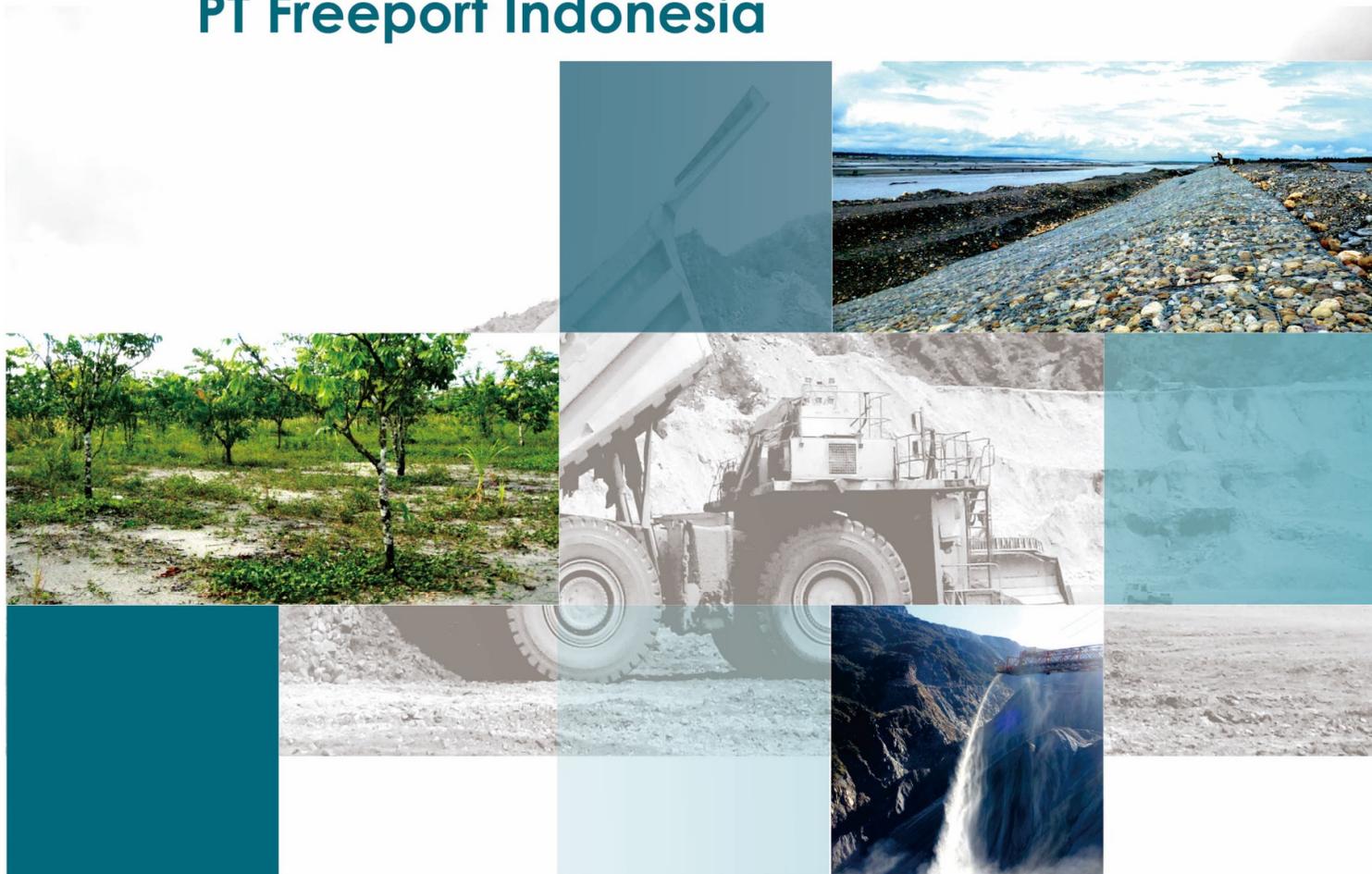


# 2014 EXTERNAL ENVIRONMENTAL AUDIT

Audit Report : August 2014

Prepared for  
**PT Freeport Indonesia**



# **2014 EXTERNAL ENVIRONMENTAL AUDIT FINAL AUDIT REPORT**

Prepared for

**PT FREEPORT INDONESIA**



**2014**

## **EXECUTIVE SUMMARY**

As described in PTFI's integrated environmental impact assessment (better known as 300K AMDAL), which was approved in 1997 by the Minister of the Environment, external audits of environmental management are a voluntary commitment by PTFI, in addition to a wide range of other duties such as management and monitoring of impacts that have to be implemented. The voluntary external environment audit is scheduled to take place once every three years.

In 2014, the seventh external environmental audit of PTFI which was carried out by PT LAPI ITB, with the primary purpose of evaluating PTFI's compliance with the national environmental law, environmental related government regulations and environmental standards. The audit also considered the adequacy of PTFI's environmental management strategies to achieve best and feasible environmental management practices and the effectiveness of PTFI's environmental management system in the actual implementation toward continuous improvement.

Since the last external audit in 2011 there were events that have had implications for environmental management. The first event was a labour dispute beginning in the second half of 2011. Almost all operations related to mining, processing and reclamation were stopped intermittently for approximately 6 months. A significant impact of the cessation of operations was related to the management of the overburden in Lower Wanagon, where large scale erosion due to scouring occurred and significant amount of material flowed into the downstream area to the Modified Ajkwa Deposition Area (ModADA). The second event was a fatality incident involving a collapse of ground at Big Gossan on May 14, 2013. During the incident review process by the government, underground operations were totally stopped for 37 days, which caused difficulties in controlling the safety and environmental aspects in underground mines.

PTFI's plan for decommissioning of Grasberg open pit in approximately 2016 and the transition to underground mines as the sole source of ore was an important consideration in this audit. During this transitional period, the current mine plan shows a decrease in daily ore production to 150 kton/day with re-handle of an ore stockpile and increasing gradually to planned production levels of 240k beginning in 2020 and onwards. An additional consideration is the potential for reduction of production due to the recently introduced progressive export tariff for copper concentrate

The audit focused on seven (7) strategic environmental issues which were defined and selected based on known interest and perception of stakeholders, including the national

government, the provincial government, district governments, and the community (including local communities). The issues are:

- i. Tailings management
- ii. Overburden/Waste rock management
- iii. Solid and B3 Waste management
- iv. Water quality and quantity
- v. Air quality
- vi. Reclamation & Mine Closure
- vii. Biodiversity

This external environmental audit did not address social, economic nor cultural issues.

The analysis on legal performance of PTFI environmental management concluded that PTFI has fulfilled the requirements and its obligation outlined in the various government regulations, Ministry of Environment decrees, as well as letters from the Governor of Papua and Regent of Mimika.

### **Tailings Management**

Regarding the issue of compliance with the tailings deposition requirements as provided in the Decree of Minister of Environment No. 431 of 2008, monitoring activities at two monitoring points, namely Kelapa Lima and Pandan Lima, were stopped in March 2013 following notification of regulators as both points were no longer representing the outflow of ModADA. Additional channels exiting the ModADA have developed in the area between the two points. PTFI should study the best location for monitoring points in the downstream area of ModADA to replace Kelapa Lima and Pandan Lima. These points will serve to monitor the retention performance in the terrestrial part of the ModADA. Since Decree of the Minister of Environment (MoE) No. 431 of 2008 is in the progress of review by MoE, data on retention performance will be important to understand the tailings sedimentation regime. Alternatively, if direct measurements downstream are not feasible, another technically defensible mechanism to estimate retention should be developed and implemented.

Tailings retention in ModADA is reported in RKL-RPL monitoring reports using total suspended solids data from monitoring station S130 at the Otomona Bridge that represents the inlet of ModADA and Kelapa Lima/Pandan Lima, which represent the outflow from ModADA. But since the measurement at Pandan Lima and Kelapa Lima could not be conducted and with several outflow channels from ModADA, this method for retention calculation is no longer valid although such calculation results were still included in the RKL-RPL reports. It is recommended to apply different methods to calculate the tailings retention in ModADA. Beside the calculation based on the sediment load balance from outflows and inflow, other methods are in place using

LIDAR measurement data and the change in transect profiles which are regularly measured.

The primary issue for tailings management remains maintaining proper levee freeboard in the ModADA, that is created under controlled loading conditions. Recognizing recent security challenges on the East Levee, PTFI staff must remain highly diligent in regularly measuring, monitoring and maintaining adequate freeboard at all times on both the West and East Levees. Failure to do so can result in significant environmental implications and impacts.

The southern end of the New West Levee is now being extended beyond the Pandan Lima compliance point which is now inundated and no longer considered a representative monitoring point. Total planned west levee extension will be 8.4 km and during the site inspection a 1.4 km long section had been constructed. This levee will further control the sedimentation in the determined deposition area and protect the western area (including port site) from sediment deposition. General levee construction appeared to be satisfactory, with limited seepage at the intersection of the levee embankment and the buttress toe on the downstream side and no visual appearance of tensional or settlement features suggesting that there are no stability issues. A breach at the southern end of the East Levee occurred on November 24, 2013, resulting in the release of tailings outside of containment area. Root cause analysis determined that the primary driver was a combination of slightly exceeding the rise rate of embankment construction and inadequate freeboard largely driven by security issues on the East Levee which has made construction and monitoring problematic.

### **Overburden/Waste Rock Management**

The inspection focused primarily on the Wanagon Overburden Stockpile (OBS) and East OBS. Some of the smaller adjacent waste rock stockpiles receiving reduced volumes of waste (i.e., Koteka) were also visited.

Lower Wanagon OBS was affected by large scale scouring/erosion during the labour dispute (Sept 2011 – March 2012) as overburden placement and water management activities on the OBS ceased. A significant amount of material flowed into the downstream area (ModADA) during this period. Since that time PTFI has conducted activities to repair the OBS and control run-off water in order to minimize erosion and stabilize the OBS.

The Wanagon Drainage Drift (WDD) is critically important to the functionality, operation and stability of the Wanagon OBS both during operations and after closure. It was reported that the WDD discharge volumes have decreased from ~ 10,000 gpm to ~5,000gpm over the past few months. While this decrease is encouraging and suggests that surface water/stormwater is being properly managed and the WDD is effectively

draining the OBS, it is also a possibility that the decrease in flows is the result of scaling and clogging of the groundwater plumbing system (i.e., array of wells drilled from the WDD up into the OBS). In this case, this could represent a serious increase in the actual phreatic head in the OBS which could have a destabilizing effect. To validate and confirm the actual conditions in the Wanagon OBS, a visual inspection of the WDD plumbing system and concomitant order of magnitude water balance for the Wanagon OBS watershed is recommended.

### **Solid and B3 Waste Management**

In general, hazardous and toxic wastes have been managed well following the “cradle-to-grave” approach in which the wastes are identified from their generation, controlled and submitted to a third party for final disposal. This is accomplished through wastes identification, local storage, segregation, periodical collection and transport, temporary storage, and finally handing over to a licensed third party company. It is further supported by development of procedures to implement EMS for the purpose of ensuring consistency and continuity of existing practices.

It is recommended to measure weight of waste in cubic container regularly for obtaining more accurate measurements, to include information about treated waste in the database system and for receiving facilities in the lowlands to require hazardous waste generators to complete information in the container label, as it was found that information on 4 out of about 40 containers labels (10%) were not completely filled.

PTFI is successfully applying segregation of hazardous waste. However, with a more systematic approach waste segregation of domestic waste could be enhanced. A more systematic approach to domestic waste segregation could be implemented, particularly in the highland area.

PTFI has a strong commitment toward resource conservations, as reported in their GRI reports. However it is found that many recyclable materials are still disposed in landfill. PTFI should increase the 3R activities (composting, plastic recycling, metal recycling, and biodiesel from used cooking oil) so that it could play a more significant role in reducing waste to landfill.

It is recommended to continue with the operation of the commissioned grey water treatment facility at Ridge Camp as well as to recalculate the capability of the existing sewage treatment system to treat the increased load of organic wastes due to additional personnel. In order to maintain process stability and continual compliance beyond scheduled effluent sampling, it is suggested to define in-process parameters covering debit, pH, DO, SV, MLSS, MLVSS, sludge age and colour (commitment to continual improvement). It would be better for system improvement if inlet-outlet quality is monitored periodically for NO<sub>3</sub>, NO<sub>2</sub>, and PO<sub>4</sub>, in addition to routine parameters.

## **Water Quality and Quantity**

### *Surface Water Quality*

The tailings acid rock drainage control protocols and geochemical monitoring of the tailings implemented at PTFI have been effective in protecting surface water quality in the receiving rivers as demonstrated by circum-neutral pH and low dissolved metal concentrations at downstream monitoring locations which are similar to those recorded at reference, non-impacted, monitoring stations.

Low grade ore from the Grasberg pit is being stockpiled for processing during the transition between open pit mining and underground mining. A total of 65 MT of low grade ore is planned to be stockpiled on the Bali Overburden Stockpile by 2017. Oxidation of the low grade stockpile will result in changes to the mineralogy of copper bearing phases within the ore from primary sulphides to oxide/carbonates phases, which have varying solubilities. This creates a potential for water quality impacts in receiving surface waters associated with processing of partially oxidized low grade ore stockpile. The low grade ore stockpile should be further characterized and mitigation procedures developed well in advance of stockpile processing. Mitigation procedures could include efforts to reduce oxygen ingress into the stockpile, ore blending strategies and/or modifications to the flotation process.

Managing surface water and control of suspended solids in the Wanagon River associated with erosion/scour of the Lower Wanagon Overburden Stockpile continues to be a challenge. Although not a compliance location, increased spikes in the total suspended solids concentration have been recorded at Banti (Monitoring Station #57) since October 2011, reflecting the fact that challenges with surface water management of the Lower Wanagon Overburden Stockpile were magnified by cessation of operations due to the labour dispute (October 2011 to April 2012). Continued requirements to manage surface water and divert flows from the surface of Lower Wanagon Overburden Stockpile are recognized by PTFI and should be prioritized. While recognizing that final water management structures will need to be constructed once the overburden stockpile construction has been completed, temporary water routing channels should continue to be established and regularly maintained to ensure as much surface water as possible is diverted away from the active surface of the Lower Wanagon Overburden Stockpile.

### *Groundwater Quality*

The focus of the present audit was on the groundwater regime in the vicinity of ModADA and Timika, given the high priority placed by PTFI and local communities

on ensuring ModADA does not negatively impact groundwater resources in Timika. Extensive modelling and monitoring studies of the groundwater system to the west of the ModADA and in Timika have been conducted in the past 3 years. The groundwater monitoring program has focused on sulphate as this parameter can be used as a conservative tracer in groundwater. There is no evidence of acid rock drainage being generated from the tailings and therefore sulphate in seepage from the ModADA is likely due to dissolution of anhydrite contained in the ore and/or gypsum associated with the tailings. The modelling and monitoring studies to date suggest that Kwamki Lakes are gaining water bodies and act as a hydraulic barrier between seepage from the New West Levee and the groundwater system below Timika.

Although results from studies to date support the tenet that there is no hydraulic connectivity between ModADA and groundwater in Timika, groundwater at 3 monitoring points immediately west of Kwamki lakes (eastern part of Timika) show elevated sulphate concentrations, with an increasing trend in recent months. However all observed sulphate concentrations are well below applicable drinking water standards. There is a possibility that some of these wells are located in an area with historic tailings, including fill material used for the construction of flood control at the airport. It is therefore not clear from the present data whether elevated sulphate in some monitoring wells in east Timika are due to inputs from local sources (historical tailings used as fill) or are being affected by seepage from the ModADA. Continued monitoring and analysis of the groundwater data from installed wells to the west of the ModADA as well as an additional new multi-level monitoring well in Timika are recommended to further test the groundwater model, elucidate the physical hydrogeology in this area, and to verify the tenet that seepage from ModADA does not have the potential to impact groundwater at Timika.

#### *Stormwater Management*

A primary focus related to stormwater management was in the Concentrating Plant/Mill area, as previous floods in this area have resulted in disruptions to operations.

The Macken Ditch at the Mill has exceeded its bank full capacity twice in the last 8 years, suggesting the ditch was partially blocked or the 100 year storm event needs reassessment. It was apparent during the audit that in many locations the Macken and Markovich ditches were partially blocked with slope debris. It is also important to note that when the Macken Ditch overtops, it flows on to a lined road that ostensibly serves to contain the flow. The Ertsberg Pit is also being dredged to provide extra attenuation capacity during storm events in order to mitigate the risk of overtopping the Macken Ditch. It is recommended that debris from the Macken and Markovich ditches be regularly removed. The 100-year storm event should be reassessed/updated using the most recent meteorological data. The adjacent road's ability to adequately transfer storm events that exceed the capacity of the Macken Ditch should be properly verified.

A secondary focus was stormwater management at the port site Dewatering Plant due to potential release of concentrate and runoff with high concentrations of total suspended solids to the estuary.

Extensive work has been conducted at the Dewatering Plant under the Effluent Action Plan and the Stormwater Management Plan. Central to both of these plans is the commissioning of a large new thickener, due to be commissioned 4<sup>th</sup> Quarter 2014. Re-grading of the facility surfaces to direct water to sumps and extension of concrete surfaces, which are on-going, will enhance the ability to collect stormwater runoff and capture total suspended solids/concentrate in the settling ponds prior to discharge of the supernatant to the estuary. An observational monitoring program is proposed by PTFI subsequent to the completion of these water/sediment management structures. Recognizing the importance of sediment control from construction and fly ash storage areas, it is recommended that TSS monitoring program at the discharges from the facility be instituted/continued, until the new water/sediment control structures are demonstrated to have successfully reduced total suspended solids loading to the estuary.

### **Air Quality**

PTFI has been controlling and implementing good air quality monitoring practices, as seen and reported in the last (2011) audit. Air pollution control is achieved by defining and implementing air pollution control procedures established to ensure compliance and internal specification conformances. Stationary source emissions are monitored for compliance as required by the applicable permit. In general, air pollution units are capable of meeting the maximum concentration of parameters as stipulated in the relevant regulations (particulate, SO<sub>x</sub>, NO<sub>x</sub>) except for NO<sub>x</sub> emissions from some select diesel driven generators on Site.

For 2014 PTFI developed Environmental Management Program No. 7 to add another four catalytic converter units (SCR) to these engines for the purpose of meeting NO<sub>x</sub> emission standards. The EMP has on one side shown PTFI's good intention in its commitment to compliance, but on the other side, it has not reached a longer term guarantee that all non-compliant engines be addressed in the future. In assuring that emission of PTFI's stationary sources can meet the threshold limit every day of the year, and in the spirit to prove PTFI's commitment to pollution prevention and to compliance, PTFI should continuously monitor emission parameters or determine indicators of operation correlating to emissions.

Following previous audit comments on mobile emission in underground operation, PTFI increased testing of vehicle emissions and monitoring of ambient air concentrations. Light Vehicle Emission Testing is covered in FRESH Standard 1.15.10 (FRESH is Freeport Occupational Safety and Health). This is a good environmental

management practice. The parameters monitored are CO, NO<sub>x</sub> and particulates. All vehicles examined have passed the emissions test. The Underground Mine Division has developed a standard operating procedure for maximum allowable concentrations of various gases in the underground mine. Equipment emissions in the open pit mine have not been monitored directly. Although not required by regulations, encouraging internal monitoring and efforts to reduce emissions would demonstrate PTFI's commitment to continuous improvement in environmental management.

It is recommended for PTFI to detail all activities emitting greenhouse gasses (GHG) for both mobile and stationary sources. It is also recommended to estimate CO<sub>2</sub> emission from solid waste/landfills because concentrations could be considerable.

The result of the ambient air, noise, and dust monitoring reveals there are no values exceeding the defined threshold limits. In this perspective, the ambient air in the PTFI operations area is in good condition.

## **Reclamation and Mine Closure**

Reclamation and mine closure are two inseparable aspects of the environmental management plan at PTFI. According to the mine closure concept, overburden stockpiles will be stabilized both geotechnically and geochemically, and native plants species will be used to re-vegetate the disturbed areas. Based on the mine closure plan, reclamation activities will be directed according to the land use plan; Most of the highland area which has been used for mining will be returned to the ecological conditions similar to the pre-mining condition. A Mine Closure Plan and a 5-Year (2014-2018) Reclamation Plan have been developed by PTFI and are presently being reviewed by the Ministry of Energy and Mineral Resources (MEMR).

### *Reclamation and Revegetation Aspects*

Overall the reclamation activities in highland and lowland areas showed good progress, especially with growth percentage of planted plants and the natural succession process. PTFI has introduced methods and techniques in reclamation to increase re-vegetation success; selection and use of local species for revegetation in the reclamation process in Grasberg and ModADA tailings deposition area. The success of native *Deschampsia klossi* and *Phragmites karka* as pioneer species is highly significant since it is a combination of revegetation efforts with local species and long-term trials. It is a common practice in open pit mining to use fast growing plant species for reclamation in poor soil condition but many of these species are exotic and can turn out to be less adaptive or even invasive.

The successful use of limestone reject as a growing medium and cocopots as plant containers are innovative techniques for revegetation in highland areas with extreme

conditions. The combination of using a surface binding agent (cover enhancer) with seasonal (sterile) non-native grass *Deschampsia caespitosa*, native moss and fertilizer in hydroseeding mixture has improved slope maintenance and created better micro habitat before planting of *Deschampsia klossii* and other perennial native shrubs species. This combination is also economically efficient.

Revegetation techniques applied for reclamation in the highlands as well as the lowlands are yet to be assimilated into a comprehensive standard operating procedure (SOP). Although PTFI has a specific SOP for reclamation (SOP E-09-40) and for reclamation monitoring in the Highlands (SOP E 15-10), these should be further developed as detailed work instructions for the entire reclamation procedure, including plant preparation, preparation of soil medium, transplant and monitoring. This will improve the success of reclamation efforts, especially in the highlands.

Special studies, such as maximum sustainable yield for various crops, should be continued and intensified because they could be used to determine the environmental carrying capacity of impacted areas. This is important for decision making on the sustainable use of biological resources together with consideration of the socio-economic aspects.

#### *Physical and Chemical Aspects*

PTFI's Mine Closure Plan is conceptual in nature, but meets the requirements of applicable regulations and forms a reasonable basis for determining post-closure and reclamation cost estimates.

A critical aspect of the closure plan will be water management and water treatment, which is presently estimated to last for 10 years post closure. Additional water balance, geochemical and water quality modeling studies are required to develop detailed post-mine water management plans and provide more scientifically defensible predictions of the duration required for water treatment to meet post-closure water quality objectives.

Subsequent to the closure of the Grasberg open pit and start of the Grasberg Block Cave operations, subsidence within the Grasberg open pit and in some areas of the overburden stockpiles, predominantly Carstenz Overburden Stockpile, is expected. The potential impact of subsidence on overburden stockpile covers, acid rock drainage control and reclamation/revegetation success will require monitoring and management measures.

During the transition from open pit to underground mining, the volume of waste rock placed in the Wanagon Overburden Stockpile will essentially cease and developing a closure plan for the facility is necessary. PTFI has commissioned a consultant to complete the Wanagon Overburden Stockpile Closure Plan. This plan should include the design basis and criteria for closure, review and rank closure design alternatives, provide a detailed design for the selected alternative and provide a cost estimate for closure.

## **Biodiversity**

PTFI has developed a biodiversity database and biodiversity information system based on data from monitoring programs, and then integrated it with other environmental data into a customized, user friendly web application called “Ekowiki”. Biodiversity information system development through Ekowiki is expected to form a biodiversity profile for the PTFI COW, which is part of the regional and national biodiversity profiles (Regulation of Minister Environmental No. 29 of 2009). This information is useful as baseline data for implementing the Nagoya Protocol (ratified in Law No. 11 of 2013) in the future, and supports decision-making, policy formulation, preparation strategies and action plans for biodiversity management in the region and increased public knowledge and awareness of biodiversity conservation, and also support reclamation programs and mine closure planning.

There is a need for development of Biodiversity Strategic Action Plan to provide direction for all biodiversity and conservation activities. PTFI could refer to applicable guidelines, including the Indonesia Biodiversity Strategy and Action Plan (IBSAP) 2003–2020. There is also a related need to determine the flagship species/keystone species for every specific bioregion based on their conservation status to guides PTFI’s Biodiversity Conservation efforts.

On the basis of available data and experience gained to date, PTFI could benefit from the accumulation and integration of this information into a management model for forest areas that could be included in national and global schemes (CDM, REDD+, etc.), bearing in mind that PTFI holds a permit to exploit mineral resources that also involves the obligation to manage vast forests until cessation of mining activities.