EXECUTIVE SUMMARY

INTRODUCTION

Montana Exploradora de Guatemala, S.A. (Montana) is a legally incorporated Guatemalan company dedicated to the exploration and mining of precious minerals in Guatemala and is the owner of Marlin Mine (the Mine). In September 2003 the Ministry of Environment and Natural Resources (MARN) approved the Social and Environmental Impact Assessment Study (EIA & S Study) of the Mine by Resolution No. 779-2003/CRMM/EM.

The mining license was granted by the Ministry of Energy and Mines (MEM) on September 27, 2003 by means of Record No. 3329. This license covers an extension of 20 square kilometres (km^2), of which the Mine has only impacted 2 km^2. The mining operation is primarily located in the hamlet San José Nueva Esperanza Municipality of San Miguel Ixtahuacan, Department of San Marcos. The mine has been in operation since 2005, when it commenced open pit and underground mining activities.

Gold and silver have been mined at the Marlin I Pit, using conventional open pit mining methods. Currently there are no more mineral reserves at the pit; therefore the technical closure of this facility needs to be implemented. Montana has developed a new proposal for the technical closure of this facility, based on new technologies and hydro-geological, hydrological, geotechnical, geochemical and environmental studies of the Area of Direct Influence (ADI) of the mine. This updated Closure Plan includes the objective to provide the best possible closure format, for the benefit of the communities and the environment, simultaneously avoiding and/or eliminating the disadvantages of the original 2003 Closure Plan.

Furthermore, this environmental study includes the technical closure of the mine dump which has to date been storing all debris or waste material originating mostly from excavations carried out at the Marlin pit and the underground mine. The updated dump technical closure plan described in this study differs from the 2003 EIA & S Study mainly with the use of filtered tailings to create an organized mixture with rock material. It is expected that this process will provide greater stability to the dump, a decrease in infiltration on this project and a reduction of 50% on the chemical fill.

Objectives

General

Develop an improved technical closure plan that complies with the highest standards of environmental recovery in the mining field for the benefit of the environment and the AID communities, based on physical, biotic and environmental component updated studies.

Specific

- Improve slope stability and ensure re-vegetation and adequate administration of runoffs at the dump site.
- Recover the affected area due to excavation at the Marlin pit through a backfill, re-contouring and re-vegetation process of the surface.
- Avoid the rock oxidation process in the west and north walls of the Marlin pit.
- As much as possible, recover the landscape in the affected areas.
- Implement development or conservation programs along the pit area, as part of the reclamation process.
- Avoid runoffs and/or landslides along the open slopes of the Marlin pit that may occur if it is left open due to hydric, seismic and eolic factors.
- Reduce potential accident risks that may occur if the pit is left open.

LOCATION

The mining operation and its facilities included in the Closure Plan are located in the Hamlet San José Nueva Esperanza, in the Municipality of San Miguel Ixtahuacán, Department of San Marcos, approximately 217 kilometres west of Guatemala City (Map 2.1).

Area of the Project

The Area of the Project (AP) is limited to the Marlin pit and dump areas. Map 2.2 shows the distribution of the facilities within the mine, including the Marlin pit and the dump. The following chart shows the area covered by each one of these sites.

Chart 2. 1. Area occupied by the closure facilities

Site	Area (m^2)
Dump	200,000
Marlin Pit	300,000
Total Area	500,000

Source: Montana Exploradora de Guatemala, S.A., 2011.

Area of Direct Influence

The Area of Direct Influence (ADI) of the Closure Plan is located in the Tzalá and Quivichil River Basins. The physiography is overlooked by mountains and slopes of moderate height with the presence of typical natural vegetation patches of Mountain Dry Forests that correspond to Sub-Tropical Low Montane Forest, according to the Holdridge System (De la Cruz 1982) or the Forest Mountain Biome (Villar 1986).

From a social and economic perspective AID includes the following communities: Salem, Siete Platos, El Salitre, San José Ixcaniche, San José Nueva Esperanza and Agel. Map 2.3 shows the Closure Plan AID.

DESCRIPTION OF THE TECHNICAL CLOSURE

The Closure Plan of the Marlin I Pit (the Pit) and the Dump Update arises as an initiative of Montana to improve the closure plan included in the approved EIA & S plan. This update is based on technical studies related to potential hydrological, hydro-geological, geochemical and geotechnical effects of the deposition of filtered tailings in the pit and dump, based on environmental and biotic quality studies of the AID of the mine and years of monitoring.

The Updated Closure Plan (the Plan) is based on the optimization of tailings handling of the leaching process (mineral processing plant), previously treated by INCO process to neutralize the cyanide. The leaching optimization includes thickening and filtering at the mine filtering plant (Photo 2.1). In this phase, the filtered liquid will be re-circulated to the process; the tailings will be transported to temporary storage piles via a conveyor belt.

Photo 2.1. Marlin Mine Filter Plant.

Photo: Everlife, S.A., 2011

For its use at the dump, the waste rock from the underground mine and the Cochís Pit will be mixed with the filtered tailings in a 3:1 proportion of waste rock and filtered tailings respectively. The placing of waste rock and filtered tailings mix will be completed in designated areas at the back of the dump, through cut and fill blockage methods. The piles of available material created for the blockage dumping will be flattened with a tractor and will be compacted by haul truck traffic. The use of tractors over the stacks of dump material will mix the material and will provide a surface suitable for traffic.

The last layer of the dump will be comprised by organic soil and will be revegetated using grains. It is anticipated that the mix of filtered tailings with waste material will provide enhancement to the stability of the dump slopes and will increase the impermeability of its surface, contributing to a reduction in the infiltration and thus create a greater drain of the runoffs.

Photo: Everlife, S.A., 2011

Photo 2.2. Dump of the Marlin Mine SE – NW view

In the case of the pit backfill, filtered tailings mixed with lime and/or cement will be used (during the initial stages of the backfill or when geotechnical conditions require it), in order to increase the carrying capacity of the tailings, as the dump trucks and other machinery will have to circumvent the filling. In accordance with the tests and trials, enough shear resistance may be obtained without drainage for light traffic by adding 1% to 3% of cement and/or lime. After the mixture is laid down, it is estimated that the minimum shear resistance will be of 100kPa. The mixture ratio will have to be increased in the areas of heavier traffic in order to reach greater a shear resistance without drainage of 250kPa, sufficient to allow heavy traffic circulation over the backfill.

The pit backfill will be carried out in a cut-and-fill sequence. This implies that a layer of approximately 250mm will be placed over an existing layer consecutively until it reaches the expected backfill level. As each layer placement progresses the material will be compacted using a conventional compactor. After the material is compacted it is expected to reach a density of 1.5 tons/m^3.

When the backfill and re-contouring of the Marlin Pit are finished, a layer of organic soil will be placed; this will be obtained from the deposit of this material inside the Mine. The pit reclamation has not been determined yet, however, some options that include agro-forestry projects, development projects and/or conservation projects may be considered.

Photo: Everlife, S.A., 2011

Photo 2. 3. Marlin Pit East West view.

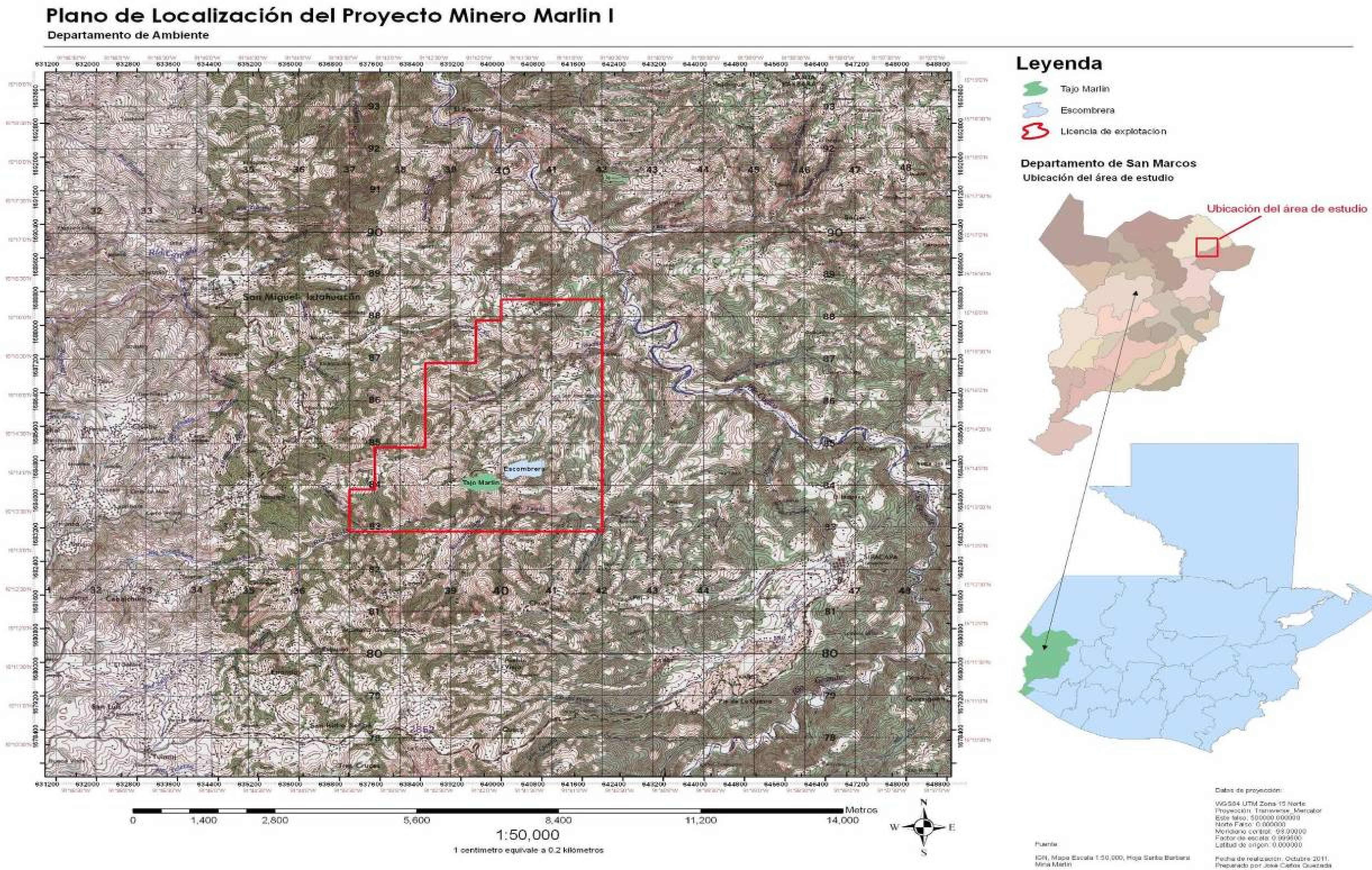
Comparison between the Original Closure Plan (EIA & S 2003) and Updated Closure Plan of the Dump and Marlin Pit

Chart 2.2 shows a comparison of the analysis of potential environmental, biotic and social impacts that could be caused by the Closure Plan included in the de EIA & S Study (Marlin Mine, 2003) and the updated Closure Plan.

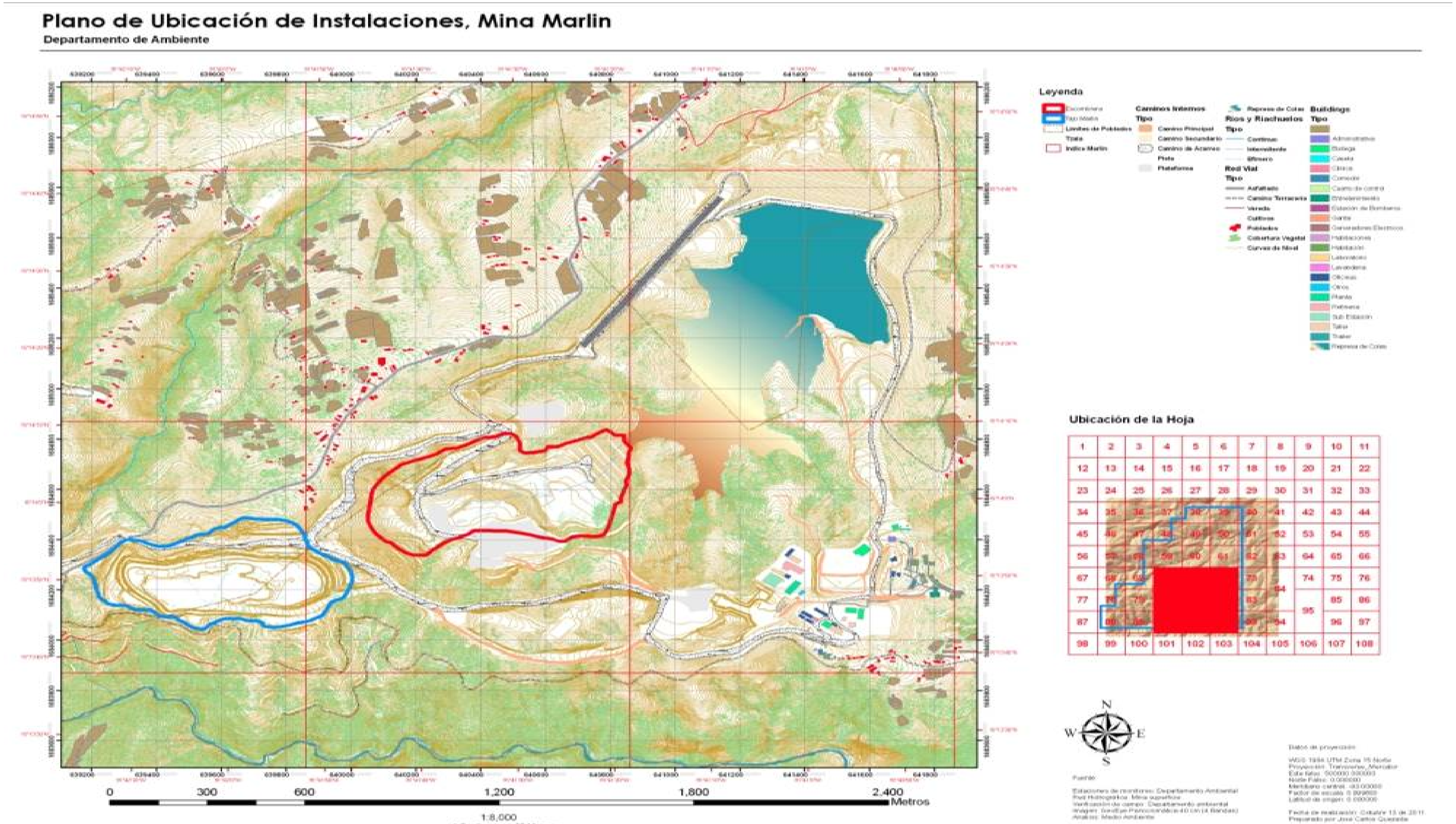
Chart 2. 2. Comparison of potential impacts between the 2003 EIA & S Study Closure Plan and the updated Closure Plan

Component	Original Closure Plan	Marlin Pit Closure Plan Update
Social	The impact consists of a mild recovery of the landscape. The area is left without productive use.	Positive impact on soil recovery for protection and/or production, as well as landscape recovery and accident risk mitigation as the pit is backfilled.
Risk of landslides and /or collapsing ground.	There will always be a risk of landslides because the walls are left exposed.	Backfilling and re-vegetation eliminates landslide risks since there are no exposed or steep slopes.
Landscape	Recovery of the landscape is reduced to re-vegetation where possible.	The landscape is significantly recovered according to the setting with the pit backfill, surface re-contouring and re-vegetation.
Groundwater	Water will always have to be removed during the rainy season to avoid infiltration. The pit walls with APG (acid generator potential) are left exposed; risk of acid drainage.	The infiltration is reduced with the pit backfill and surface re-contouring, natural runoffs and the addition to lime and cement to the filtered tailings. The pit walls are covered with APG preventing the acid drainage by eliminating or minimizing contact with air or water.
Surface water	Gutters have to be built to divert water running towards the pit. These gutters will exist during the useful life of the pit.	Rain water will run normally minimizing soil displacement once the pit closure and re-vegetation are finished.
Soil	There is no greater recovery of soil since the pit remains open.	Large extensions of land will be recovered through backfilling, adding a soil layer and re-vegetating. This land may be used for development and/or conservation programs.
Flora	The pit slopes and material don't allow the re-vegetation of large areas.	Large extensions of land will be recovered and re-vegetated with native species.
Fauna	Greater return of fauna is not expected for lack of re-vegetated areas due to the topography.	It is anticipated that the pit backfill and re-vegetation will create habitats for the return of fauna.
Pit reclamation	Was not considered.	Its soils can be used for productive, agro-forestry or conservation uses.

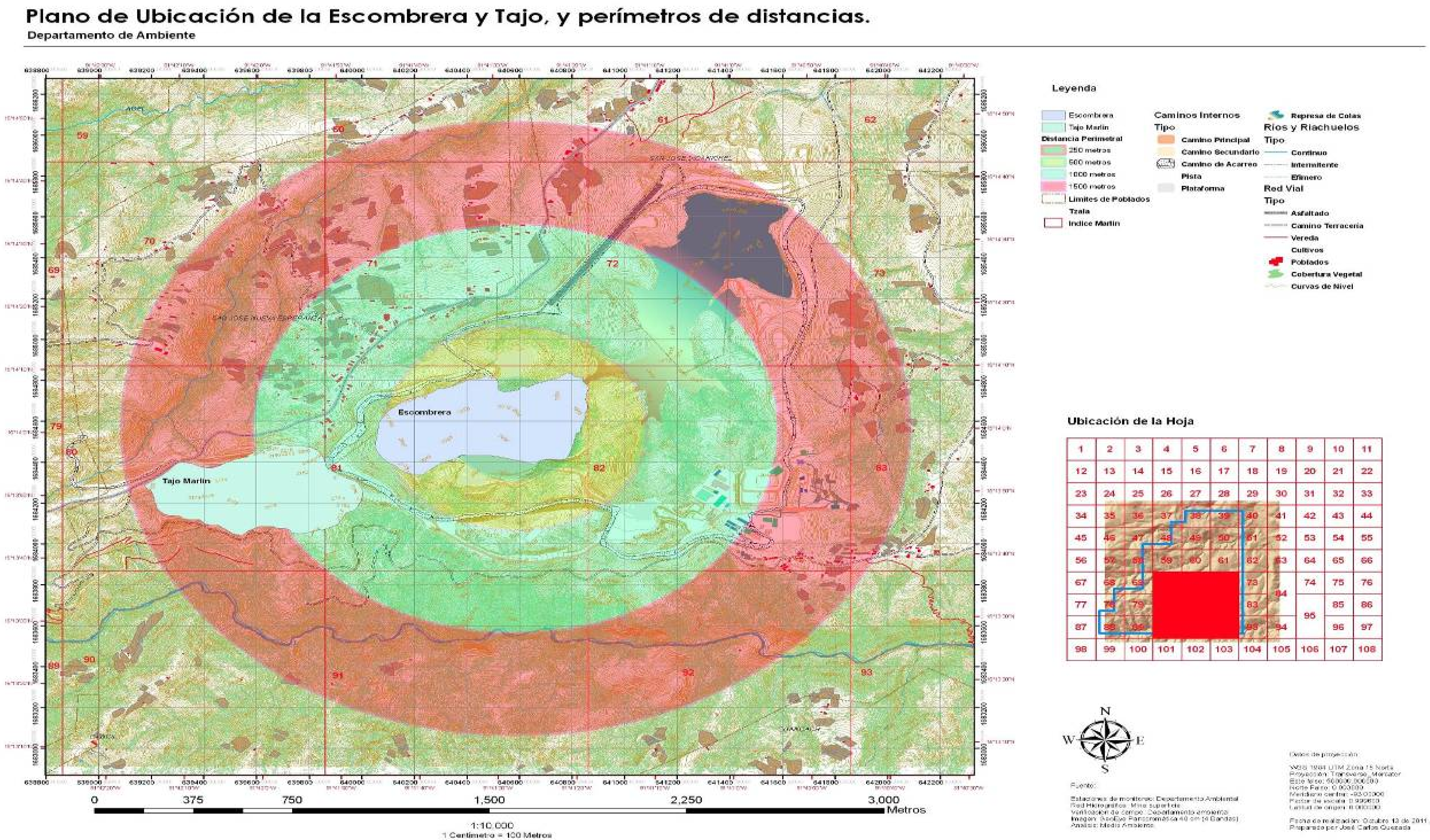
Map 2. 1 Marlin Mine Project Location.



Map 2. 2 Marlin Mine Project Facilities Location.



Map 2. 3 Marlin Mine Project Map Area and Direct Area of Influence of Marlin Dump and Pit Closure Area



ENVIRONMENTAL CHARACTERISTICS OF THE DIRECT INFLUENCE AREA

With regards to climactic aspects, the weather station located at the mine facilities shows an annual average rainfall of 1,136 mm, with minimal monthly rainfall from November to March and maximum rainfall registered in June and September.

The average annual temperature registered at the INSIVUMEH Huehuetenango weather station, which is the closest station with available data shows 18.8°C, with a monthly maximum of 20.2°C in September and a minimum of 15.9°C in December and January. At the station the maximum absolute temperature registered is 34.4°C and the absolute minimum is -5.5°C, therefore this area has extreme temperature variations, although the average has an annual difference of less than 5°C.

The average relative humidity of the Huehuetenango is 66.9%, with a monthly maximum of 75.9% in September and a minimum of 53.4% in March. In general the area has low relative humidity, characteristic of the highlands of the country.

The mine weather station has reported evaporation data that based on the area and the formula generally accepted is multiplied by 0.8 to determine the evapo-transpiration (ET), which shows an annual data of 1,111.3 mm, with a minimum of 53 mm in December and a maximum of 149 mm in March.

From a geological point of view, the Marlin pit and dump area have three formations identified as main units:

- The Volcanoclastic Sequence: has the largest geographic extension and rock volume, belonging to the sedimentary rocks.
- The Marlin Andesite consists of lava and agglomerates, it belong to the group of igneous rocks.
- The Breccia Fault consists of fragmented material in the fault areas and, is considered the third relevant unit.

With regards to the geologic structure of the area, the Marlin Fault runs parallel to the Motagua Fault System, its secondary faults running East - NE, and a fault was identified in Agel. Some diaclases running East-NE were also identified.

In the geotechnical aspect SRK (2003), classified the rocks in the area within five categories based on its geotechnical characteristics:

Weathered Andesite: Includes most of the near-surface material to depths of 50 meters or more. In general this rock shows poor geotechnical conditions due to weathering and high fracturing density.

Fresh Andesite (without weathering evidence): Mainly found to the South of the Project, between Don Tello and Marlin Faults. According to geotechnical characterizations these rocks are classified from fair to good, with variations due to its fracturing density. Most fractures are flat, with iron sheen and covered with clay (less than 1 mm).

Mineralized zone: This category includes altered rocks associated to the vein and fault systems. This shows it has a poor to fair geotechnical quality.

Badly fractured rock: This Group includes badly broken or fractured rocks associated with tectonic breccias that are south slanting and some faults with near vertical sloping. Therefore this rock is geotechnically classified as very poor.

Volcaniclastics: This category includes Tertiary volcaniclastic rocks which underlie the Marlin Complex. These show similar characteristics to fresh andesite. This rock is weak to strong, depending on its fracture density, which is mostly flat, shrivelled, with iron oxide and clay sheens.

As a consequence of the Marlin pit open cut operation; this physical appearance has undergone most of the changes. The original moderate slope of the hillside has changed giving way to a pit or depression with at least 8 berms with a 45° average slope and 10 to 20 metres in height covering an area of about 300,000 m^2.

With regards to hydrological factors, the soil infiltration capacity around the Marlin area is 10^{-5} cm/s, which are considered very low. This is especially due to Marlin typical characteristics which are: high clay content in the soil texture, steep slope, and moderate vegetation cover and under the thin soil layer (20 cm average thickness) the rock shows an average infiltration rate of 10^{-6} cm/s.

Based on water balance data for each type of soil, most of the water infiltrating into the soil remains available (between 98-100%) on the surface layer for plant roots and a portion converts into evapo-transpiration. Therefore, only a low percentage (0-2%) recharges to groundwater (vertical recharge).

Based on the Marlin Mine water balance, of the total rainfall there is 17% surface retention, 32% surface infiltration, 0.5% underground infiltration and 51% runoff.

The regional water recharge comes mainly from the south-southwest of Marlin; which is the high basin of the Cuilco River and southeast headwater of the Chicomuselo-Cuilco/Selegua cross border aquifer.

With regards to the hydro-geological aspect, the flow of groundwater at Marlin is mainly due northeast. This means that it heads towards the Cuilco River which belongs to the Gulf of Mexico watershed. The deepest groundwater level is between 100 and 300 meters below ground level. The underground system is fractured or cracked and with a high degree of sealing, largely hindering continuous and uniform flow of water.

Geochemical analyses show the presence of a rock mix with Acid Generation Potential (AGP) and no-AGP is exposed on the Marlin pit surface. Samples picked during mining exploitation have indicated sulphur and carbonates measured in a geologic block model. Results indicate that AGP material is approximately 30% of the pit surface.

Column tests show that the APG waste rock in contact with the water generates a low pH and high CE values; similar to mineralized groundwater with predominance of calcium and sulphate and smaller amounts of bicarbonate and metals.

The mix of the open pit waters could have slightly higher CE levels and predominance of sulphate in higher quantities than in mineralized groundwater. After the mine closure, the APG rock outcrops could develop more acidic conditions, with runoffs more similar to the water in contact with APG waste rock.

IDENTIFIED POTENTIAL IMPACTS

Air quality

An increase in sound levels at a point and plot scale is expected due to the Marlin pit and dump closure activities. The main sources of noise generation are: Tailings haulage to the temporary storage of filtered and mixed tailings, Marlin floor cleaning and levelling, pit backfilling and dump configuration, closure layer placement and pit backfill levelling and configuration. It is also expected that machinery and light vehicle traffic will contribute to a certain degree to this potential impact.

Other potential impacts were identified from these activities, like the increase in suspended particles and gas emissions, the latter directly related to vehicle and heavy machinery operation.

Based on the analysis of these potential impacts, they are considered to be temporary, specific and of low magnitude. Therefore, the potential impacts described above have been graded with a low Environmental Impact Value (EIV).

Edaphic Component

A series of variables regarding the edaphic component that could be affected by the Marlin pit and dump closure were analyzed. These variables include slope stability, recovery of geomorphology and changes in land use.

The impact on slope stability is considered to be positive and a high average VIA. This assessment is based on the fact that the current pit closure proposal includes its backfill, which will eliminate open slopes, preventing future instability as well as eliminating the necessity of future intervention. In comparison, the pit closure proposal included in the approved EIA of the Marlin Mine, has a very positive improvement with regards to the pit walls' stability.

Regarding the geomorphology, the updated pit closure proposal is considered more important if compared with the initial closure proposal, which set out to leave the pit open. The two activities that will impact the most in the pit geomorphology recovery are its backfill and re-contouring and the levelling of the north wall. The average VIA of the activities of the Marlin pit and dump closure has been assessed as high.

It is expected that during the backfill and configuration phase, mitigation measures will have to be implemented in regards to the erosion process which could be caused by the Marlin pit and dump closure activities. Both structures will have gutters built to direct the runoffs to the tailings pond as it is currently done. The potential impact has been assessed as low considering the needed mitigation measures will continue to be implemented until it is determined that the runoff may continue to flow towards the natural surface drainage without eroding the recovered areas.

It is expected that the pit and dump closure plan will have a positive impact on the current use of the soil, especially in the case of the Marlin pit. Agro-forestry proposals focused on community development are among the proposals for the final pit reclamation. Therefore, the recovery of soils for productive use has been assessed as an environmental impact with social incidence with positive effect and a high VIA.

Surface Water Impacts

Potential impacts on surface waters are related to the erosion process of soils and sediment dragging. Surface water contamination due to acid drainage has also been considered in this environmental report. These are the current conditions of the pit after 7 years of mining; its main impacts described as sediments, waters with possible acid drainage and erosion products are combined at the centre and lower part of the pit.

These impacts will be mostly mitigated as a consequence of the pit backfill that as a final product will consist of a low slope surface, re-vegetated with adequate drainage works and conditions similar to the original topography. The backfill will completely cover the surface with exposed sulphurs avoiding the creation of acid drainage. The erosion of the new soil will be minimal due to compacting and vegetation, therefore it is expected that the sediment dragging index will be similar to the natural conditions of the area.

The only change regarding the waste dump is that it will include a mixture of filtered tailings and waste rock, which to a certain extent will increase the impermeability of the area allowing increased runoff which will be channelled through drainage works considered initially.

In general, the impacts on surface waters of the project are positive and with a high VIA assessment.

Groundwater Impacts

Based on studies carried out, the current situation of the pit shows that at least 50% of water collected inside the pit is infiltrated into the subsoil and the other 50% is pumped to the tailings pond. The pit backfill will cover the AGP rock areas, additionally, the backfill chemical composition which will include a small percentage of lime and/or cement mixed with filtered tailings, will change the pH of the infiltrated waters towards more basic conditions, inhibiting their acidity and avoiding the generation of acid drainage potential.

In addition to the benefit in its chemical composition, the cement mix will increase the impermeability of the backfill; reducing the infiltration rate into the subsoil and aquifer of the area preventing oxidation of infiltrated water with rock from the old pit walls.

As a result of mixing the filtered tailings with cement, there will be a 97% infiltration reduction in the pit area, from 820 m^3/day to 5 m^3/day, improving the quality of the small amount of unfiltered water because of the backfill chemical composition alkalinity and covering of pit rock outcrops with sulphur.

As previously mentioned the pit will have similar dimensions and handling as in the original EIA. The only change for this project will be the addition of filtered tailings mixed with waste rock in a 3:1 proportion of rocks and filtered tailings. This will assist the dump by decreasing the permeability of this structure as well as the infiltration volume of rainwater into the subsoil.

In general, the impacts on the Project groundwater are positive and have a high VIA assessment.

Flora and Fauna Impacts

Flora

There will be a positive impact on the flora as a large area of soils some 300,000 m^2 will be recovered at the pit and 200,000 m^2 at the dump. Part of the closure activities include the re-vegetation of these two structures using grain species. This activity will promote restoration of the vegetal structure and configuration that will hopefully increase over time and will mean a reduction of the edge effect.

The recovery of this natural area is expected to generate sources of food and refuge for much wildlife. Likewise the regeneration of the vegetation will provide stability to the hillsides and slopes, avoiding landslides and erosive effects.

The activities that will be implemented with the updated Marlin pit and dump closure plan mean that the habitat will be partially recovered. The average VIA due to the implementation of activities for wildlife habitat recovery is high.

Fauna

The backfilling process will have a positive effect. This is mainly due to an increase in wildlife habitat area around the mine. This process will be somewhat slow because as time passes we will be able to see the development of an adequate habitat that fulfills the ideal conditions to sustain stable local wildlife population. Depending on the group being evaluated, the restoration will allow the creation of new refuge areas, feeding and mating areas. Other potential impacts are the reduction of the edge effect due to the interconnectivity that will be established with the vegetal layer to the nearby forested remnants.

Social and Cultural Impacts

Landscape Impacts

One of the most positive impacts is the landscape recovery, caused by backfill, configuration and revegetation of the Marlin pit. The best method to represent the effect of the pit closure is presented by a mock up prepared as a tool for a public participation process (Photos 2.4 and 2.5). These photos illustrate the current state of the pit and its projection at the conclusion of the closure and reclamation activities.

	
Photo 2. 4. Marlin Pit current state.	Photo 2. 5. Marlin pit projection in its Post-Closure phase.

A positive high-level impact is expected regarding the dump because this structure will have a geoform that will mitigate the visual impact caused by the depression where it is being built and the re-vegetation of grains will also provide a better landscape appearance of the affected area. Photo 2.6 shows a view of the dump from an angle where the hillsides have already recovered and re-vegetation can be seen.

	Photo 2. 6. View of the dump.

The average VIA assessed from the implementation of these activities is high.

CORRECTIVE OR MITIGATION ACTIONS

Corrective or mitigation actions have been proposed in several areas. However, due to the nature of the project, it should be considered that the majority of impacts are positive and therefore, the required mitigation actions are reduced to and based on Good Environmental Practices. Following is a list of proposed mitigation actions:

- Vehicles and heavy machinery involved in Marlin Mine closure activities will follow transit policies of the Mine i.e. speed limits and rules of conduct.
- Avoid overloading trucks beyond their capacity.
- Carry out water spraying on local roads to minimize dust; reduce mounds of materials and surfaces exposed to eolic erosion (wind).

- Supply personnel working in areas with higher dust generation with masks.
- Continue with periodic maintenance programs for all vehicles and machinery. This prevents the increase in sound volumes and limits gas emission levels.
- Re-vegetation in the areas to be recovered with species that will easily adapt to the local ecological conditions.
- Implement the use of erosion barriers when necessary to avoid sediment entrainment towards the Tzalá River.
- Protect as much as possible the slopes, re-vegetate and replant around the Marlin pit, especially along the road to Agel in order to reduce the visual impact.

CLOSURE ADMINISTRATION PLAN

Tailings Optimization

The tailings optimization process consists of thickening and filtering the tailings at the pressing plant, after completion of the cyanide neutralization through the INCO process. The filtered solutions will be recycled in the processing plant through a pumping process and the filtered tailings will be transported through a conveyor belt into a temporary storage site.

The filtered tailings have a density of around 1,4 t/m^3. The process of mixing filtered tailings with cement and/or lime to increase the physical resistance of the material will be carried out. This mixture will only be used at the beginning of the pit backfill and selectively as the process progresses so that there is always a suitable surface for truck and heavy machinery transit.

Dump Closure

The dump backfill will be done with a mixture of waste rock and filtered tailings in a 3:1 proportion. The inclusion of filtered tailings as part of the dump backfill is the main change included in the updated Closure Plan, in contrast with the original Marlin Mine Closure Plan included in the Environmental and Social Impact Assessment Study (EIA & S Study).

Based on filtered tailing trials and tests carried out, it has been determined that their low permeability will add to the stability of the structure through a better surface drainage system. With this purpose in mind, a surface layer of filtered tailings mixed with cement will be carried out, and subsequently a layer of oxide material and finally an organic soil layer will be placed on top.

The filtered tailings haul from the storage site to the dump will be done with articulated Caterpillar 730 trucks. The waste rock hauling will be completed with 777 Dump or Articulated trucks, making the necessary adjustments to attain the mix ratio previously mentioned.

The filtered tailings will be placed around the waste rock piles in order to facilitate the mix and the layering with the use of a tractor. The piles of material deposited will be flattened with a tractor and compacted with passing trucks and the use of compacting machinery to obtain the designed density.

The slope of the dump hillsides will be prepared with an inclination of 2.5:1 to promote the drainage of the runoffs and to make re-vegetation possible. It has been determined that this inclination represents an adequate angle of repose for the accumulated material.

Constant mix ratio tests and adjustments to keep vehicle transit flowing will be carried out. The topsoil of the dump will be configured to provide a suitable surface to control the water from runoffs before the permanent sealing layer is put in place.

The runoffs will be captured by the current concrete gutter located to the north side of the dump. A by-pass channel that will pass through the underground mine manoeuvring yard will be built and will connect with the current by-pass channel. The technical closure includes improving the hillside stability and securing the re-vegetation and runoff administration at the dump.

Marlin pit Closure

The Marlin pit backfill process will start by levelling and cleaning the floor and walls in order to remove any loose material. The pit walls will be cleaned gradually as the backfill of this structure progresses. The material product of this cleanup will be hauled to the filtered tailing mix site to be stored at the dump.

The first phase of the backfill will be carried out with a mix of filtered tailings and 2% cement. The trials and tests with this material have confirmed that the mixture with the aforementioned cement percentage significantly enhances the load bearing capacity of the tailings and reduces its permeability at a ratio of 10^{-7} cm/s. The backfill in this phase will reach 2,070 meters above sea level (masl).

The next backfill phase reaches an elevation of 2,100 masl and will consist of mainly filtered tailings. The next step entails the backfilling of the pit to an elevation of 2,140 where the four pit walls will be almost completely covered. From this elevation the backfilling will start towards the north wall of the pit with a slope of 2.5:1 and up to an elevation of 2,170 meters.

Finally at an elevation of 2,170, the backfilling will continue up to the highest point of the north wall until it reaches an elevation of 2,230 masl.

It is important to note that the Marlin Pit and Dump Closure is a work of engineering with constant supervision of geotechnical conditions of the backfill, the slope angle and the properties of the filtered tailings. Trials and tests for filtered tailing placement and compacting will be carried out with different cement and lime additives, evaluating the lift thickness and its capacity to withstand traffic of the material being placed.

A drain to collect runoff water accumulated inside the pit will be built from the onset of the backfill activities. For this, the backfill surface will have a 2% slope towards this structure. The drain will have a hydraulic pump to pump the water to the tailings pond. This drain will be readjusted as the backfill level progresses, so water will always flow in that direction.

The Marlin pit closure includes placement of coverage and vegetation material on top of the backfill area and setting up a surface water administration system. Finally, it includes reclamation of the Marlin pit aimed at developing conservation or development programs among others.

The runoff administration will change after the Marlin pit surface re-vegetation process is finished. From that moment on, the runoff will flow towards the natural Tzalá River basin drainage through the drain that will be built on the south side of the backfill. This structure will have a "V" shape with a depth of 30 meters and a width at its base of 10 meters. The drain walls will be covered from its base up to 2 meters high with a cement breakwater, as runoff velocity dissipater.

Hydro-geologic, geochemical and geotechnical evaluations were carried out to determine the Marlin pit backfill and closure processes. The hydrologic model developed shows that the behaviour of the filtered tailings during and immediately alter backfilling the pit will contribute in a limited way to the groundwater behaviour under the pit. The hydric balance of groundwater flow currently evaluated shows that groundwater flows naturally to the south and discharges to the Tzalá River. Currently, part of the aquifer drains to the underground mine whose lower levels are below the Tzalá River level.

The current slopes will be eliminated after the open pit is backfilled, leaving only the hillsides with a slope of 2.5:1 as part of the north wall backfill.

The soil stability in the backfill is guaranteed by engineering studies and backfill method. Filtered tailing lots with greater quantity of additives (cement and lime) will be used in areas with heavier traffic (access ramps) to compensate traffic frequency and weight of loaded trucks.

In addition to ensuring physical stability, the Marlin pit backfill will also achieve geochemical stabilization of the Acid Generating Potential walls (AGP), as backfilling in areas containing sulphur residue in the west and north walls of the pit will have priority from the commencement of the closure. Reducing the infiltration rate prevents pyrite mineral oxidation in the waste rock. The quality of water infiltrating through the pit to the groundwater will improve due to the alkalinity contained in the cemented tailings. It is expected that the effects of better water quality and less infiltration flow rate may reduce the chemical charge infiltrating from the pit at a rate of more than 95%.

POST CLOSURE ACTIVITIES

The filtered tailings disposal is part of an integral plan which programs the extraction of the mineral together with the mine's final closure. Therefore, when the backfills are completed, the filtered tailings will be disposed of in the tailings pond, that will mark the end of conventional tailings in this pond.

The runoff will be led through water diversion channels to their natural micro-basins. The dump runoff will be channelled towards the tailings pond and then to Quebrada Seca, and the pit runoff will be channelled towards the Tzala micro-basin.