7.0 LENZOLOTO

7.1 INTRODUCTION

7.1.1 Location

The Lenzoloto placer gold mining operations are located in the northern part of the Bodaybo administrative district, Irkutsk Region. The operations are widespread in the region and stretch from north of the town and district centre of Bodaybo to north and west of Kropotkin settlement, which is 125 km north of Bodaybo. Access is as described for Zapadnoe (see Section 5.1) and the locations and features of the area are shown in Figure 5.1.

The physiography and socio-economic aspects of the area are generally as for Zapadnoe (see Section 5.1). The operations are located in the river valleys and flood plains at elevations of 600 m to 850 m. Placer mining has been practiced in the area for nearly 150 years and consequently many of the valleys and the river systems have been severely degraded.

7.1.2 Overview

Gold placer mining has been practiced in the area for 150 years. Seven subsidiary companies are currently working at up to 60 of 120 licence areas, some of which are for exploration only. As well as being the majority shareholder of the subsidiary companies, with holdings between 61% and 84%, Lenzoloto holds the leases and provides operating, central purchasing and sales services.

The placers are exploited by truck and shovel and bulldozer operations, accounting for approximately 70% of gold produced, and by dredging, accounting for approximately 30%. In addition to working the primary placer deposits, Lenzoloto subsidiaries are also currently reworking the tailings from numerous previous phases of mining. In recent years, the number of subsidiaries has declined from eleven to seven and gold production has declined to 6.6 t in 2005 from a peak of 9.1 t in 2002.

7.2 MINERAL RESOURCES

7.2.1 Geology

The Lenzoloto alluvial gold deposits are found in the Lenskii gold field, situated on the northern flanks of the Baikal orogenic belt. Gold mining from placer deposits in the Lenskii region has been on going for 150 years. Many of the deposits are technogenic, meaning that the deposit has been subject to multiple previous phases of mining by a number of methods including dredging, open pitting and in some cases shallow underground mining. Some primary placer deposits remain in areas beneath thick permafrost which provided difficulties for the early mining methods.

The gold deposits are largely alluvial gold in river bed gravels and flood plain terraces. The alluvial deposits are formed in river channels within incised glacially eroded valleys. Many of the valleys form along fault dislocations and were formed during glaciation and erosion during the late Tertiary and Pleistocene. The valleys form the draining network for the region and hosted streams and rivers form as tributaries for the major Lena River to the north and west and the Vitim River to the south. Valleys containing mineral deposits are typically 300 m to 400 m deep and 1,000 m wide, however lake-alluvial valleys can be up to 2,000 m wide. The valleys are concave in profile, and the general thickness of sediments in valleys varies between 20 m and 300 m thick. The greatest sediment accumulations are also of lake-alluvial genesis.

The alluvial gold deposits are buried below a cover of between 10 m and 30 m of glacial till. The deposits are underlain by bedrock which can be either limestone or terrigenous rocks. Gold placer deposits were formed in alluvial gravels which accumulated due to the variable relief of the bedrocks as a result of the erosion.

Gold bearing alluvial gravels are typically between 2 m and 6 m thick, and can extend for a few thousand meters along the river channel. The composition of alluvial gravels is exceptionally diversified, containing a range of particles from fine shale to small till pebbles and boulders a few meters in diameter.

The distribution of the gold in the alluvial gravels is irregular and both plan and section. Gold grade of the gravels in technogenic deposits is typically low, between 200 mg/m^3 and 300 mg/m^3. The gold grade in the primary placer deposits is higher at 1 g/m^3 or more. Many deposits are small, originally containing pre-mining reserves of less that 500 kg of gold.

Gold is believed to have been derived from low-grade bedrock concentrations and occurs as flake gold, in typically large particles up to 0.25 mm. Gold nuggets have been found in the placer deposits up to several kilograms in size. Gold particles less than 200 µm in size are not evaluated since there are no methods in place to recover this fraction.

The fineness quality of the gold varies from 850 to 928, the balance of which is mostly silver. There is some variation in fineness in each deposit, but the purity is determined at exploration stage from laboratory samples, and the average is considered for planning.

7.2.2 Exploration

During the 1930's the TsNIGRI institute studied the geology of the placer deposits. Most of the deposits were thoroughly mapped in 1939 during a state funded exploration programme performed in the region in search of placer gold reserves. All river channels in the project area were explored on the prospect of finding economic grade deposits. Exploration was performed using percussion churn drills on lines spaced up to 200 m apart down stream with holes 50 m apart across the stream. The majority of deposits explored during this expedition have since been subject to many phases of mining. The original exploration data is available and plans exist for most deposits that show the year and style of mining. This information is used as a guide for exploration. After one phase of mining, the placer deposit is considered as a prognostic resource and should be drilled again.

To define mineral reserves of the alluvial deposits, surface drilling is performed on section lines spaced between 100 m and 400 m along the river channel. C_1 mineral reserves are normally drilled at 100 m to 200 m by 20 m. Based upon operating experience C_1 mineral reserves must be drilled on a grid of 100 m by 20 m to enable accurate and reliable estimation. Approximately 90% of all deposits are drilled to define C_1 mineral reserves. A drilling grid of 200 m to 400 m by 20 m is required to define C_2 mineral reserves. Exploration drilling is conducted two years in advance of mining operations.

Churn drills are used to drive 6 inch diameter holes for exploration and reserve definition. The sample is recovered by a bailer, which provides a very high rate of recovery. The entire borehole is sampled and assayed as a requirement for State approval of mineral reserves. The first metre of drilling in overburden is composited to form one sample and subsequent samples are collected every 0.5 m until the alluvial gravel is intersected. It is not unusual to find pockets of grade within the overburden cover. Within the alluvial gravels a sample is obtained every 0.2 m until bedrock. Normally holes are extended 1 m to 2 m into the bedrock to ensure that the entire mineralised zone is sampled.

7.2.3 Mineral Reserve Estimation

The minimum commercial grade for the definition of mineral reserves is estimated using conversion tables based upon the thickness of overburden and alluvial gravels. The river channel is separated into mineral reserve blocks using the 200 m drill spacing and a cut-off grade is calculated and applied to each block. A regional economic grade is determined for each pacer deposit and the economic zones are defined. Balance reserve grades are reported only as recoverable gold >200 μm.

Losses and dilution are factored into the direct cost of mining the alluvial gravels. Planned losses are 5% to 10%, based upon factual average losses. Irgiredmet has calculated losses figures based upon research on gravity recovery of gold and losses figures have been approved by the GKZ. Dilution is typically high at 20% to 30% since gold concentrations are normally interspersed with unmineralised alluvial gravels. Low-grade gravels are always processed to achieve the maximum recovery of gold.

Summary plans are prepared showing the mineral resource blocks. The plans are colour coded for the year and type of mining in the schedule. The locations of boreholes are shown on the plan along with information on the thickness and grade of the gravels and the depth of overburden.

The GKZ approved mineral reserves for Lenzoloto are presented in Table 7.1.

Table 7.1: Lenzoloto Mineral Reserves at 1st January 2006

Category	Balance Mineral Reserves			Off-Balance		
	Volume (k m^3)	Grade (g/m^3 Au)	Gold (kg)	Volume (k m^3)	Grade (g/m^3 Au)	Gold (kg)
A+B	10,263	0.4	4,270	21,870	0.1	3,097
C_1	86,326	0.6	53,405	83,476	0.1	11,622
C_2	11,374	1.1	12,297	17,821	0.2	3,862
$A+B+C_1+C_2$	107,963	0.6	69,972	123,167	0.2	18,581

7.2.4 Mineral Resource Statement

Mineral reserves of the Lenzoloto gold deposits were defined using various gold cut-off grades. Cut-off grades are calculated for each deposit utilising recoverable gold and considering the pay gravel and overburden thickness. Mineral reserves have been reclassified using the terms and following the guidelines of the JORC Code. Both the balance and off-balance C_1 category mineral reserves are considered to be equivalent of JORC Code Indicated mineral resources. Off-balance C_2 mineral reserves are considered to be Inferred mineral resources. Lenzoloto gold deposit mineral resources at 1st January 2006 are presented in Table 7.2.

Table 7.2: Lenzoloto Mineral Resources at 1st January 2006

Category	Volume (k m^3)	Grade (g/m^3 Au)	Gold (kg)
Measured	32,133	0.2	7,367
Indicated	169,802	0.4	65,027
Measured + Indicated	201,935	0.4	72,394
Inferred	29,195	0.6	16,159

7.3 MINING AND PROCESSING

7.3.1 Mine Design

The Lenzoloto subsidiaries employ various mining methods, including: dredging for bulk, low-grade technogenic deposits; dozing for the smaller, higher-grade primary deposits; and conventional open pit/dozing in permafrost. The choice of method is a function of the physical conditions, gravel grade and economics. In general, dredging is used for the bulk, low-grade technogenic resources.

The depth of the primary deposits varies across the region. Nearer to Bodaybo, where placer mining has taken place for more than a century, the deposits are at depths of between 20 m and 70 m. In the centre of the region the depth is between 10 m and 20 m.

The mining methods employed at the sites visited by Micon were observed to be appropriate for the conditions and attributes of the deposits. However, there are likely to be areas where efficiencies could be improved with potential for reducing costs.

7.3.2 Ore Reserves

Ore reserves for mining operations within the Lenzoloto group are presented in Table 7.3. Ore reserves are adjusted for anticipated mining dilution and ore losses. Average mining dilution has been estimated to be 30%. The average mining losses during exploitation are estimated to be 6.7%.

Table 7.3: Lenzoloto Ore Reserves at 1st January 2006

Category	Volume (k m^3)	Grade (g/m^3 Au)	Gold (kg)
Proven	12,453	0.3	3,986
Probable	104,750	0.5	49,848
Proven + Probable	117,203	0.5	53,834

7.3.3 Production

Lenzoloto production statistics for years 2001 to 2005 and planned production for 2006 are summarised in Table 7.4.

Table 7.4: Lenzoloto Production

	2001 Actual	2002 Actual	2003 Actual	2004 Actual	2005 Actual	2006 Plan
Development Waste (k m^3)	41,065	54,318	55,585	49,194	41,844	
Overburden Waste (k m^3)	27,790	33,475	33,701	32,681	31,707	
Total Waste (k m^3)	68,855	87,613	89,286	81,875	73,551	63,365
Total Gravel Washed (k m^3)	13,129	14,993	13,271	13,153	10,737	
Gold Produced by Dredge (kg)	1,699	2,109	1,970	1,846	1,733	
Gold Produced by Bulldozer (kg)	5,754	6,015	6,037	5,387	4,473	
Gold Produced by Other (kg)	609	945	1,020	429	372	
Total Gold Produced (kg)	8,062	9,068	9,027	7,663	6,578	6,210
Average Gravel Grade (g/m^3)	0.6	0.6	0.7	0.6	0.6	0.7
Stripping Ratio Overburden/Gravel	2.1	2.2	2.5	2.5	3.0	
Stripping Ratio Total Waste/Gravel	5.2	5.8	6.7	6.2	6.9	6.8

Total gold production has steadily declined from 9,068 kg in 2002 to 6,578 kg in 2005 and 6,210 kg planned for 2006. This reduction is associated with a similar decline in the volume of gravel washed rather than gravel grade. Actual gold production for 2006 to July was 1,543 kg, 24% of the plan for the year and less than the 32.9% for the equivalent period in 2005. Overburden and development waste volumes excavated have also declined, although there has been an increase in the overburden stripping ratio.

The declining production trends are exhibited by most of the subsidiaries. In 2005, two subsidiaries, JSC Svetly and JSC Lensib, accounted for 52% of the gold production with 31.3% and 20.7%, respectively. Four smaller subsidiaries accounted for 37.5% of gold production and three other subsidiaries the remaining 10.5%. The 2006 plan shows a similar distribution. Two subsidiaries ceased production in 2005 and a third is scheduled to cease in 2007.

The overall decline in production appears to have been due to a combination of the following factors: declining local resource availability; reduced profitability of some subsidiaries; and reduced equipment availability. The proportion of gold produced from bulldozer operations remained steady at 66% to 71%, so operation type does not appear to have been a factor.

Lenzoloto's forecast production schedule for 2007 to 2010 is summarised in Table 7.5.

Table 7.5: Lenzoloto Forecast Production

	2007	2008	2009	2010
Development Waste (k m^3)	37,060	39,810	37,965	33,595
Overburden Waste (k m^3)	35,155	37,760	40,560	37,740
Total Waste (k m^3)	72,215	77,570	78,525	71,335
Total Gravel Washed (k m^3)	9,695	10,635	11,455	12,030
Gold Produced by Dredge (kg)	1,440	1,440	1,410	1,920
Gold Produced by Bulldozer (kg)	4,770	5,030	5,390	5,450
Gold Produced by Other (kg)	240	230	200	130
Total Gold Produced (kg)	6,450	6,700	7,000	7,500
Average Gravel Grade (g/m^3)	0.7	0.6	0.6	0.6
Stripping Ratio Overburden/Gravel	3.6	3.6	3.5	3.1
Stripping Ratio Total Waste/Gravel	7.5	7.3	6.9	5.9

The decline in gold production since 2002 is projected to cease in 2007 and an increase in production is forecast thereafter. Again, this is related to a similar increase in gravel washed rather than grade, which in fact falls slightly from 2007. Overburden and development waste volumes excavated also increase from 2007 to 2009, and the overburden stripping ratio is initially higher, but it subsequently decreases.

Micon notes that Lenzoloto has not provided an implementation plan in support of its forecast to 2010 and that the forecast has not been approved by Polyus. Although the reserve presented in Table 7.3 indicates a surplus over the Lenzoloto production forecast, it consists primarily of low-grade technogenic deposits. In the absence of production and financial planning for this material beyond 2010, Micon has used the Lenzoloto forecast for its valuation.

7.3.4 Operations

Micon visited a number of operations of JSC Svetly, which has seventeen licence areas of which seven are currently producing. Three are dredging operations and four are bulldozer operations, including two open pits employing conventional blasting, shovel and truck methods for overburden removal. Svetly's operations are understood to be typical of the various mining methods employed by Lenzoloto's subsidiaries.

The three Russian dredges operate continuously for up to eight months per year. Commencing in March and ahead of dredging, the bulk of the overburden is removed and side-cast by dragline. The final overburden and gravel horizons are then dredged. The dredges are equipped with sluices for gold recovery.

Waste and overburden removal at the two open pits continues year-round and employs drilling and blasting of the frozen ground. However, the necessity for blasting is reduced during the summer. Russian electric shovels load the waste to a fleet of Belaz trucks for haulage to the dumps. Gravel is mined primarily by Russian bulldozers supplemented by some Komatsu bulldozers between June and October. Pay gravel is loaded by Russian excavators to Belaz trucks for haulage to the washing plants

The other bulldozer operations employ Russian draglines and excavators for removal of the overburden, which is side-cast, commencing in March. Gravel mining and washing takes place between June and October employing Russian and Komatsu bulldozers, which push the gravel to the sluices.

The gold bearing gravels from the bulldozer mining operations are washed using ten standard Russian scrubber, screen and sluice arrangements of various unit capacity and of various designs. The type of unit used depends on the gravel, gold size range and the type of operation.

Primary sluice concentrates from the dredge and bulldozer operations are collected daily and upgraded at centralised facilities using secondary sluices, shaking tables and hand finishing to a fineness of 770 to 950, depending on the deposit. Concentrates are transport to the refinery in Krasnoyarsk. Some primary sluice tailing washing is conducted by contractors using scavenger sluices.

Micon observed that much of the equipment utilised at the Svetly mining sites is old and probably requires early replacement. Analysis of equipment lists confirmed that this situation also applies to the other Lenzoloto subsidiaries. This is of concern at the forecast levels of earthmoving and gravel washing.

7.3.5 Outlook

As noted in Section 7.3.3, despite the reserve potential, Lenzoloto has only prepared a detailed five-year plan to 2010, which has not been approved by Polyus. Further study is required of the feasibility of mining additional reserves beyond 2010 and, in particular the capital investment required for equipment replacement.

7.4 INFRASTRUCTURE

7.4.1 Utilities

The operating sites are supplied by 35 kV and 6 kV lines from the VitimEnergo 110 kV grid; the typical site demand is 600 kW. Diesel generators are installed where necessary and for emergency supply in the event of a grid failure.

7.4.2 Services

Infrastructure at the subsidiaries' operating sites is by nature transitory and variable according to the type and location. Sufficient facilities are provided at the sites for workers' accommodation, equipment maintenance and fuel storage. The sites are serviced from the settlements in the area, such as Kroptkin and Marakan, where the subsidiaries' stores and workshops are based. Much of the major supply and equipment repair is conducted during winter when the operating sites are shut down.

Use is made of the LZRK subsidiaries Vitim Service and LenzolotoDortrans, located in Bodaybo, for purchasing, supply and transport services.

7.5 ENVIRONMENT, HEALTH AND SAFETY

7.5.1 Environmental Issues

7.5.1.1 Potential Impacts and Risks

The alluvial operations are of a design that is fundamentally the same as that adopted for many decades and the key issues associated with such operations are well documented, as follows:

- Whilst the operations are now managed in accordance with current regulatory requirements, management of surface waters (diversion of rivers, control of storm water run-off and management of abstractions and discharges) remain major challenges and the drainage system of the area is severely impacted by operations.
- Many of the areas currently operated by Lenzoloto are reworking sites that have been the focus of previous mining operations. These operations are invariably often faced with a severely degraded ecosystem before current working is started. Differentiating between the environmental impacts associated with the current operations and the long term impacts arising from historic operations is not always straightforward.
- Although the alluvial sediments are wet during working, dumps of waste (i.e. worked material) are often free draining and when dry can be prone to severe dusting.
- The licence conditions include a requirement for the eventual rehabilitation of the sites after cessation of operations and a recultivation project is to be submitted to the authorities two years before cessation of mining. Preliminary estimates of the work involved have been developed although, in practice, Lenzoloto has deferred almost all rehabilitation work pending a further evaluation of residual gold in the worked-out areas and an assessment of the feasibility of reworking these areas again.

  Whilst this policy is understandable in the short term, in the longer term the rehabilitation work will have to be initiated at some time. Micon also suspects that it will be extremely difficult to differentiate between areas disturbed by operations conducted under the terms of the current licence and areas within the same licence boundary that were worked historically.

As a consequence of the inherent nature of alluvial operations, combined with the extensive and ill-defined areas requiring rehabilitation, Micon considers the overall risk associated with environmental and social considerations at the alluvial operations to be high.

7.5.1.2 Management

Environmental management is the responsibility of the nine individual operating companies, most of which employ a Mine Ecologist who reports directly to the Chief Engineer and is responsible for the maintenance of all licences and permits, environmental controls, monitoring and supervision of environmental taxation payments.

Environmental management is designed solely to satisfy regulatory requirements and is reactive to requests from the regulatory authorities. The environmental control and monitoring programmes are developed on site and approved by the regulatory authorities; monitoring records are submitted to the authorities with little in-house interpretation primarily as the basis for calculating environmental taxes.

7.5.1.3 Compliance Status

Micon has not seen all of the operating licences, but a review of the licences for two of the larger operating sites indicates that:

- Separate licences are issued for bulldozer and dragline operations.
- The accompanying licence conditions are broadly comparable to those associated with licences for hard rock mining operations and include a general requirement to abide by regulatory requirements and a requirement to rehabilitate the sites after cessation of mining.

The original design for many of the alluvial operations pre-dates much of the current permitting requirements. Nevertheless, all operations are required to have licences and permits for water usage and discharges, waste management and air emissions based on technical projects completed in accordance with current standards. Micon confirmed that the two operating sites selected for detailed review have all the appropriate licences and permits in place.

Micon has reviewed these licences and permits, together with the corresponding monitoring data, and notes that monitoring data do not indicate any significant breaches of the conditions.

7.5.1.4 Financial Liabilities

No historic or planned costs associated with environmental management and monitoring for the combined alluvial operations were available for review. At the end of 2005, Polyus estimated that the total of closure and rehabilitation to current Russian standards (excluding redundancy payments) would be US$6.38 million. Micon considers this to be an underestimate. Micon recognises that the likely costs of closure and rehabilitation are difficult to estimate without a better definition of the areas involved; nevertheless, Micon would expect the total cost of closure and rehabilitation to exceed US$25 million.

7.5.2 Health and Safety

7.5.2.1 Management

Lenzoloto maintains a health and safety management system in accordance with current Russian practice and regulatory requirements. Lenzoloto maintains a basic programme for monitoring the working environment. This programme, which is approved by the regulatory authorities, includes monitoring of air quality and light, humidity, temperature and noise in enclosed working spaces.

7.5.2.2 Compliance Status

Accident statistics are available only from 2004, the year in which the current management assumed responsibility for the operation. The incidence of recordable accidents for all of the alluvial operations combined for 2004 and 2005 was 21 and 27, respectively, of which only one in each year was in the light category. However, there were no fatalities.

Micon considers that the low rate of recorded light accidents is low and probably reflects the practice whereby accident classification is initiated by qualified doctors and only a serious trauma is reported to medical personnel.

Monitoring records indicate that there have been no significant breaches of the statutory limits for potentially hazardous substances or noise.

Health monitoring of the workforce has identified some individuals as suffering from industrial diseases; fourteen such individuals were recorded in 2004 and twelve in 2005 (out of a total workforce of more than 5,000). No medical details of the nature of the disease are available, although no case was deemed serious enough to result in an inability to perform normal working.

The alluvial operations are operated according to current Russian good practice. Nevertheless, certain health and safety issues continue to require careful management. Although Lenzoloto has developed and implemented a health and safety management system, some weaknesses are all evident at the alluvial operations. Consequently, Micon considers that the risks associated with current standards of health and safety to be moderate.

7.5.2.3 Financial Liabilities

All costs associated with health and safety management are internalised in operating costs. Micon has identified no additional liabilities.

7.6 COSTS

7.6.1 Operating Costs

Lenzoloto actual unit operating costs per cubic metre of total volume mined and washed for 2003 to 2005 and plan for 2006 are summarised in Table 7.6.

The production and unit costs exclude four minor subsidiary operations, which ceased operating during the period 2003 to 2005 or are planned to cease in 2006. The general and administration cost includes refining, royalty and other taxes. The increase of 32.3% in unit cost per ounce between 2003 and 2005 compared to the increase of 11.6% in unit cost per cubic metre reflects the lower gravel grade.

Table 7.6: Lenzoloto Unit Operating Cost

Production/Cost Element	2003 Actual	2004 Actual	2005 Actual	2006 Plan
Production				
Waste Mined (k m^3)	68,028	64,462	66,568	63,365
Gravel Washed k (m^3)	10,737	10,825	10,125	9,290
Gold Produced (kg)	7,510	6,276	6,151	6,210
Unit Cost (US$/$m^3$ total volume mined and washed)				
Labour	0.37	0.38	0.39	0.45
Materials	0.25	0.26	0.28	0.21
Fuel	0.11	0.16	0.19	0.20
Power	0.06	0.06	0.07	0.08
Services	0.09	0.07	0.08	0.20
General and Administration	0.25	0.26	0.25	0.11
Total Unit Cost	1.12	1.19	1.25	1.25
Total Unit Cost (US$/oz gold produced)	366.44	444.65	484.94	456.55

The 2006 plan unit cost of US$1.25/$m^3$ does not reflect inflation of the order of 25%, as evidenced by Olympiada actual costs in the first quarter of 2006. The related 2006 plan decrease of 5.9% in unit cost per ounce reflects a reduced stripping ratio and higher gravel grade than 2005 actual. While the plan 2006 production is reasonable and some efficiency improvement could result from optimisation of the subsidiary operations, Micon suggests that the unit cost per cubic metre of total volume mined and washed should reflect some level of inflation. For its valuation, Micon has increased the unit cost by 12% to US$1.40/$m^3$. This would increase the unit cost per ounce to US$509.46/oz.

7.6.2 Capital Costs

The Lenzoloto capital cost forecast for 2006 is summarised in Table 7.7.

Table 7.7: Lenzoloto 2006 Forecast Capital Cost

Area	US$ million
Mine Equipment	4.30
Construction and Other	0.71
Exploration	2.49
Total	7.50

As noted in Section 7.3.4, much of the existing equipment fleet is in urgent need of replacement. Micon considers that the plan provision of US$4.3 million for equipment is inadequate for the immediate needs. For its valuation Micon has used total capital costs of US$11.1 million per year for 2006 and 2007, and US$7.4 million per year thereafter.

Lenzoloto has forecast the cost for closure and rehabilitation to be US$6.5 million. As noted in Section 7.5.1.4, Micon considers that this is inadequate and has used US$25 million for its model.