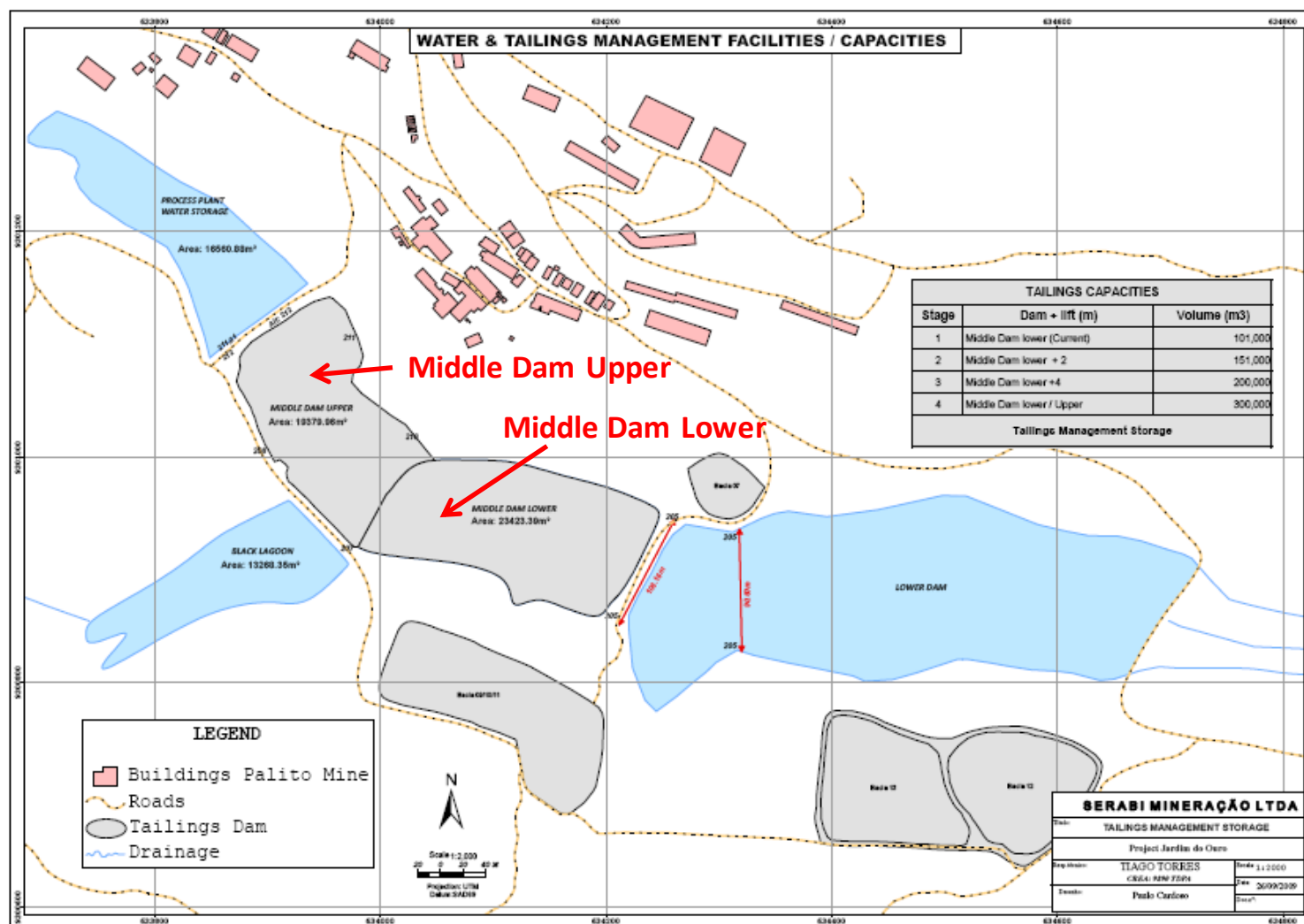
The current tailings storage facility sits on top of a prospective geophysical anomaly, and the site has not been subject of condemnation drilling. As part of the PEA study NCL retained the services of WALM Engenharia e Tecnologia Ambiental Ltda, Brazilian consultants, to develop a preliminary study for tailings disposals options. The result of the study recommends an alternative which considers two phases: i) initial phase considering the current alternative with tailings storage ponds and ii) final phase re-establishing original tailings location at the named upper, middle and/or lower dam sites (Figure 18.3).

Site assessments were made for the initial phase and it was concluded that that best site alternative for the new tailings storage pond is the area in between existing ponds 12/13 and 9/10/11. An attempt was made to achieve a balance between cut and fill volumes with the existing topographic conditions in view. Excess excavated material will result, which can be used for repairing erosion on existing pond slopes, as well as build a small dyke to divert storm water flows which, otherwise, could enter the new pond and adversely affect its ability to store tailings (Figure 18.4).

A waterproof lining is proposed to be applied to the entire inner surface of the pond to isolate non-stabilized tailings from the surrounding environment, as required under the current regulations. Proposed lining consists of a compacted, well-graded clayey soil layer 0.50m in thickness, and an overlying 2mm thick HDPE geomembrane. A HDPE geomembrane of such thickness was selected because it is less likely to be perforated by external agents and because no drainage systems will be in place to collect leak flows.

A 500 g/m<sup>3</sup> nonwoven geotextile would be placed in between the HDPE geomembrane and the underlying soil to serve as a mechanical protection for the HDPE. The geomembrane-geotextile system would be anchored to the crest of the cut/fill slopes, by excavating anchor trenches, which would be backfilled with compacted soil, thereby holding in place the edges of the geomembrane and geotextile.

**Figure 18.3 - Existing Tailings Storage Facilities**



**Figure 18.4 – Tailings Management -Initial Phase Conceptual Design**



### 18.5 Power Supply

Power is fed to the project through a 34.5 kV power line constructed by the local electric company CELPA in 2006. The line is 30 km long, connecting with the village of Moraes de Almeida. Originally the line was fed by a diesel power plant located in the village of Novo Progresso, and in 2009 it was connected to the hydro generated northern Brazil power grid, which takes power from the Curua Hydro plant, approximately 100km NE of Novo Progresso.

A demand requirement in the order of 1.2mW was estimated for 250 tpd throughput rate, some 0.4mW less than when the mine was in production during 2003-2010. The project also has a back-up power plant capable of delivering 1.0mW of power if required.

### 18.6 Water Supply

The project has a water supply system consisting of a dam that contains water from the following sources:

- Mine water that is pumped from the underground working ends
- Recycled process water, after neutralization and decantation.
- Rain water

The total water consumption during the period of normal operation of the mine was in the range between 40 m<sup>3</sup>/h and 50 m<sup>3</sup>/h, including the process plant and the mine.

Water is an abundant resource in the area, and the current water supply system is not a limiting factor for a future re-start of the Palito operation or even possible expansions of the processing facilities or the mine throughput.

Fresh drinkable water for use in the camp is supplied by conventional water wells. The total fresh water consumption when the mine was operating at full capacity was approximately 60m<sup>3</sup>/day.

### 18.7 Camp

Serabi has established a full mining camp at the Palito Mine. The camp consists of accommodation for the personnel, offices, warehouses, maintenance facilities, and a wide variety of services that make the camp self sufficient in many aspects.

The accommodation facilities consist of four units that can host up to 250 people. Serabi Mineracao also provides a daily bus service for employees and contractors living in Jardim do Ouro and Moraes d' Almeida.

There are mine offices that are basic but in sound condition. Workshops and warehouses are adequately sized and are in reasonable order.

Fuel is stored on site in storage tanks with an approximate capacity of 90,000 L of diesel. All the fuel storage tanks are located in a contained fuel storage area. There is an explosives storage facility located away from the main offices that is currently in care and maintenance.

There is a well equipped laboratory on site, currently being used.

The site is self sufficient for most of the required services. The mine has access to radio telephones (two lines), high speed broadband satellite internet within a secure domain, two telephone land lines and radio communications. Serabi has the facilities to provide catering services for all the personnel.

Serabi has built and operates a clinic and hospital at the Palito Mine.

Serabi contracts its own security service. There is a guard house at the entrance to the mine.

### **18.8 Access Roads and Air Strip**

The mine is accessed by unsealed road from the nearest town and delays can be expected during the wet season. An airstrip, suitable for light planes, was implemented in 2006, and is currently fully operative. Serabi Mineracao owns bulldozers, front end loaders and trucks which are used for site construction, road building and road maintenance.

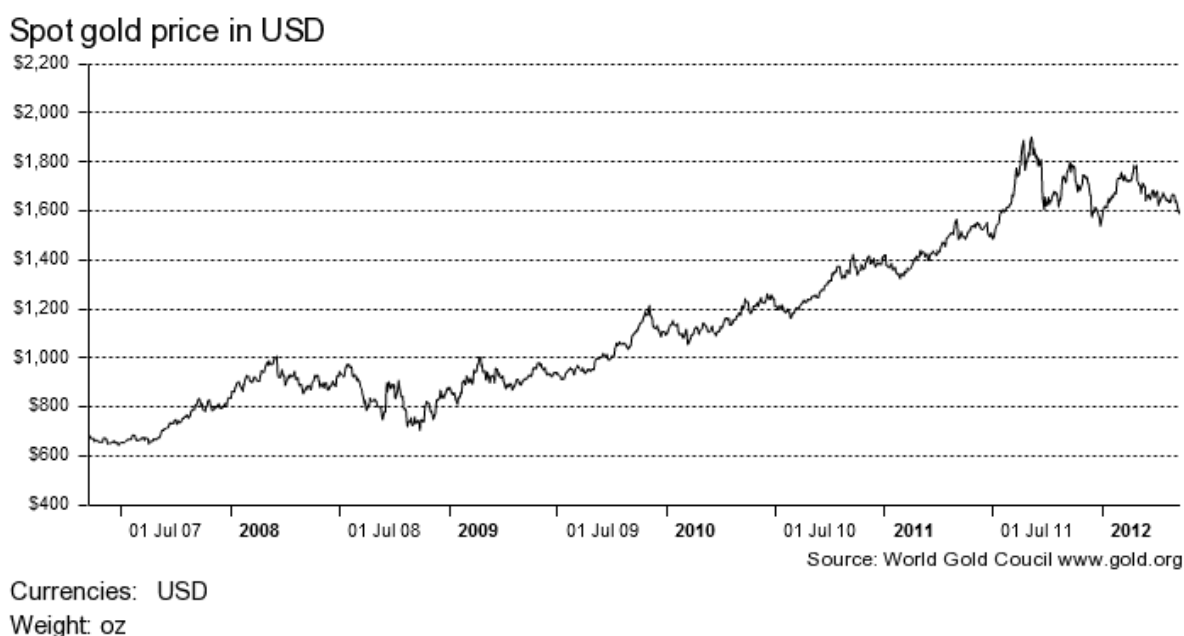
## 19 MARKET STUDIES AND CONTRACTS

### 19.1 Metal Prices

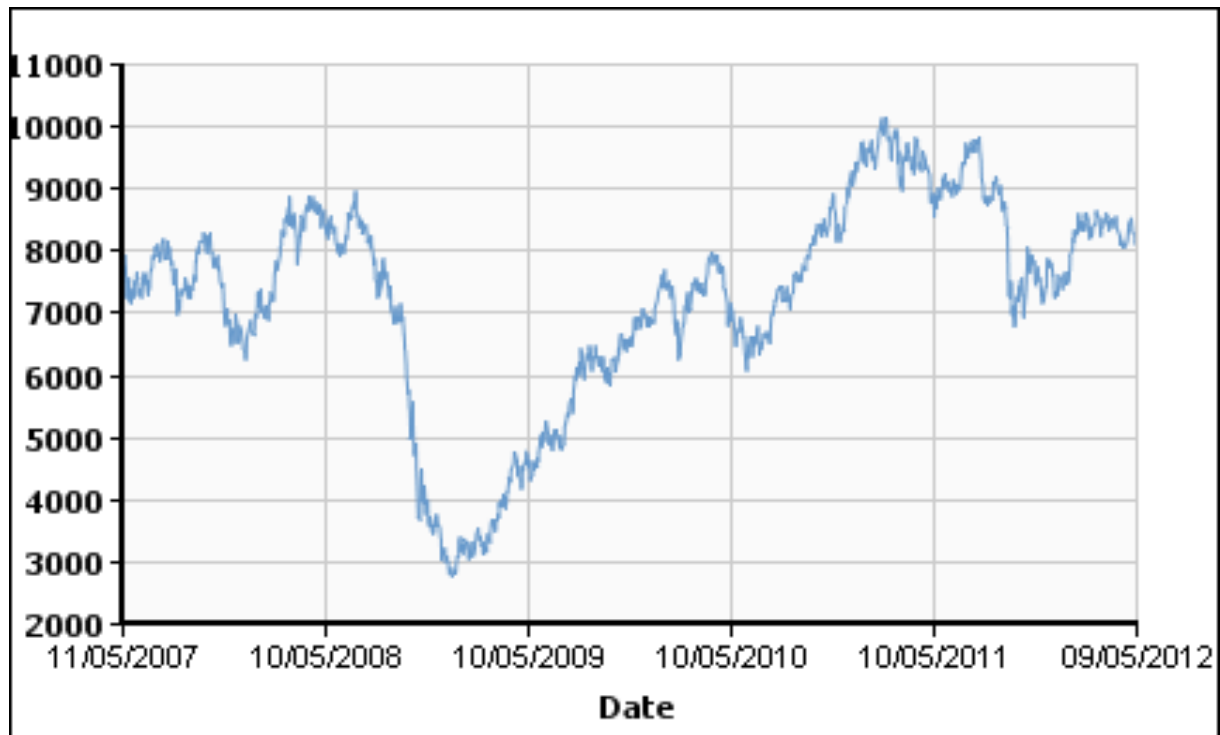
Over the past three years, gold prices have varied from lows of around US\$800/oz. to over US\$1,900/oz. as indicated in figure 19-1. At the time of the preparation of this report (end June 2012), gold has been trading between the ranges of US\$ 1,540 to US\$ 1,635 during the preceding four week period.

It is accepted that it is not possible to accurately forecast the future price of gold. For the purpose of this study, a gold price of US\$1,400 per troy ounce has been assumed, a forecast that is consistent with NCL's price recommendations for carrying out scoping, prefeasibility and feasibility studies. It is also in-line with the views expressed by and the forecasts used by a number of market observers and investment professionals.

*Figure 19.1- 5 year gold prices*



Revenue from the Palito mine will be primarily from gold but the operation will also produce copper and silver. The silver credits are not expected to generate any more than 1% of total revenue and for this reason no projection of silver revenue has been considered in this study. Copper credits will however be of greater significance and are expected to represent around 4% of total revenue.



**Figure 19.2 - Cash Seller and settlement price Copper in USD**

Source: London Metal Exchange

As can be seen from Figure 19-2, copper prices declined dramatically during the global financial crisis in the latter part of 2008 but have recovered to pre-crisis levels and whilst subject to global economic conditions, a long term price forecast of around US\$7,000 per tonne (US\$3.18 per lb.) appears consistent with market observers and investment professionals. For the purpose of this study a long term price of US\$6,600 per tonne (US\$3.0 per lb.) has been used.

## 19.2 Refining Terms

The Palito Mine will produce two products, namely a gold concentrate and gold doré. It is anticipated that 100% of gross copper production and around 78% of gross gold production will be sold in the form of copper concentrate with the remaining 22% of gross gold production being sold as gold doré.

### Concentrate Production

When the Palito Mine was previously in production sold all of its copper concentrate production to Umicore SA, shipping the material to Umicore's premises in Hoboken, Belgium, under arrangements spanning a period from 2005 to early 2009. The exact terms of the commercial arrangements are subject to confidentiality agreements however it is reasonable to assume that the following terms which have been used for the purposes of the economic assessment should be achievable in the future either from Umicore SA or other refining companies.

### Gold

- Payment would be based on 98% of the value of the gold content of the concentrate using prevailing London Bullion Market Association quotations and would take into account any pricing or content discounts applied.
- Treatment fees would be US\$160 per kg of payable gold.

### Copper

- Payment would be based on 95% of the value of the copper content of the concentrate using prevailing London Metal Exchange quotations and would take into account any pricing or content discounts applied.
- Treatment charges would be US\$0.60 per kg of payable copper

### Treatment Charges

- We anticipate an overall treatment charge of US\$150 per metric tonne of material treated

In addition to the above basic charges, Serabi will contract with an independent laboratory to supervise sampling procedures when the material is delivered to the refinery and to undertake further assaying of such samples to verify the metal content of the concentrate reported by the refinery. There will also be penalties charged by the refinery for certain specific minerals and any other impurities identified within the concentrate. Overall it has been assumed for the purposes of the evaluation that the treatment and refining charges comprise 9.5% of concentrate revenue.

### **Doré Production**

A discount of 3% against prevailing prices of the London Bullion Market Association quotations is anticipated for the sale of doré to gold traders located in the Tapajos such discount mitigating the need for security transport, acknowledging the relatively small volumes that will be delivered with each sale and covering all treatment charges and impurities.

## **19.3 Transportation**

### **Concentrate**

For the period that the Palito Mine was previously in production, Serabi Mineração, employed a local logistics and shipping agent to manage the transportation of the concentrate. Serabi Mineração has indicated that they will follow the same strategy for the shipping of concentrate as before. Concentrate material was produced in one tonne bags and the bags are sealed and loaded into containers usually of 20 tonnes per container. These are transported by road to Itaituba and then put onto barges and taken by river to the port of Belem where they can then be placed on ocean going vessels and shipped anywhere around the world. Because of the relatively low value of the concentrate material no special security arrangements are warranted.

### **Doré**

Doré is produced at the Palito mine and was previously shipped out of the mine on a weekly basis, coinciding with the elution cycles operated at the mine. This ensured that doré was never stored at the mine itself and immediately moved offsite. Transportation would be by light aircraft leaving the

dedicated Palito mine runway and transported to Itaituba where it would be immediately delivered to local gold traders. To contract directly with refineries in Brazil or elsewhere would necessitate putting in place arrangements with a recognised security company to transport from mine site to a refiner. There is no recognised security company located in Itaituba able to undertake this task and the company would therefore have to deliver the doré to the airport at Cuiaba the nearest commercial airport where a recognised security company has a presence and additionally would be required stockpile inventory prior to shipment to the refiner in order to deliver commercially viable volumes.

## **19.4 Sales**

### **Concentrate**

Previously Serabi had in place a contract with Umicore SA, to deliver copper concentrate to Umicore's processing facility located at Hoboken, Belgium. Serabi has approached Umicore regarding the potential recommencement of operations and Umicore have indicated that they would be willing to consider the purchase of copper concentrate production from Palito and to enter into contract discussions nearer to the time of planned production start-up. There are other refineries located around the world that Serabi could also approach to ensure that a competitive process is undertaken. We do not anticipate any change in the various elements that are contained within the concentrate that will be produced and sold, to that material previously produced on the basis that it is derived from the same ore-body. Accordingly we would anticipate that Serabi could expect to enter into new contract terms that will not be materially different to those previously provided by Umicore.

At this current time Serabi has not contracted with any party for the sale of the concentrate.

### **Doré**

There are a number of gold dealers located in Itaituba servicing the needs of small scale mining and garimpo operations. All provide similar pricing structures and in the past have placed a premium on the regular supply of gold from Palito. We do not anticipate Serabi encountering difficulty in being able to sell its doré production on terms similar to those offered previously.

At this current time Serabi has not contracted with any party for the sale of the doré.

## **20 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT**

The Jardim do Ouro Project comprises of the Palito Gold Deposit which lies within the mining concession 850.175/2003. This concession, totalling 1,149.59 ha was granted mining license concession status in 2007 by the National Department on Mineral Production (DNPM), the Brazilian Mining authority.

On December 5<sup>th</sup> 2008, the Company submitted to the DNPM a change of mine plan report advising of a "Temporary Suspension of Mining Operation", protocolled by the DNPM # 48405-005773/2008.

To recommence mining in these areas, the Company will be required to file a further change of mine plan report to the DNPM to reactivate the mining concessions. The Operating License (LO # 6704/2012, granted by the Para state environmental authority (SEMA) on the 27<sup>th</sup> of April 2012, has recently been renewed and was a pre-requisite to re-commencement of operations.

### **20.1 Environmental Liabilities**

The Jardim do Ouro Project contains significant ground disturbance within the Palito Mining lease (850.175/2003), as part of the Palito mining and processing activities. Serabi is in compliance in all material respects with all environmental regulatory requirements related to the exploration and mining activities pursuant to Brazilian environmental laws, and has taken all necessary actions in order to keep the environmental licences and permits in force, valid and in good standing.

Within the Jardim do Ouro Project, outside of the Palito Mine lease ground disturbance has been primarily by garimpo activities, restricted mainly to creeks, including shallow water filled pits and small open pits from which saprolitic materials have been hydraulically extracted and processed by gravity separation. Serabi has conducted a small program of diamond drilling outside of the mining lease in exploration lease 850.174/2005, consisting of drill pad placement and access road construction. These areas have since been remediated.

Serabi presented a closure plan to the Brazilian mining authority as part of the plan of economic usage of the mine, required for the mining license application. In this plan, a value close to R\$2.5 million was estimated to cover closure costs, spread over a period of three years, after the mine exhaustion.

### **20.2 Licensing and Permitting**

The Palito Mine has valid operating permits that allow both exploration and operating activities to take place. The key permit in place is the Operating license (LO) – Protocol #6704/2012 issued by Secretaria de Estado de Qualidade Ambiental (SEMA), renewable annually. Serabi has recently received renewal of this license 27<sup>th</sup> April 2012. This renewable LO supports the original final application document, the 'Plano Aproveitamento Econômico' (PAE) for the 850.175/2003 concession, which was submitted to the DNPM 31<sup>st</sup> May 2007, protocolled 003961/2007 and subsequently granted mining license status.

The LO allows the extraction and processing of gold and associated minerals in the mine license area of 1,712ha up to a maximum rate of 700 tonnes per day.

Other valid permits include:

1. Cadastro Ambiental Rural (proof of land ownership and use for industrial purposes) – Protocol # 12787/2010 – issued by SEMA
2. Outorga (license to extract water for industrial use) valid until 12/01/2013 and issued by SEMA - #193/2010

3. Anexo - Outorga (license to extract water for domestic use) valid until 12/01/2013 and issued by SEMA
4. License to Procure, Store, Use Explosives at site - # 1871 issued by Ministry of Defence valid until 31/10/2013

## 21 CAPITAL AND OPERATING COSTS

### 21.1 Capital

The total initial capital investment for the mining, process plant and infrastructure for 250 tpd, in addition to the expected life of Project sustaining capital, has been summarized in Table 21.1.

**Table 21.1 – Overall Capital Costs**

Category (MUS\$)	Initial Capital	Sustaining Capital	Total Capital
Underground mining equipment, Development & pre-production operation	7.64	17.13	24.77
Pre-production overhead	2.27		2.27
Plant	7.13		7.13
Tailings Storage Facility	0.75	7.25	8.00
Closure		2.00	2.00
<b>TOTAL</b>	<b>17.79</b>	<b>26.38</b>	<b>44.17</b>

#### 21.1.1 Mining

Using the developed mine schedule estimates were obtained for both equipment and underground development.

The mine capital cost estimate is detailed in Table 21.2 through Table 21.5. The estimate had been divided into development, equipment, infrastructure & services, pre-production operation and others. The initial capital cost amounts to US\$ 4.8 million for equipment and infrastructure, US\$ 0.8 million for development and US\$ 2.0 million for pre-production operation. Additional US\$ 17.1 million is required as sustaining capital, mainly because of development requirement and fleet substitution.

**Table 21.2 – Mine Capital Costs**

Year	Development	Equipment	Pre-production	Total
-1	0.78	4.85	2.01	7.64
1	0.42	0.04		0.46
2	0.33	0.04		0.37
3	0.13	1.14		1.27
4	1.45	1.25		2.70
5	0.94	4.91		5.85
6	1.30	0.03		1.33
7	1.93	1.10		3.03
8	2.12			2.12
9				
10				
11				
12				
13				
<b>TOTAL</b>	<b>9.41</b>	<b>13.35</b>	<b>2.01</b>	<b>24.77</b>

**Table 21.3 – Mine Development Costs**

Developments (m)	US\$/m	Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Ramp 4x4	957	700				1,022	600	700	1,200	1,800	
Drift 4x4	957	120	443	345	135	490	381	661	820	414	
TOTAL	MUS\$	0.78	0.42	0.33	0.13	1.45	0.94	1.30	1.93	2.12	-

For mine equipment, a new fleet was estimated as initial capital, a over-haul of the fleet was considered in Year 3 (30% of the price) and a full substitution in Year 5.

**Table 21.4 – Mine Equipment Capital Costs**

Equipment	US\$/un		Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
LHD 6 yd <sup>3</sup>	Requirement		1	1	1	1	1	1	1	1	1	1
		US\$ 750,000	Acquisition	1			0.3		1			
LHD 3.5yd <sup>3</sup>	Requirement		2	2	2	2	2	2	2	2	2	2
		US\$ 540,000	Acquisition	2			0.6		2			
Trucks 20t	Requirement		3	3	3	3	3	3	3	3	3	3
		US\$ 300,000	Acquisition	3			0.9		3			
Jumbo horizontal (1 arm)	Requirement		2	2	2	2	2	2	2	2	2	2
		US\$ 300,000	Acquisition	2			0.6		2			
Others												
Ventilation raises	US\$ 1,000,000		1				1	1		1		
Main Fans	US\$ 100,000						1	1				
Pumps	US\$ 25,000		1	1	1	1	1	1	1			
Various Geology	US\$ 100,000		0.5	0.1	0.1	0.1	0.1	0.1				
Others (10%)	10%		10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
TOTAL	MUS\$		4.85	0.04	0.04	1.14	1.25	4.91	0.03	1.10	-	-

**Table 21.5 – Mine Pre-Production Cost**

<b><u>MINE PRE-PRODUCTION COST</u></b>		Year -1
<b>Preparation</b>	US\$	<b>879,436</b>
<b>Extraction</b>		-
Stoping	US\$	-
Loading	US\$	-
Hauling	US\$	-
<b>Mine Services</b>	US\$	<b>148,742</b>
<b>Labour</b>	US\$	<b>986,291</b>
<b><u>MINE</u></b>	US\$	<b>2,014,469</b>

### 21.1.2 Pre-Production Overhead

The overhead estimate for the operating costs considers US\$ 400,000 per annum for Technical Services, US\$ 1,500,000 per annum for G&A at Palito and US\$ 1,500,000 per annum for G&A of Belo Horizonte and Itaituba offices. Eight months of these expenses was considered as working capital, which amounts to US\$ 2.3m.

### 21.1.3 Process Plant and Infrastructure

#### Process Plant

The capital expenditure estimated by AJG corresponds to the result of the diagnostic carried out of Palito processing facility and infrastructure. The summary shown in Table 21.6 is due to improvements, repairs, changes of circuits, equipment purchases, engineering, etc., for the re-opening of the plant to a capacity of 250 tpd.

It must be noted that some equipment, as CIP Plant, refinery, concentrate filtration and laboratory was estimated to operate at 500 tpd as the differences in equipment costs and installation only represent about 15% to 20%.

**Table 21.6 – Plant Replacement and Refurbishment Capital Cost**

DESCRIPTION	ACQUISITION	CONSTRUCTION	TOTAL
	US\$	US\$	US\$
<b>EQUIPMENT</b>	<b>2,120,400</b>	<b>960,415</b>	<b>3,080,815</b>
<b>CIVIL WORKS</b>	<b>40,364</b>	<b>136,502</b>	<b>176,866</b>
<b>STRUCTURAL</b>	<b>377,161</b>	<b>341,361</b>	<b>718,523</b>
<b>PIPING</b>	<b>157,176</b>	<b>110,552</b>	<b>267,728</b>
<b>ELECTRICAL</b>	<b>1,043,636</b>	<b>201,835</b>	<b>1,245,471</b>
<b>I.- TOTAL DIRECT COSTS</b>	<b>3,738,737</b>	<b>1,750,666</b>	<b>5,489,403</b>
Engineering design	(6% Direct Costs)		<b>329,364</b>
Project and procurement management	(2% Direct Costs)		<b>109,788</b>
Site supervision & constr'n management	(8% Construction Cost)		<b>140,053</b>
Servicios de Terreno-Terceros	(1% Direct Costs)		<b>54,894</b>
Freights, insurance	(1% Acquisition)		<b>37,387</b>
Commissioning	(1% Direct Costs)		<b>54,894</b>
Spare parts	(4% Acquisition)		<b>149,549</b>
<b>II.- TOTAL INDIRECT COSTS</b>		<b>US\$</b>	<b>875,930</b>
<b>III.- TOTAL</b>		<b>US\$</b>	<b>6,365,333</b>
Contingencies	12%	US\$	<b>763,840</b>
<b>TOTAL PLANT REPLACEMENT AND REFURBISHMENT</b>		<b>US\$</b>	<b>7,129,173</b>

#### Infrastructure

The main area of infrastructure is for the Tailings Storage Facility (TSF). According to WALM estimate a total US\$ 8,000,000 is required for the full facility, considering US\$0.75m as initial capital and US\$ 1.0m in year 1, extending the current pond concept.

The definitive TSF will be built in three stages, in years two, four and six of operation respectively. The estimated sustaining capital costs for these stages are US\$ 2.75m for stage one, US\$ 1.75m for stage two and US\$ 1.75m for stage three

In addition in Year 9 a provision US\$ 2,000,000 has been included for mine closure.

## 21.2 Operating Cost

The LOM average operating cash cost is US\$549 per gold equivalent ounce or US\$150 per tonne of ROM. The total cash cost per gold equivalent ounce including refining and treatment costs plus government royalties (CFEM) is US\$ 738.5 per gold equivalent ounce. The breakdown of Serabi's mining, processing and general and administration costs are presented in Table 21.7.

**Table 21.7 – Operating Cost Summary**

	US\$ / oz (AuEq)	US\$ / tonne
Mining Ore	257.3	70.0
Process Plant	138.8	37.8
G&A	152.9	41.6
<b>Op. Cash Costs</b>	<b>549.1</b>	<b>149.4</b>
Refining Costs	171.9	
Royalties (CFEM)	17.5	
<b>Total Cash Costs</b>	<b>738.5</b>	

### 21.2.1 Mining

Mining operating costs were developed from the recommended equipment requirements and the personnel requirements. The mine operating costs include all the parts, supplies, and labour costs associated with mine operation and maintenance. Table 21.8 and Table 21.9 summarize the total mine operating costs, total cost and unit cost per total tonne of material mined respectively.

### 21.2.2 Processing Cost

The operating cost estimate is quoted to an accuracy level of -20 to +50% in line with PEA requirements. The following qualifications are made:

- The estimate is in United States of America dollars USD;
- All measurement units are metric;
- The estimate is only for the process plant and associated operating costs. No allowance has been made for any corporate overhead or offsite costs;
- No allowance has been made for offsite bullion transport and refining costs (included separately as refining charges and shipping, section 21.2.4);
- There is no escalation in the estimate.

The average processing cost amounts to US\$ 37.7 per tonne, as detailed in Table 21.10

**Table 21.8 – Mining Cost (US\$)**

		Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	TOTAL	TOTAL (US\$/t)
<b>Total Operating expenses</b>	<b>US\$</b>	<b>2,014,469</b>	<b>6,320,608</b>	<b>6,435,621</b>	<b>6,353,642</b>	<b>6,313,454</b>	<b>6,317,031</b>	<b>6,495,068</b>	<b>6,184,001</b>	<b>6,255,512</b>	<b>1,129,183</b>	<b>53,818,589</b>	<b>72.7</b>
<b>Preparation</b>	<b>US\$</b>	<b>879,436</b>	<b>1,689,060</b>	<b>1,868,894</b>	<b>1,799,083</b>	<b>1,724,337</b>	<b>1,647,364</b>	<b>1,813,883</b>	<b>1,603,705</b>	<b>1,659,459</b>	<b>-</b>	<b>14,685,222</b>	<b>19.9</b>
Hauling drift 3 x 3	US\$	424,281	809,094	897,897	858,429	814,028	858,429	873,230	784,427	779,493	-	7,099,310	9.6
Extraction points 3 x 3	US\$	341,892	660,991	729,369	706,576	683,783	592,612	706,576	615,405	660,991	-	5,698,195	7.7
In stope raises	US\$	113,263	218,975	241,628	234,077	226,526	196,323	234,077	203,873	218,975	-	1,887,717	2.6
<b>Extraction</b>	<b>US\$</b>	<b>-</b>	<b>2,830,740</b>	<b>2,765,919</b>	<b>2,753,752</b>	<b>2,788,309</b>	<b>2,868,859</b>	<b>2,880,377</b>	<b>2,779,488</b>	<b>2,795,245</b>	<b>678,356</b>	<b>23,141,045</b>	<b>31.3</b>
Stoping	US\$	-	2,162,002	2,159,915	2,158,204	2,161,394	2,158,298	2,148,904	2,163,028	2,157,874	492,874	17,762,491	24.0
Loading	US\$	-	208,685	208,685	208,685	208,685	208,685	208,685	208,685	208,685	52,171	1,721,655	2.3
Hauling	US\$	-	460,053	397,318	386,863	418,230	501,876	522,787	407,774	428,686	133,311	3,656,898	4.9
<b>Mine Services</b>	<b>US\$</b>	<b>148,742</b>	<b>321,372</b>	<b>321,372</b>	<b>321,372</b>	<b>321,372</b>	<b>321,372</b>	<b>321,372</b>	<b>321,372</b>	<b>321,372</b>	<b>80,968</b>	<b>2,800,684</b>	<b>3.8</b>
Ventilation	US\$	104,624	209,248	209,248	209,248	209,248	209,248	209,248	209,248	209,248	52,312	1,830,918	2.5
Water + Elec + Comp. Air	US\$	36,618	104,624	104,624	104,624	104,624	104,624	104,624	104,624	104,624	26,156	899,765	1.2
Dewatering	US\$	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500	2,500	70,000	0.1
<b>Labour</b>	<b>US\$</b>	<b>986,291</b>	<b>1,479,436</b>	<b>1,479,436</b>	<b>1,479,436</b>	<b>1,479,436</b>	<b>1,479,436</b>	<b>1,479,436</b>	<b>1,479,436</b>	<b>1,479,436</b>	<b>369,859</b>	<b>13,191,638</b>	<b>17.8</b>
Maintenance	US\$	135,000	202,500	202,500	202,500	202,500	202,500	202,500	202,500	202,500	50,625	1,805,625	2.4
Mine Sup	US\$	157,691	236,536	236,536	236,536	236,536	236,536	236,536	236,536	236,536	59,134	2,109,113	2.9
Mine Op	US\$	693,600	1,040,400	1,040,400	1,040,400	1,040,400	1,040,400	1,040,400	1,040,400	1,040,400	260,100	9,276,900	12.5

**Table 21.9 – Mining Cost (US\$/t)**

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	TOTAL
<b>Total Operating expenses</b>	<b>US\$/t</b>	<b>70.2</b>	<b>71.5</b>	<b>70.7</b>	<b>70.1</b>	<b>70.3</b>	<b>72.6</b>	<b>68.6</b>	<b>69.6</b>	<b>55.0</b>	<b>72.7</b>
<b>Preparation</b>	<b>US\$/t</b>	<b>18.8</b>	<b>20.8</b>	<b>20.0</b>	<b>19.2</b>	<b>18.3</b>	<b>20.3</b>	<b>17.8</b>	<b>18.5</b>	<b>0.0</b>	<b>19.9</b>
Hauling drift 3 x 3	US\$/t	9.0	10.0	9.5	9.0	9.5	9.8	8.7	8.7	0.0	9.6
Extraction points 3 x 3	US\$/t	7.3	8.1	7.9	7.6	6.6	7.9	6.8	7.4	0.0	7.7
In stope raises	US\$/t	2.4	2.7	2.6	2.5	2.2	2.6	2.3	2.4	0.0	2.6
<b>Extraction</b>	<b>US\$/t</b>	<b>31.4</b>	<b>30.7</b>	<b>30.6</b>	<b>31.0</b>	<b>31.9</b>	<b>32.2</b>	<b>30.9</b>	<b>31.1</b>	<b>33.0</b>	<b>31.3</b>
Stoping	US\$/t	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Loading	US\$/t	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.5	2.3
Hauling	US\$/t	5.1	4.4	4.3	4.6	5.6	5.8	4.5	4.8	6.5	4.9
<b>Mine Services</b>	<b>US\$/t</b>	<b>3.6</b>	<b>3.6</b>	<b>3.6</b>	<b>3.6</b>	<b>3.6</b>	<b>3.6</b>	<b>3.6</b>	<b>3.6</b>	<b>3.9</b>	<b>3.8</b>
Ventilation	US\$/t	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.5	2.5
Water + Elec + Comp. Air	US\$/t	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.2
Dewatering	US\$/t	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
<b>Labour</b>	<b>US\$/t</b>	<b>16.4</b>	<b>16.4</b>	<b>16.5</b>	<b>16.4</b>	<b>16.5</b>	<b>16.5</b>	<b>16.4</b>	<b>16.5</b>	<b>18.0</b>	<b>17.8</b>
Maintenace	US\$/t	2.2	2.3	2.3	2.2	2.3	2.3	2.2	2.3	2.5	2.4
Mine Sup	US\$/t	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.9	2.9
Mine Op	US\$/t	11.6	11.6	11.6	11.6	11.6	11.6	11.5	11.6	12.7	12.5

**Table 21.10 – Processing Cost (US\$/t)**

ITEM	Operating Cost / year	Unit price US\$	Unit		
				Quantity	US\$/year
<b>1.0</b>	<b>PLANT</b>				
<b>1.1</b>	<b>Consumables</b>				
	Energy	0.0975	KWh/a	6,588,697	642,398
	Reagents		Ton	471	679,186
<b>1.2</b>	<b>Spare parts</b>				
	Crushing	40,434	Gl	1	40,434
	Grinding	67,389	Gl	1	67,389
	Grinding balls	59,303	Gl	1	59,303
	Classification	24,000	Gl	1	24,000
	Others	19,113	Gl	1	19,113
<b>1.3</b>	<b>Labour</b>				
<b>1.3.1</b>	<b>Administration</b>				
	Superintendent	9,368	c/u	1	112,417
	Plant Metallurgist	3,884	c/u	2	93,218
	HSEC	3,275	c/u	1	39,297
				4	
<b>1.3.2</b>	<b>Operation</b>				
	Operations supervisor	2,256	c/u	8	216,584
	Process technicians	1,749	c/u	27	566,703
	Samplers	1,242	c/u	4	59,620
				39	
<b>1.3.3</b>	<b>Maintenance</b>				
	Mechanics	2,087	c/u	6	150,270
	Mechanics helpers	1,918	c/u	8	184,136
	Electricians	2,087	c/u	6	150,270
	Operators	2,087	c/u	4	100,180
				24	
<b>1.3.4</b>	<b>Laboratory &amp; Process Control</b>				
	Metallurgist helper	1,580	c/u	2	37,922
	Chemist	1,580	c/u	2	37,922
	Laboratory operator	1,580	c/u	2	37,922
	Sampling preparation	1,580	c/u	4	75,844
				10	
<b>Operating Cost</b>			<b>TOTAL</b>	<b>US\$/year</b>	<b>3,394,128</b>
			<b>Production</b>	<b>tonnes/year</b>	<b>90,000</b>
			<b>OPEX</b>	<b>US\$/t</b>	<b>37.71</b>

### 21.2.3 General and Administrative (G&A) Cost

General and administrative (G&A) costs for the Project have been estimated according to Serabi records of past operation and using March, 2012 US dollars. The G&A costs are inclusive of the following:

- Technical Services: US\$ 400,000 per year
- HSEC : US\$3.70/t
- G&A Palito: US\$ 1,500,000 per year
- G&A Belo Horizonte / Itaituba: US\$ 1,500,000 per year

The average G&A costs equate to US\$ 41.6/t.

#### **21.2.4 Refining Cost and Shipping**

It has been assumed for the purposes of the evaluation that the treatment and refining charges comprise 9.5% of concentrate revenue.

A discount of 3% against prevailing prices of the London Bullion Market Association quotations is anticipated for the sale of doré to gold traders located in the Tapajos such discount mitigating the need for security transport, acknowledging the relatively small volumes that will be delivered with each sale and covering all treatment charges and impurities.

A value of US\$ 1,900 per tonne of concentrate has been assumed for the transport of the concentrate from Palito to final destination, based on Serabi's previous experience.

#### **21.2.5 Royalties**

Mining royalties in Brazil are calculated on the gross value of sales, less logistical and insurance costs. Payments for mining royalties, also called CFEM (financial compensation for exploiting mineral resources), are divided between the federal government (12%), the state government where the mineral is extracted (23%), and the municipal government for the mine's location (65%).

A weighted average of 1.25% for gold, copper and silver was applied in the economic model. This average corresponds to the experience obtained during previous operation.

## 22 ECONOMIC ANALYSIS

This technical report includes mineral resources that are not mineral reserves and therefore do not have demonstrated economic viability.

*The reader is cautioned that the preliminary economic assessment is preliminary in nature and includes Inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. There is no certainty that the preliminary economic assessment will be realized. No Mineral Reserves have been estimated.*

Serabi should bear in mind that NCL is not a financial adviser, and that these models are indicative only, based on NCL's experiences. NCL recommends that Serabi seeks its own financial and tax advice before taking action in relation to the financial matters rose herein.

NCL has considered the cash flow on a 100% equity basis, i.e. no account has been taken of financing arrangements and associated costs.

Economical parameters used for the evaluation are shown in Table 22.1.

**Table 22.1 – Economical General Parameters**

Item	Unit	Value
Average Mining Costs	US\$/tonne mined	72.75
Processing Cost	US\$/tonne	37.77
Technical Services	MUS\$/year	0.40
HSEC	US\$/tonne	3.7
G&A (Palito)	MUS\$/year	1.5
G&A (BH+IT)	MUS\$/year	1.5
Base Case Prices	Gold US\$/oz	1400
	Copper US\$/lb	3.0
Transport, Freight, Insurance, Refining	US\$/tonne concentrate	1,900
Metallurgical Recovery	Flotation Gold (%)	71%
	Flotation Copper (%)	90%
	CIP Gold (%)	68%
Concentrate	%Cu	26%
TC/RC	% of concentrate revenues	9.5%
Refining	% of bullion revenues	3.0%
Income Tax	%	15.25% up to 2018 - 34.0% from 2019
Royalty	CFEM (average gold, copper and silver)	1.25%
Depreciation	Constant per year	15%
Losses Utilised	MUS\$	US\$50m, max 30% of profit
Exchange rate	R\$ / US\$	2.0

The cash flow model is based on the mine production and processing schedule, associated gold grades, metallurgical recoveries and capital and operating costs summarised in Table 22.1 above. The economic analysis assumes delivery of a copper concentrate to an appropriate refinery located outside of Brazil which accounts for approximately 78% by volume of the estimated gold production

with the balance being delivered in the form of gold doré to gold traders and refiners located in Brazil. NCL has assumed that overall treatment and refining and insurance charges will account for 9.5% of the value of the concentrate delivered to the refinery whilst a 3% fee has been assumed for the costs of refining gold doré.

The base case economic analysis assumes a gold price of US\$1,400 per ounces and a copper price of US\$3.00 per pound.

## **22.1 Royalties**

Mining royalties in Brazil are calculated on the gross value of sales, less logistical and insurance costs. Payments for mining royalties, also called CFEM (financial compensation for exploiting mineral resources), are divided between the federal government (12%), the state government where the mineral is extracted (23%), and the municipal government for the mine's location (65%).

A weighted average of 1.25% for gold, copper and silver was applied in the economic model. This average corresponds to the experience obtained during previous operation.

## **22.2 Taxation**

The profits tax assessable on the project takes into account a tax incentive that was granted to the company during 2008 by SUDAM (Amazon Development Superintendence). This incentive consists of a reduction by 75% of the regular corporate income tax (also referred to as IRPJ and currently levied at a rate of 25% for a ten-year period. Thereafter it has been assumed that the normal rate of corporate income tax of 25% will be applied. The CSLL tax (a social welfare tax amounting to 9%) has been assumed to apply for the duration of the project life.

Other tax incentives are available and in particular the RECAP is a special tax regime for the acquisition of goods by export companies and applies to the exemption of PIS and COFINS (Brazilian social contribution taxes) on purchases of imported machinery and equipment. In the past Serabi has been able to benefit from this tax regime and will make application again in respect of the project. However at this time no application has been made and the project economics have not considered the potential benefits that such a tax regime may bring to the project.

## **22.3 Economic Analysis**

This technical report includes mineral resources that are not mineral reserves and therefore do not have demonstrated economic viability.

*The reader is cautioned that the preliminary economic assessment is preliminary in nature and includes Inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. There is no certainty that the preliminary economic assessment will be realized. No Mineral Reserves have been estimated.*

The total estimated initial capital cost of the Project is US\$ 17.8 million, which comprises i) US\$ 7.6 million to fund the mine de-watering, the acquisition of the necessary mobile fleet, ramp development and stope preparation activities in the first year prior to the start -up of the plant, ii) US\$ 7.9 million for plant replacement/refurbishment and initial tailings management, iii) US\$2.3 million is considered necessary for mine-site overhead costs ("G&A") during this same period.

Sustaining capital expenditure during the life of the operation totals US\$26.4 million, including US\$17.1 million for continued underground capital development, fleet overhaul and replacement, and the overhaul of key some surface infrastructure during the project life. US\$7.25 million is

considered for future tailings management facilities and a US\$2.0 million provision has been included at the end of the project to cover estimated mine closure costs.

The base case financial model assumes gold price of US\$ 1,400 per ounce and copper price of US\$ 3.0 per pound. Results of the discounted cash flow modelling (NPV5 and NPV10) for the 250 tpd throughput scenario at Palito, together with the projected Internal Rate of Return (IRR) and payback period, are presented in Table 22.2.

Detail cash flow model is presented in Table 22.3.

**Table 22.2 – Economical Valuation Results Summary**

Financial Model	US\$ 1,400/oz Au - US\$ 3.0/lb Cu
NPV <sub>0</sub> pre-tax	US \$ 89.0 M
NPV <sub>0</sub> Free Cash flow (after tax)	US \$ 72.2 M
NPV <sub>5</sub> pre-tax	US \$ 64.2 M
NPV <sub>5</sub> Free cash flow (after tax)	US \$ 52.0 M
NPV <sub>10</sub> pre-tax	US \$ 47.3 M
NPV <sub>10</sub> Free cash flow (after tax)	US \$ 38.2 M
IRR pre-tax	78%
IRR Free cash flow (after tax)	68%
Initial Capital	US \$ 17.8 M
Sustaining Capital	US \$ 26.4 M
Operating Cost (per tonne)	US \$ 149 /tonne
Cash Cost (per ounce equivalent) (*)	US \$ 739 /oz eq
Years to payback from start of production (at 0% discount)	1.27
Years to payback from start of production (at 5% discount)	1.37
Years to payback from start of production (at 10% discount)	1.49

(\*) Equivalent gold is calculated using the referred gold and copper prices, average metallurgical recovery of 90.7% for gold and 90.0% for copper.

**Table 22.3 – Cash Flow Economic Model**

		Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	TOTAL
<b>1 Mine Plan</b>												
Ore	t	-	90,047	89,960	89,888	90,021	89,892	89,501	90,089	89,875	20,528	<b>739,801</b>
Gold	Au g/t	-	9.58	8.45	9.96	7.36	6.89	7.13	11.05	11.30	9.43	<b>8.98</b>
Copper	Cu %	-	0.23	0.18	0.21	0.32	0.28	0.23	0.25	0.21	0.30	<b>0.24</b>
Contained Gold	oz	-	27,731	24,433	28,797	21,289	19,914	20,530	32,011	32,648	6,226	<b>213,581</b>
Contained Copper	lb	-	463,948	351,852	411,247	626,846	551,741	458,536	486,743	424,294	133,964	<b>3,909,172</b>
<b>Plant Feed</b>												
Ore	t	-	90,047	89,960	89,888	90,021	89,892	89,501	90,089	89,875	20,528	<b>739,801</b>
Gold	Au g/t	-	9.58	8.45	9.96	7.36	6.89	7.13	11.05	11.30	9.43	<b>8.98</b>
Copper	Cu %	-	0.23	0.18	0.21	0.32	0.28	0.23	0.25	0.21	0.30	<b>0.24</b>
Contained Gold	oz	-	27,731	24,433	28,797	21,289	19,914	20,530	32,011	32,648	6,226	<b>213,581</b>
Contained Copper	lb	-	463,948	351,852	411,247	626,846	551,741	458,536	486,743	424,294	133,964	<b>3,909,172</b>
<b>2 Recoveries</b>												
<i>Flotation</i>												
Gold		0.0%	71.0%	71.0%	71.0%	71.0%	71.0%	71.0%	71.0%	71.0%	71.0%	
Copper		0.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	
<i>CIP</i>												
Gold		0.0%	68.0%	68.0%	68.0%	68.0%	68.0%	68.0%	68.0%	68.0%	68.0%	
<b>3 Production</b>												
Concentrate @ 26%Cu	t	-	728	552	646	984	866	720	764	666	210	<b>6,138</b>
Gold	oz	-	19,689	17,347	20,446	15,115	14,139	14,577	22,728	23,180	4,421	<b>151,642</b>
Copper	lb	-	417,553	316,667	370,123	564,162	496,567	412,683	438,069	381,864	120,567	<b>3,518,255</b>
Bullion												
Gold	oz	-	5,469	4,818	5,679	4,198	3,927	4,049	6,313	6,438	1,228	<b>42,118</b>
<i>Total</i>												
Gold	oz	-	25,158	22,166	26,125	19,314	18,066	18,625	29,040	29,619	5,649	<b>193,760</b>
Copper	lb	-	417,553	316,667	370,123	564,162	496,567	412,683	438,069	381,864	120,567	<b>3,518,255</b>
Gold Equivalent	oz eq	-	26,053	22,844	26,918	20,522	19,130	19,510	29,979	30,437	5,907	<b>201,300</b>

**Table 22.3 – Cash Flow Economic Model (cont)**

		Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	TOTAL
<b>4 Prices</b>												
Gold	US\$/oz	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	
Copper	US\$/lb	3	3	3	3	3	3	3	3	3	3	
<b>5 Total revenue</b>												
Concentrate	US\$	-	28,817,627	25,236,294	29,734,572	22,853,957	21,284,607	21,645,283	33,132,852	33,598,002	6,550,792	<b>222,853,985</b>
Gold	US\$	-	27,564,967	24,286,294	28,624,205	21,161,472	19,794,906	20,407,234	31,818,645	32,452,408	6,189,090	<b>212,299,222</b>
Copper	US\$	-	1,252,660	950,000	1,110,368	1,692,485	1,489,701	1,238,048	1,314,207	1,145,593	361,702	<b>10,554,764</b>
Bullion	US\$	-	7,656,073	6,745,433	7,950,272	5,877,524	5,497,966	5,668,037	8,837,517	9,013,542	1,718,998	<b>58,965,361</b>
Gold	US\$	-	7,656,073	6,745,433	7,950,272	5,877,524	5,497,966	5,668,037	8,837,517	9,013,542	1,718,998	<b>58,965,361</b>
Total Revenue	US\$	-	36,473,699	31,981,727	37,684,844	28,731,481	26,782,573	27,313,320	41,970,368	42,611,544	8,269,790	<b>281,819,347</b>
Copper credit	US\$/oz	-	49.79	42.86	42.50	87.63	82.46	66.47	45.25	38.68	64.03	<b>54.47</b>
<b>6 Operating Costs</b>												
Mining	US\$		6,320,608	6,435,621	6,353,642	6,313,454	6,317,031	6,495,068	6,184,001	6,255,512	1,129,183	<b>51,804,120</b>
Processing	US\$		3,401,461	3,398,178	3,395,486	3,400,505	3,395,634	3,380,855	3,403,076	3,394,967	775,434	<b>27,945,597</b>
Technical Services	US\$		400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	100,000	<b>3,300,000</b>
HSEC	US\$		333,172	332,851	332,587	333,079	332,601	331,154	333,330	332,536	75,954	<b>2,737,264</b>
G&A (Palito)	US\$		1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	375,000	<b>12,375,000</b>
G&A (BH+IT)	US\$		1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	375,000	<b>12,375,000</b>
Total Operating Cost	US\$	-	13,455,242	13,566,650	13,481,715	13,447,038	13,445,267	13,607,076	13,320,408	13,383,015	2,830,571	<b>110,536,980</b>
Total Operating Cost	US\$/t	-	149.43	150.81	149.98	149.38	149.57	152.03	147.86	148.91	137.89	<b>149.41</b>
<b>7 Operating Cash Flow</b>	US\$	-	23,018,457	18,415,077	24,203,129	15,284,443	13,337,306	13,706,244	28,649,961	29,228,529	5,439,220	<b>171,282,366</b>
<b>8 Cash Cost</b>												
Cash cost wo/ Cu credit	US\$/oz	-	534.83	612.06	516.05	696.25	744.22	730.57	458.69	451.85	501.11	<b>570.48</b>
Cash cost w/ Cu credit	US\$/oz	-	485.04	569.20	473.55	608.62	661.76	664.10	413.44	413.17	437.07	<b>516.01</b>
Cash cost (gold equivalent)	US\$/oz	-	516.46	593.88	500.85	655.23	702.82	697.46	444.33	439.70	479.19	<b>549.12</b>

**Table 22.3 – Cash Flow Economic Model (cont)**

		Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	TOTAL
<b>9 TCRC + shipping + refining</b>												
TCRC (9.5% of concentrate revenue)	US\$	-	2,737,675	2,397,448	2,824,784	2,171,126	2,022,038	2,056,302	3,147,621	3,191,810	622,325	<b>21,171,129</b>
Shipping	US\$	-	1,384,071	1,049,661	1,226,852	1,870,036	1,645,979	1,367,927	1,452,075	1,265,773	399,647	<b>11,662,020</b>
Bullion refining	US\$	-	229,682	202,363	238,508	176,326	164,939	170,041	265,125	270,406	51,570	<b>1,768,961</b>
Total TC/RC, shipping & refining	US\$	-	4,351,428	3,649,472	4,290,144	4,217,488	3,832,956	3,594,270	4,864,821	4,727,989	1,073,542	<b>34,602,109</b>
<b>10 Royalties</b>												
CFEM (1.25% of gross revenue)	US\$	-	455,921	399,772	471,061	359,144	334,782	341,417	524,630	532,644	103,372	<b>3,522,742</b>
Total Royalties	US\$	-	455,921	399,772	471,061	359,144	334,782	341,417	524,630	532,644	103,372	<b>3,522,742</b>
<b>11 Net Revenue</b>	US\$	-	31,666,350	27,932,484	32,923,640	24,154,850	22,614,835	23,377,634	36,580,917	37,350,910	7,092,876	<b>243,694,496</b>
<b>12 Total cost per ounce, including refining &amp; royalty</b>												
Total cost per ounce, including TC/RC & royalty (wo/ credit)	US\$/oz	-	725.92	794.74	698.30	933.21	974.91	941.88	644.28	629.46	709.46	<b>767.25</b>
Total cost per ounce, including TC/RC & royalty (w/ credit)	US\$/oz	-	676.13	751.88	655.80	845.58	892.45	875.41	599.02	590.78	645.43	<b>712.77</b>
Total cost per ounce, including TC/RC & royalty (gold equivalent)	US\$/oz	-	700.99	771.14	677.73	878.24	920.68	899.19	624.10	612.54	678.43	<b>738.5</b>
<b>13 EBITDA</b>	US\$	-	18,211,108	14,365,834	19,441,924	10,707,812	9,169,568	9,770,558	23,260,510	23,967,896	4,262,306	<b>133,157,515</b>
<b>14 Depreciation</b>	US\$		2,888,007	3,355,751	3,545,674	4,212,566	5,090,158	4,662,676	3,265,530	3,281,277	3,206,140	<b>33,507,777</b>
<b>15 Losses (US\$ 50M to be deducted, 30%EBITDA)</b>	US\$		4,596,930	3,303,025	4,768,875	1,948,574	1,223,823	1,532,364	5,998,494	6,205,986	316,850	<b>29,894,921</b>
<b>16 EBT</b>	US\$	-	10,726,171	7,707,058	11,127,375	4,546,673	2,855,587	3,575,517	13,996,486	14,480,633	739,316	<b>69,754,817</b>
<b>17 Taxes (15.25% up to Y5, 34% onwards)</b>	US\$	-	1,635,741	1,175,326	1,696,925	693,368	435,477	1,215,676	4,758,805	4,923,415	251,367	<b>16,786,101</b>

**Table 22.3 – Cash Flow Economic Model (cont)**

		Year -1	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	TOTAL
<b>18 Net Earnings</b>	US\$	-	13,687,360	9,834,757	14,199,325	5,801,879	3,643,934	3,892,206	15,236,175	15,763,204	804,798	<b>82,863,637</b>
<b>19 CASH FLOW</b>	US\$	-	16,575,367	13,190,507	17,745,000	10,014,445	8,734,091	8,554,882	18,501,705	19,044,480	4,010,938	<b>116,371,415</b>
<b>20 Net Capex</b>												
Capex	US\$	17,790,797										<b>17,790,797</b>
Sustaining / Closure	US\$		1,462,585	3,118,291	1,266,157	4,445,941	5,850,613	3,080,388	3,033,750	2,119,467	2,000,000	<b>26,377,193</b>
Total Capex	US\$	17,790,797	1,462,585	3,118,291	1,266,157	4,445,941	5,850,613	3,080,388	3,033,750	2,119,467	2,000,000	<b>44,167,989</b>
<b>21 Total cost per ounce, including capex &amp; taxes</b>												
Total cost per ounce, including capex (wo/ credit)	US\$/oz	-	898.85	1,086.82	882.49	1,381.52	1,580.50	1,357.61	861.19	811.80	1,631.12	<b>1,168.13</b>
Total cost per ounce, including capex (w/ credit)	US\$/oz	-	849.06	1,043.96	839.99	1,293.89	1,498.04	1,291.14	815.94	773.12	1,567.09	<b>1,113.66</b>
Total cost per ounce, including refining & royalty (gold equivalent)	US\$/oz	-	867.98	1,054.54	856.49	1,300.14	1,492.59	1,296.08	834.23	789.98	1,559.78	<b>1,124.38</b>
<b>22 Net Free Cash Flow (yearly &amp; cumulative)</b>												
Net Free Cash Flow	US\$	(17,790,797)	15,112,782	10,072,217	16,478,842	5,568,504	2,883,478	5,474,493	15,467,954	16,925,013	2,010,938	<b>72,203,425</b>
Cumulative	US\$	(17,790,797)	(2,678,014)	7,394,203	23,873,045	29,441,549	32,325,026	37,799,520	53,267,474	70,192,487	72,203,425	
<b>23 Net Present Value (NPV)</b>				<b>24</b>	<b>Payback (years)</b>							
0%	\$	72,203,425			1.3							
5%	\$	52,041,328			1.37							
10%	\$	38,202,736			1.49							

## 22.4 Sensitivity Analysis

The Project's sensitivity to changes in revenue, operating costs, capital costs and discount rate was tested with the following observations. Note that all figures given in the following tables are after tax.

- When the gold price was increased to a constant US\$ 1,600 per ounce gold (+14%), NPV after tax at a 5% discount rate increases by US\$ 24 million to US\$ 76 million and the IRR increases from 68% to 94%.
- In none of the analysed cases the Project NPV became negative. The lowest obtained value was US\$ 8 million for the combination of US\$ 1,200 per ounce gold, 10% discount rate and +20% increase on operating costs.

	Metal Prices		Operating Expenditure		Capital Expenditure		NPV (post tax)	NPV (post tax)	IRR (post tax)
							@ 10%	@ 5%	
	USD / oz (gold)	USD / lb (copper)	USD per tonne ROM	USD per oz (gold equivalent) (*)	Initial USD(m)	Sustaining USD(m)	USD(m)	USD(m)	
	1,600	3.5	149.4	756.8	17.8	26.4	56.8	75.6	94%
	1,400	3.0	149.4	738.5	17.8	26.4	38.2	52.0	68%
	1,200	2.5	149.4	720.3	17.8	26.4	19.6	28.4	42%
Sensitivity to Opex									
20%	1,600	3.5	179.3	866.6	17.8	26.4	45.4	61.3	79%
20%	1,400	3.0	179.3	848.3	17.8	26.4	26.9	37.7	52%
20%	1,200	2.5	179.3	830.3	17.8	26.4	8.0	13.6	24%
-20%	1,600	3.5	119.5	647.1	17.8	26.4	68.1	90.0	109%
-20%	1,400	3.0	119.5	628.7	17.8	26.4	49.5	66.4	84%
-20%	1,200	2.5	119.5	610.4	17.8	26.4	31.0	42.8	58%
Sensitivity to Capex									
20%	1,600	3.5	149.4	756.8	21.3	31.7	51.1	69.1	74%
20%	1,400	3.0	149.4	738.5	21.3	31.7	32.5	45.5	52%
20%	1,200	2.5	149.4	720.3	21.3	31.7	13.9	21.8	29%
-20%	1,600	3.5	149.4	756.8	14.2	21.1	62.5	82.2	123%
-20%	1,400	3.0	149.4	738.5	14.2	21.1	43.9	58.6	92%
-20%	1,200	2.5	149.4	720.3	14.2	21.1	25.3	35.0	59%

(\*) Equivalent gold is calculated using the referred gold and copper prices, average metallurgical recovery of 90.7% for gold and 90.0% for copper.

## **23 ADJACENT PROPERTIES**

No data from adjacent properties were used for the definition of the mineral resources at the Palito area, nor included for the Preliminary Economic Assessment.

## **24 OTHER RELEVANT DATA**

There is no other relevant data and information pertaining to the estimation of the mineral resources and reserves, at the Palito mine.

## **25 INTERPRETATION AND CONCLUSIONS**

NCL has undertaken a study of the mine production schedule and plant feed schedule, based on the mining inventory, for a processing rate of 250 tonnes per day and a life of mine of 9 years, for an average annual production rate of 24,000 ounces of gold equivalent. Based on project assumptions preliminary financial model indicates robust project economics with a NPV of US\$ 38 million.

The pertinent observations and interpretations which have been developed in producing this report are detailed in the sections above.

It is not anticipated that there are any reasonable foreseeable risks or uncertainties on the potential viability of this project.

The PEA has been based only on the previously declared mineral resource estimates for the Palito gold mine and does not consider any additional resources that could be developed from the three discovery areas established in 2011 of Palito South, Currutela and Piaui.

## **26 RECOMMENDATIONS**

### **26.1 Drilling**

- Continue the current well balanced drilling strategy of targeted infill drilling to increase resource confidence and extensional resource definition drilling at known prospects to add additional mineral resources;
- Continue to develop a 'project scale' geological, structural and mineralization model to assist with identifying additional exploration targets;
- Continue to update relevant mineral resource estimates for all significant mineralized zones to reflect ongoing changes to mineral resource confidence and the overall Palito mineral resource base.

### **26.2 Mining**

- Continue mine engineering and planning studies to define and confirm the economic viability of the Project, and move towards development stage;
- Continue mining studies to refine the current mining model and identify the optimum tonnage throughput that yields the best compromise between profitability and practicality;
- Define grade-control requirements for selective mining underground scenario;
- Continue to develop a 'project scale' geological and structural model to support further geotechnical and mining studies;
- Develop geotechnical testwork and studies including drilling geotechnical holes parallel to the vein-strike in order to identify structures that may be parallel to exploration drilling;
- Additional laboratory tests on rock mass and structure surface properties are also recommended to further improve the database;
- Implement geotechnical logging and analysis of all exploration core;
- Benchmark similar mining operations to ensure that optimum design, cost and output are being achieved in the mining model.

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## APPENDIX A: Overall Plant Flowsheet

