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Peasant Perceptions of Environmental Remediation Developed by Consorcio Santo Toribio in the Peasant Community of Cari Cari - Mañazo - Puno, 2020 – 2024

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Abstract

The research addresses the perceptions of the peasants of the community of Cari-Cari - Mañazo, province and department of Puno, about the environmental remediation carried out by the Santo Toribio Consortium. These actions were carried out to mitigate the effects of the environmental liabilities generated by the former Aladino VI Mining Unit, which operated in the area until 1986 in the Quearaya annex. The main objective was to systematize the population's perceptions regarding the recovery of ecosystem services in the areas affected by copper mining. The methodology used was qualitative, descriptive-ethnographic, non-experimental-longitudinal design, using the inductive method. To collect the information, observation guides and in-depth interviews were applied. The results highlight the effects of mining environmental liabilities in the community, 24 passive components were identified, including a mine entrance, as a legacy of the mining activities of the former Aladino VI Unit. Within the framework of Law No. 28271 of 2004, which regulates mining environmental liabilities (PAMs), the company Activos Mineros S.A.C. (AMSAC) commissioned the consulting firm CESEL S.A. to design a closure plan for these liabilities and the Santo Toribio Consortium assumed the responsibility of executing the environmental rehabilitation, in the project called "Recovery of ecosystem services of the middle part of the Chactani Gorge of the Ilpa Basin". These activities took place between August 10, 2020 and 2024. In conclusion, the research highlights the importance of environmental rehabilitation actions and their impact on the perception of community members, who value the efforts made to restore ecosystem services in their community, after years of negative impact from mining.

Keywords: *Peasant Community, Mining Exploitation, Environmental Liabilities Perception, Environmental Remediation.*

Introduction

The research has been developed within the area of community relations activities and within the framework of the line of study of conservation of natural resources, according to the program of the master's degree in social sciences with a mention in: Community Relations and Social Conflict Resolution. Therefore, it is essential to glimpse the problem. Peru is a country with various substantial activities, within it, mining is one of the extractive activities, which has a long history, dating back to pre-Inca times. In the context it has a greater impact on the Peruvian economy. Because during the Republic and in the twentieth century, exploratory work was intensified throughout the country, particularly in the Andes. For Azcona (2022) "Peru is a substantial world player in the production of precious metals and base metals, which allows it to occupy the second place in the production of copper, silver and zinc worldwide, the third place in copper globally and in its territory it houses the largest reserves of silver" (p. 10). In the context, "the mining sector contributes 61.9% of total exports (60.5% corresponds to metallic minerals and 1.3% to non-metallic minerals). The main metals exported are: copper, gold and zinc, which represent more than 50% of the value of national exports (Chappuis, 2019). For this reason, the new mines were allowed to open.

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In the Peruvian environment, many mines are in operation and other mines have been abandoned for various reasons, where environmental rehabilitation activities were not carried out, which led to the generation of Mining Environmental Liabilities (PAMs). Currently, "these liabilities are presented in the form of waste, mining work, infrastructure, machinery, etc. of different types and in different quantities, which trigger risks for humanity and the environment" (Azcona, 2022, p. 11). In 2003, the Peruvian State enacted the Mine Closure Law Law N° 28090 (2003), to avoid a permanent and potential risk to the health of the population due to unclosed work, to the surrounding ecosystem and to property. In addition, concrete measures were incorporated for the closure stage. In 2004, the law regulating PAMs was published (Law N° 28271), previously detailed. The objective of this law was to prevent the emergence of new PAMs.

It is important to highlight in the research on the environmental legislation of our country that it is based on the concept "the polluter pays" and in Law No. 28271 that regulates the environmental liabilities of mining activity are defined in Article 2, as: "those facilities, effluents, emissions, remains or deposits of waste produced by mining operations, currently abandoned or inactive and that constitute a permanent and potential risk to the health of the population, the surrounding ecosystem and the property". For Wong and Bernardo (2018), these mining liabilities have become one of the most serious pollution problems in the country, mining companies generate environmental liabilities that are not accounted for. "Mining environmental liabilities by regions are located in six main regions, which represent more than 71% of the accumulated total, in first place, there is the Ancash region where a total of 1,251 liabilities (14.5%) are located, followed by Cajamarca and Puno with 1,075 (12.5%) and 1,050 (12.2%) liabilities; fourth place corresponds to Huancavelica with 9.96%. In fifth and sixth place are Junín with 7.39% and Lima with 7.11%. The rest of the regions account for 29.6% of total mining liabilities." (Sotomayor, 2015, p. 83).

The genesis of an environmental liability is related to imbalance of nature, that is, land degradation, climate change, water pollution. According to Jensen and Birch (2018), they are combined with government policies, culture of use, management and protection of natural resources, the environment, the biophysical characteristics of the terrestrial space and climate variability. "PAMs originate when an extractive, mining, oil or gas activity ceases and leaves the place where it operated without repairing environmental damage. These liabilities pollute water, soil, air, affect the health of the population and can even harm the property of third parties" (Mejía, 2017). For regional and local authorities, for populations, the existence and permanence of mining environmental liabilities (PAMs) is of concern to everyone.

It is important to mention that PAM inventories involve all abandoned or inactive components located in the former mining operations and that some of them do not presume an environmental risk such as camps, canals and roads. According to the Peruvian standard (MINEM, 2018), environmental liabilities can be differentiated according to the type of component: i) mining work (mine entrances, chimneys), ii) mining waste (tailings, clearings), iii) infrastructure (camps, offices, workshops), and iv) others (chemical waste).

It is worth mentioning that, since 2004, the MINEM has received support from international cooperation for the management of the PAMs; such as the Federal Institute of Geosciences and Natural Resources (BGR) of Germany (2004 and 2018), the World Bank, the Inter-American Development Bank, the ACDI (Japan Cooperation Agency, through the Japan Oil, Gas and Metals National Corporation (JOGMEC)), as well as the Mine Reclamation Corporation of Korea (MIRECO), a corporation that supported MINEM in improving the management of PAMs, with the project "Strengthening Management for the Remediation of Mining Environmental Liabilities in Peru". Starting this year, interest was taken with the objective of identifying, characterizing and evaluating the Mining Environmental Liabilities in Peru so that their prioritization and remediation are allowed.

In this context, Activos Mineros S.A.C. (AMSAC) has the vision of being the leading State company in mining environmental remediation that is recognized for recovering the areas altered by mining and that contributes to the sustainable development of the country, in alliance with private investment. According to the Ministerial Resolution N° 482-2012-MEM/DM, 2012) and Ministerial Resolution N° 094-2013-MEM/DM, 2013, AMSAC was commissioned to remediate 475 mining environmental liabilities, distributed in the regions of Cajamarca, Lima, Ancash, Puno, among others (Chappuis, 2019, p. 15).

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In compliance with current environmental legislation on the Closure of Environmental Liabilities of mining activity, Activos Mineros S.A.C., hereinafter AMSAC, commissioned the consulting firm CESEL S.A. to prepare the Closure Plan for the Mining Environmental Liabilities of the former Aladino VI Mining Unit located in the district of Mañazo. province of Puno, Puno region. The former Aladino VI Mining Unit is made up of twenty-four (24) liabilities. The presence of mining environmental liabilities indicates previous exploitation of an underground mine, the area where the PAMs are located is a currently altered environment. There is the PAM Closure Plan, as a technical document that made it possible to determine the most viable strategies, criteria and measures for the closure of liabilities. The closure of the PAMs includes the stabilization and environmental rehabilitation of the same, as well as their subsequent maintenance and monitoring.

This research article on peasant perceptions of environmental remediation developed by Consorcio Santo Toribio in the peasant community of Cari-Cari - Mañazo - Puno. Its objective was to describe the perceptions of the community members on environmental remediation, in relation to the mining environmental liabilities generated by the former Aladino VI Mining Unit in the peasant community of Cari Cari. To this end, the qualitative method has been used, where our experiences of having participated as a facilitator and companion in environmental remeasurement were substantial. The testimonies of the inhabitants and the authorities. All the regulations that regulate mining environmental liabilities and projects and mine closure report were also important.

Methodology

To collect information, the qualitative research method was used with a phenomenological perspective and with the comprehensive interpretative analysis of the objective meaning of the mining environmental liabilities (PAM) of the former Aladino VI Mining Unit, which is located in the peasant community of Cari-Cari, in the district of Mañazo, province of Puno. This method helped us to describe and analyze ideas, beliefs, meanings, knowledge and practices of groups, cultures and communities. (Patton, 2002; Mc Leod & Thomson, 2009). Ethnography involves the in-depth description and interpretation of a group, social or cultural system (Creswell, 2009). (Cited by: Hernandez et al., 2010). This methodology is the most appropriate to meet the objectives of the investigation. In addition, it has allowed us to carry out fieldwork within the framework of social empathy with the community members, permanence in the In-situ, participant observation, evidence of the passive effects of the former Aladino VI Mining Unit, and actions of the Santo Toribio consortium and collect testimonies focused on the perceptions of the community members on environmental remediation.

In this task, the non-probabilistic type of sampling has been taken. A sample of opinión (Mitacc, Calculo III, 2011). The qualitative sample (Martínez, 2007) is a part of a group or population chosen through criteria of sociocultural representation. Through methodological strategies such as participant observation, interviews using the guidelines, review of the documentation, that is, report of remediation activities. Images to learn about before and after the environmental restoration activities.

Population, the peasant community of Cari-Cari, according to has a population of 800 people, of which 320 are women and 480 are men. As for families, according to the 2023 communal registry, there are 200 families in the community. Our investigation focuses on the Quearaya annex, which has 46 families that have been directly affected by the Aladino VI mining exploitation, it is within the jurisdiction of the peasant community of Cari Cari. (INEI, 2018) Sample, the sample population for this research, the families of the Quearaya annex have been considered, which are 46 families, for the investigation 3 directors of the Santo Toribio company in charge of restoring the affected environment, 5 communal authorities, 2 former authorities, 5 community members of Quearaya and 5 workers of the company are considered. A total of 20 informants (men, women and young people) have provided us with their information about the research.

Data and Category Analysis. It focuses on the unit of analysis in mining environmental liabilities caused by the former Aladino VI Mining Unit and environmental remediation entrusted to Activos Mineros S.A.C., hereinafter AMSAC, a State company belonging to the FONAFE Holding. And executed by the Santo

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Toribio Consortium. Therefore, the population's perceptions of mining exploitation and environmental remediation are substantial.

The levels of analysis were the effects of the mining action of the former Aladino VI Mining Unit, the remediation actions of the Santo Toribio Consortium (Activos Mineros S.A.C., hereinafter AMSAC, a state-owned company belonging to the FONAFE Holding) and the perceptions of the peasants of Cari-Cari. And as axes of analysis there is environmental remediation. And our observation units are focused on the action of the Former Aladino VI Mining Unit, the executing company Consorcio Santo Toribio, on remediation and the language of the community members on the actions of these companies.

Literature Review

Extractive Policies and Mining in Peru

In the context of our country, there are regulations on mining extraction. According to Baca (2013) his study "on the regulatory framework, he states that this entire process of extractive policies is based on the approach of the policies of the Washington Consensus, strongly implemented in Peru, since the early 90s, whose main objectives were to promote investments in the mining sector" (p. 5). To this end, the State has a very attractive regulatory framework for investments. In recent years, the cost of minerals has risen, which has strongly increased profitability. To this end, "mining" activity began to play a decisive role in the growth of the economy, with rates above 7% for several years. Mining contributes 60% of exports, 30% of income tax, 17% of internal taxes and 13% of the Gross Domestic Product (GDP), according to the latest measurement by the National Institute of Statistics and Informatics" (Baca, 2013, p. 5).

The rules and policies that regulate the operation of mining activity in Peru are oriented towards environmental, tax, social and labor issues. They can be identified according to the stages of the value chain; that is, the timeline that follows the cycle of a mining investment project, which begins with the search and prospecting, mining exploration and the decision whether or not to exploit the resource; development and construction, production or exploitation until the closure of mines. The regulatory framework reformed in the early 90's was also aimed at encouraging the arrival of foreign investment in the sector. Among the main regulations we can mention: Single Harmonized Text of the General Mining Law approved by the (Supreme Decree N° 014-92-EM, 1992); Law on the Promotion of Investments in the Mining Sector, Legislative Decree No. 708; Law N° 27343 (2000), Law that regulates Legal Stability Contracts with the State under the Sectoral Laws; the (Supreme Decree No. 162-92-EF (1992) (Regulation of the Private Investment Guarantee Regimes; Legislative Decree No. 662 Approval of the Stability Regime for Foreign Investment) and Law N° 26821 (2005) the Organic Law for the Sustainable Use of Natural Resources. The new mining in Peru should be related to sustainable contribution and development, respecting the rights of communities and caring for the environment, all of which are encompassed in four points: the mining concession system, the environmental regulatory framework, the tax regime (tax and non-tax payments, legal stability contracts) and social and labor standards. At this point, it is also worth noting the contribution provided by Domínguez, (2014):

"The mining obligations established by the Single Harmonized Text (TUO) of the General Mining Law, whose basis are Articles 66 and 67 of the Political Constitution of Peru, establish the following: "Article 66. Natural resources, renewable and non-renewable, are the patrimony of the Nation. The State is sovereign in its use, and the conditions for its use and its granting to private individuals are established by organic law. The concession grants its holder a real right, subject to said legal norm. Article 67. The State determines the national environmental policy. It promotes the sustainable use of its natural resources. These provisions are the basis for mining regulation in the country." (p. 9-11)

Socio-environmental Conflicts in Peru

To understand socio-environmental conflicts, it is necessary to take into account the (Law N° 28611, 2008), General Law of the Environment: The environment comprises the physical, chemical and biological elements of natural or anthropogenic origin that, individually or in association, make up the environment

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in which life develops, being the factors that ensure the individual and collective health of people and the conservation of natural resources. biological diversity and the cultural heritage associated with them, among others.

Social conflicts in Peru are mostly socio-environmental and have been increasing from 2008 to 2013. It should be noted that the six departments with the highest transfer of mining canon are also the main departments with the greatest social conflict and the greatest socio-environmental conflicts specifically. According to the systematization of the conflicts carried out in the annexes of this work, it can be seen that the vast majority of the socio-environmental conflicts identified in the six departments respond to conflicts related to mining and the environment, where there is fear of the possible environmental pollution that the company may carry out in the area and the environmental impacts that the activity may generate. So there is a perception of incompatibility between mining and the environment by the population. (Domínguez, 2014, p. 107)

In these contemporary contexts. "An environmental conflict can be defined as a social event" (Santandreu and Gudynas, 1998), when the damage affects the interest of the population is "from an environmental impact, damage or problem (Jorquera, 2019).

Environmental conflicts in our context of Peru, "basically originate from conflicting interests around the environmental impact of a certain activity" (Sabatini, 1997), for a good living of the community members it is very important to have environmental conditions. According to Jorquera (2019) the conceptions of the conflict as follows:

Conflict is not static, so it develops over time with modifications and changes; • It takes place in the public sphere, which means that it excludes the private or individual sphere; • It is developed collectively, involving groups of people with different degrees of organization; • It results from different values, perceptions or meanings that the actors give to the circumstances that affect them; • The conflict manifests a dynamic of opposition, controversy, dispute and protest between actors; Finally, there is a recognition of the actors in opposition to the conflict, this means that their independent counterpart who approves or rejects their claim, recognizes that there is another actor who exercises opposition. (p. 24)

Another important aspect is that when we see the effects of environmental pollution, we are already recognizing the environmental conflict, and it helps us to understand "the divergences of perspectives and interests and the relations of power and resources existing between the parties that make up the conflict." (Urkidi, 2008). In the cases of the visibility of PAMs, the experience in the community is substantial, the collateral effects of environmental pollution require immediate intervention for environmental remediation.

In the literature review, we found a similar case in PAM that occurred in Chile, it was that of the El Salvador copper extraction mining site, a company of the Copper Corporation (CODELCO). "This site developed the historical practice of transporting its tailings through the Salado River, reaching the coasts of Chañaral. Currently, and with the improvement in the technologies of the processes of extracting ore from the rock, the shipment of tailings to the coast has ceased, but the impact of this practice has not ceased and is still evident in the community" (Jorquera, 2019, p. 25). The evidence caused by CODELCO was also presented by a research of Vásquez et al. (2015) where "it identified that in the community of Chañaral (specifically in the children of the commune), their lung capacities were found to be diminished" (Vásquez et al., 2015).

Institutions That Manage Mining Environmental Liabilities

In the context of Peru, there is Law No. 28271, which regulates the environmental liabilities of mining activity. Signed on July 2, 2004, and pursuant to Article 61 of the Mine Closure Regulations, which states: "once the guarantees have been liquidated, the General Directorate of Mining will entrust a specialized company with the execution of the works of the Mine Closure Plan that has not been complied with, without prejudice to the sanctions and/or legal actions that may be brought against the owner of the mining activity". In compliance with the provisions of Supreme Decree No. 059-2005-EM, Regulation of Environmental Liabilities of Mining Activity, any company, public or private, that has generated mining

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environmental liabilities is obliged to submit the Closure Plan of Mining Environmental Liabilities to the Ministry of Energy and Mines and execute it in accordance with the schedule and terms approved by the General Directorate of Mining Environmental Affairs. For this reason, "the government of Peru assumes the task of remediation of those PAMs whose perpetrators cannot be identified and, exceptionally, when, in the opinion of the MINEM, there is a high risk and the person responsible in charge of the sanitation has not carried out the remediation of the affected area or there is a repeated negligent execution of the Environmental Liability Closure Plan (PCPAM)" (Chappuis, 2019, p. 14). Once the non-compliance with the closure plan has been declared and verified and the corresponding guarantees have also been liquidated, the DGM must entrust a specialized company with the execution of the works of said PCPAM, without prejudice to the sanctions and/or legal actions that may be imposed against the mining owner.

The Perception of Risk in Environmental Conflicts

Perception can be understood from several positions such as: empiricist, associationist, which is based on sensations that the perceiving subject will later order. Therefore, perception is always developed through prior knowledge of reality. "The perceiving subject is passive at first and limits himself to receiving external stimuli and then proceeding actively and organizing the "Mosaic" of perception" Enriquez and Jaramillo, 2019, p. 23). In the perception scenario, the peasants verify and project their attention towards the remediation activities and environmental characteristics and then make a sampling, then draw their conclusions and qualify positively or negatively in the context of coexistence in the community with nature.

When dealing with perceptions, it is understood that it is a concept of several interpretations and in research it is substantial because it presents us with evaluation knowledge. As Peralta and Quispe, (2018) assure us: "Social perception is conditioned by the social phenomena that occur in their environment; consequently, social perception is a process by which the individual interprets and understands social phenomena" (p. 58). This notion allows us to understand the peasants and their communal experience, the perception of the environmental remediation activity that is in process and is an objective reality.

Perception is the first action of the inhabitants towards the outside world. It is impossible to know the world without first perceiving it. For (L., E. M. , E. M. Sánchez-Vázquez, 2015) "perception is socially conditioned, which gives it a social character, since the notion we have about society and social processes comes from social interaction itself" (p. 27). The community members are social beings, while social coexistence is the environment where it is influenced by the customs, beliefs and different social phenomena that occur in their communal environment. Therefore, the data of experience would be automatically organized in the very act of perception when we see things. We do not unify the scattered data of sensation as if it were a puzzle, but we perceive the mosaic in its entirety, directly and indirectly.

To glimpse the context of the organization, it is important to take into account Enriquez and Jaramillo (2019): "Perceptual organization would be the result of the physical processes that take place in the cerebral cortex. There would be a certain isomorphism (an equality of form) between external stimulation and the effects it produces in the brain" (p. 24). So perception is the result of a biological adaptation to the environment, because peasant coexistence is through nature. Perceptions are not a mere subjective reality or a correspondence with what is reality, experiential perceptions are objective realities.

From the shores of psychological notions, the vision that perception provides us with is ordered in itself, structured with the other characteristics of a whole. As Gómez (2009) reveals "that the individual perceives his environment in an organized way, as a structured whole" (p. 7). From social perspectives, the notion of perception is substantial and serves, to approach a more adequate understanding of the concepts of the person and the social (Surralés, 2002), this action is revealed by our senses and daily experience, this is the first action of people.

With these epistemological views on perception, for our Aymara and Quechua context, the worldview is important. To this end, Rengifo (1999) asserts that "the peasant population has life for them, that is, the earth, the wind, the water, the sun and the deities and humans, all are essential and live in a symbiotic context" (p. 19). So, the relationships with their environment are not subject to object, rather within the

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framework of the worldview, they are all living beings, so the *Apus* (tutelary hills) are seen as a reality in their feeling.

Results and Discussions

Mining Environmental Liabilities of the Former Aladino VI Mining Unit

Environmental Impact

The former Aladino VI Mining Unit in the mining process generated mining environmental liabilities, the activity was underground mining generating the PAMs, however, to date it has not been possible to identify the person responsible for the mining activity or the period in which the activity was carried out. Therefore, the name of the mining company and/or owner has not been identified or documented. However, according to the testimonies of the residents, the mine would have operated until 1986. On the subject, Mr. David León Ticona tells us:

I was born in this community, I am already 45 years old, the mine had always existed, the owner of this place had been Santiago Ortega. On the Tutayani hill there were 8 chimneys, that is, tunnels where they extracted copper, it seems that in those years copper was well valued, my father had been a worker in this Aladino VI mine.

In the process of investigation we found assertions that in the mine of the former Aladino VI Mining Unit, coincides with the account of Mr. David León Ticona that they would have exploited copper, in addition to information from community directors, they mention that material was also brought from other artisanal mines to process in the plant that was installed. Leaving tailings material in large quantities, sinkholes, and clearing material from the excavation of the sinkholes and galleries.

In recent years, the different environmental conflicts have become more visible, particularly in rural areas which, being privileged ecozones with the natural resource of minerals, are the ones affected by the problem of mining development. The former Aladino VI Mining Unit generated an environmental impact in this Cari-Cari community. For this reason, the Peruvian state commissioned ACTIVOS MINEROS S.A.C. (AMSAC) and it contracted the SANTO TORIBIO CONSORTIUM to carry out the execution of the project: "Recovery of the Ecosystem Services of the Middle Part of the Chactani Gorge of the Ilpa Basin" affected by the environmental liabilities of the former Aladino VI Mining Unit. Noting the ongoing process of updating the National Environmental Policy to 2030 (MINAM, 2020), it identified "as a public problem the decrease in the goods and services provided by ecosystems that affect people's development and environmental sustainability" (p. 141).

In our country, on July 2, 2004, Law No. 28271, Law that regulates the environmental liabilities of mining activity, was enacted, and Supreme Decree No. 059-2005-EM, published on December 8, 2005, approved the corresponding Regulations, which regulate the scope and responsibilities of natural persons. public or private legal entities whose mining operations generated mining environmental liabilities.

In compliance with the provisions of the Supreme Decree N° 059-2005-EM, (2005), Regulation of Environmental Liabilities of Mining Activity, any company, public or private, that has generated mining environmental liabilities is obliged to submit the Mining Environmental Liabilities Closure Plan to the Ministry of Energy and Mines and execute it in accordance with the schedule and terms approved by the General Directorate of Mining Environmental Affairs. Through the Resolution Ministerial N° 252-2026-MEM/DM (2016), the Ministry of Energy and Mines identified and commissioned Activos Mineros S.A.C. to remediate 24 Mining Environmental Liabilities classified as very High Risk and High Risk in the former Aladino VI Mining Unit. In this process, the situation of the ownership of the surface land of the former Aladino VI Mining Unit is located within the territory of the peasant community of Cari-Cari. Approved Environmental Instruments, does not have any approved environmental instruments.

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The damage caused by mining is basically the polluting tailings deposited from deforestation in a boedal area, where it contaminates the water and makes this area infertile, in the rainy season this material is dragged to the contiguous areas and finally to the river. In the dry season due to the winds, the contaminated material is dragged to the adjacent areas, harming the inhabitants, since the pollution falls in the areas of grasslands which are consumed by animals and these die or do not develop normally. The inhabitants have been harmed in their agricultural and livestock activities. On the subject we have the following testimony:

The mining activity has caused us a lot of damage, in this area everything was white tailings, there were no pastures, this contamination reached the river, when our cattle drank water, the animals were with diarrhea and others became weak, crops cannot be planted. Of course, those who worked in the mine earned their salary were fine. So mining doesn't care about anything and it caused us a problem. (INF-8).

PAM Closure Plan

To develop this environmental remediation activity. Activos Mineros S.A.C. (AMSAC), commissioned the consulting firm CESEL S.A. to prepare the Closure Plan for the Mining Environmental Liabilities of the former Aladino VI Mining Unit, located in the district of Mañazo, province of Puno, Puno region.

Mining Environmental Liabilities (PAM) according to the definition of the law that regulates the Environmental Liabilities of Mining Activity (Law N° 28271, 2004), Article 2.- "are those facilities, effluents, emissions, remains or deposits of waste produced by mining operations, currently abandoned or inactive, and that constitute a permanent and potential risk to the health of the population, the surrounding ecosystem and property". (p. 1)

The activity of the former Aladino VI Mining Unit has left twenty-four (24) passive components and mine mouth 8805 (excluded from the order). The presence of mining environmental liabilities is a sign of the exploitation of underground mining; in addition, the area where the PAMs are located is a currently altered environment. Therefore, the PAM Closure Plan is a technical document that made it possible to determine the most viable strategies, criteria and measures for the closure of liabilities, as well as the investment amounts that these activities entail. The closure of PAMs includes environmental stabilization and rehabilitation, subsequent maintenance and monitoring, for which the application of appropriate criteria and technologies to mitigate significant environmental impacts is essential.

Activos Mineros S.A.C. (AMSAC) began the work called "Closure of the mining environmental liabilities generated by the Former Aladino VI Mining Unit" which include the remediation of 24 mining environmental liabilities in the community of Cari Cari, district of Mañazo, components such as clearings, mine entrances, tailings and infrastructure, among others, with the aim of recovering the ecosystem of the middle part of the Chactani Gorge of the Ilpa Basin. affected by these liabilities, with an investment of more than 34 million soles, the execution time in an approximate period of 480 days. With the aim of benefiting more than 5,517 inhabitants.

Component Identification

*Identification of the Owner***.** Activos Mineros S.A.C., hereinafter AMSAC, a state-owned company belonging to the FONAFE Holding, was created in October 2006, to remedy the environmental liabilities generated by the State's mining activity and others that are expressly entrusted to it. Through Ministerial Resolution No. 252-2016-MEM/DM, the Ministry of Energy and Mines entrusts Activos Mineros S.A.C. with the remediation of 24 Mining Environmental Liabilities generated by mining activity in the former "Aladino VI" Mining Unit. Subsequently, through Report No. 043-2017-MEM-DGM/PAM, the Ministry of Energy and Mines incorporates 11 new mining environmental liabilities in addition to those identified in Ministerial Resolution No. 252-2016-MEM/DM. Likewise, in the aforementioned report, the PAM ID 8805 is excluded from the scope of AMSAC.

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Figure 1. Organizational chart of Activos Mineros S.A.C.

Note. Activos mineros S.A.C.

Identification of the Consulting Entity. The consulting company responsible for the preparation of the Closure Plan for the Mining Environmental Liabilities generated by the former Aladino VI Mining Unit, is CESEL S. A., with RUC No. 20101064191, with legal address at Av. José Gálvez Barrenechea N°646, District of San Isidro, Lima, represented by its General Manager Mr. Duilio Ayaipoma Nicolini, identified with DNI No. 07937703, according to power of attorney registered in Item 02005336 of the Registry of Legal Entities, of the Registry Office of Lima and Callao.

CESEL S. A. is a Peruvian consulting company, with 46 years of continuous activity in engineering projects and has extensive experience in the preparation of environmental studies for the mining sector, such as: environmental remediation study, mine closure plans, preparation of closure plans for mining liabilities, developed at the feasibility level, including budget estimates, mine closure engineering and environmental impact studies.

It should be noted that CESEL S. A., through Directorial Resolutions No. 026-2016 MEM/DGAAM, No. 295-2017 MEM/DGAAM and No. 339-2017 MEM/DGAAM, is registered in the Registry of entities authorized to prepare Mine Closure Plans, for mining activities, of the Ministry of Energy and Mines.

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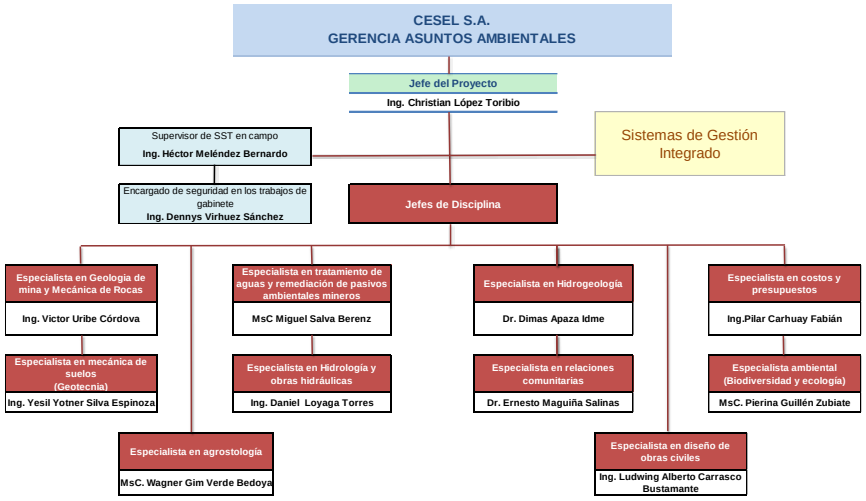
Figure 2. Organizational Chart of Specialists Who Participated in the Project



Note. CESEL S.A.

Objectives of Mine Closure

The main objective of the closure is the remediation of the environment where the mining environmental liabilities generated by the former Aladino VI Mining Unit are located. Likewise, the Closure Plan for Mining Environmental Liabilities will seek to stabilize the environment, reducing the need for intervention for the care and maintenance of closure works, achieving adequate interaction with social actors and remediated PAMs, and complying with current environmental legislation.

Human Health and Safety Objectives

The activities of the Closure Plan will be developed with the objective of eliminating the risks that may affect the health and safety of the surrounding population generated by the presence of PAMs.

Physical Stability Goals

The objectives of physical stability are as follows:

- The closure of the five mine entrances, three chimneys, a half bar, a shaft, a pit, a trench, two tailings deposits, seven waste deposits, an infrastructure and two processing plants are intended to prevent or mitigate the negative impacts they generate
- Prevent the entry of people and animals that pass through the vicinity of environmental liabilities
- Reduce the negative landscape effect. Minimize the visual effect and restore the landscape to its natural state as much as possible

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- Prevent the entry of runoff water into mine cuttings and tailings deposits, which may generate a process of instability, through saturation and the generation of pore pressures on the slopes, in the foundation and on the contact surface

- Ensure the physical stability of the slopes in chimneys, shafts, pits, trenches, mine clearances and tailings deposits, designing the slope in such a way that it is physically stable, assuming for this purpose, the most unfavorable conditions existing during the post-closure period, such as seismic and climatic events

- Ensure the stability of the covers to be placed

- Secure, with containment works, the foot of the slopes against the influence of runoff, or possible landslides of the cover that may occur at the base of the waste deposits and in tailings deposits.

Geochemical Stability Objectives

The objectives in geochemical stability are the following:

- Ensure the geochemical stability of mining environmental liabilities
- Design covers that guarantee the geochemical stability of environmental components.

Land Use Objective

The objective regarding the use of land is the following:

- Recover a quality condition, similar to the one it had before the existence of the PAMs.
- Recover areas affected by the presence of PAMs.

Hydrological Stability Objectives

The objective of hydrological stability is as follows:

- Rehabilitate potentially affected watercourses, through the development of strategies aimed at their recovery, so that they can be used later.

Closure Criteria

The Closure includes the development of activities such as: engineering designs required for dismantling, demolitions, on-site studies for the final disposal and/or rescue of materials, physical, geochemical and hydrological stabilization, restoration of the landform, revegetation, rehabilitation of aquatic habitats, rehabilitation of loan areas, provisions to provide essential services to the community, transfer of ownership and access to land, etc.

The specific physical, geological, hydrological, hydrogeological, climatic and environmental conditions of each component, the characteristics of the mining-metallurgical methods and the operating conditions determine the particular criteria applicable to that reality; however, the aspects that are always present are the protection of water, soil, air, flora and fauna resources, as well as giving a beneficial use to the land after closure. In order to comply with the objectives set out in the Closure Plan for mining environmental liabilities generated by the former Aladino VI Mining Unit, the general closure criteria are defined that will allow the design of the strategies, in such a way as to guarantee their viability, both technically, economically, and environmentally, and which are mentioned below.

- No care is when no additional care or maintenance activities are required after the closure activities are completed.

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- Active care is when long-term post-closure care and maintenance programs are required, and usually requires the presence of permanent personnel on site.

- Passive care is when there is a minimal need for ongoing care and maintenance programs in the post-closure stage. The level of effort required for care and maintenance can vary widely. Work may include occasional monitoring programs, annual inspection of waste storage facilities, and vegetation maintenance, but in general, permanent on-site personnel are not required.

The Project considers that after the execution of the closure activities, the site will remain in a Passive Care condition.

Table 1. Summary of the PAMs of the former Aladdin VI U.M.

Group		Mining environmental liabilities	Quantity	Partial
Mine	Underground work	Bocamina	5	11
		Chimney	3	
		Trench	1	
		Chigger	1	
		Half bar	1	
	Open Sky	Tagus	1	1
Waste management facilities		Tailings tank	2	9
		Mine clearing	7	
Processing facilities		Processing Plant	2	2
Other related infrastructures		Infrastructure	1	1
		Total	24	24

Note. CESEL S.A.

Table 2. List of PAMs in the former Aladdin VI U.M.

No.	ID	Group	PAM	UTM coordinates MINEM Inventory		UTM Lev coordinates. Topog. CESEL	
				This	North	This	North
1	564	Mine	Bocamina	357 431	8 248 192	357 429	8 248 190
2	8800	Mine	Bocamina	357 594	8 248 202	357 569	8 248 196
3	8803	Mine	Bocamina	357 622	8 248 107	357 623	8 248 102
4	8807	Mine	Bocamina	357 442	8 248 190	357 440	8 248 187
5	15039	Mine	Bocamina	357 457	8 248 200	357 460	8 248 199
6	15029	Mine	Chimney	357 595	8 248 107	357 599	8 248 104

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No.	ID	Group	PAM	UTM coordinates MINEM Inventory		UTM Lev coordinates. Topog. CESEL	
				This	North	This	North
7	15036	Mine	Chimney	357 402	8 248 201	357 401	8 248 206
8	15041	Mine	Chimney	357 591	8 248 111	357 587	8 248 109
9	15033	Mine	Trench	357 524	8 248 178	357 521	8 248 176
10	8802	Mine	Chigger	357 576	8248 146	357 564	8248 152
11	15038	Mine	Half bar	357 896	8 247 895	357 901	8 247 893
12	15031	Mine	Tagus	357 593	8 248 108	357 592	8 248 109
13	565	Mining waste	Tailings Deposit	357 751	8 248 234	357 808	8 248 352
14	566	Mining waste	Tailings Deposit	357 700	8 248 117	357 691	8 248 135
15	8717	Mining waste	Mine clearing	357 423	8 248 206	357 418	8 248 223
16	8801	Mining waste	Mine clearing	357 602	8 248 216	357 588	8 248 232
17	8804	Mining waste	Mine clearing	357 637	8 248 104	357 630	8 248 104
18	15030	Mining waste	Mine clearing	357 602	8 248 113	357 608	8 248 120
19	15034	Mining waste	Mine clearing	357 527	8 248 182	357 527	8 248 181
20	15035	Mining waste	Mine clearing	357 459	8 248 212	357 459	8 248 215
21	15040	Mining waste	Mine clearing	357 641	8 248 266	357 644	8 248 263
22	567	Processing facilities	Processing Plant	357 737	8 248 156	357 711	8 248 178
23	8806	Processing facilities	Processing Plant	357 352	8 248 169	357 338	8 248 181
24	8716	Other related infrastructures	Not determined (Infrastructure)	357 722	8 248 077	357 704	8 248 097

Note. MINEM.

The PAM closure plan has been developed within the framework of the General National Environmental Regulations, having as a legal framework the legal standards of environmental protection in force in the country, mainly Law No. 28271 that Regulates the Environmental Liabilities of Mining Activity and its Regulations approved by Supreme Decree No. 059-2005-EM modified by Supreme Decree No. 003-2009-EM. Likewise, its preparation is based on the technical standards issued by the MINEM, the competent body in environmental matters for this sector, as well as the applicable technical standards and the guide for the preparation of mine closure plans.

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Figure 3. Tailings of the former Aladino VI Mining Unit

Note. Photograph before the start of environmental remediation.

The Previous Actions Developed on Environmental Remediation, By the Santo Toribio Consortium

The activity of the former Aladino VI Mining Unit has left twenty-four (24) components (Mining Environmental Liabilities). The presence of mining environmental liabilities is a sign of the exploitation of underground mining; in addition, the area where the PAMs are located is currently an altered environment. For this reason, the Closure Plan of the PAMs. In this process, Activos Mineros S.A.C. (AMSAC), has planned the execution of the work "Recovery of the Ecosystem Services of the middle part of the Chactani Gorge of the Ilpa Basin affected by the mining environmental liabilities of the former Aladino VI mining unit", under the modality of Indirect Administration - by contract, therefore, it carries out a tender for the service of a supervisory company and will execute. The supervising company CONSORCIO CHACTANI and the company will execute CONSORCIO SANTO TORIBIO. In the archives of this process we find the ACT OF DELIVERY OF LAND. It reads: At 11:00 a.m. on Sunday, August 9, 2020, in the area of the land of the former mining unit of Aladino VI, district of Mañazo, province and department of Puno, the representative of the company ACTIVOS MINEROS S.A.C., Eng. Edison Ventura Cabana, Specialist in Works Management, Eng. Wilson Ricardo Cabrera Longa, Legal Representative of the supervisory company Consorcio Chactani, and on behalf of the contractor company Consorcio Santo Toribio, Eng. Luis Miguel Medina Quiroz, resident of the work. Subsequently, the tour of the places where the "RECOVERY OF THE ECOSYSTEM SERVICES OF THE MIDDLE PART OF THE CHACTANI RAVINE OF THE ILPA BASIN AFFECTED BY THE MINING ENVIRONMENTAL LIABILITIES OF THE FORMER ALADINO VI MINING UNIT, IN THE MAÑAZO DISTRICT, PROVINCE, PUNO DEPARTMENT OF PUNO, where the facilities were identified, accesses and areas where the works for the execution of the work will be carried out. In the descriptive report valued – liquidation of the work we find a unit cost amount of S/. 21,503,266.02 and direct cost the sum of S/. 31,347,290.55. The SANTO TORIBIO consortium was awarded to execute the work under the conditions of the PAMs.

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After 4 years of environmental remediation work, the area is restored as we can see in the following photograph.

Figure 4. Space With Environmental Restoration

Note. Remedied area. Photograph taken June 2024.

Environmental Perception

Currently, after the execution of the works, in the investigation we verify the recovery of the areas affected by the contamination of the former Aladino IV mining unit. The contaminated material (tailings areas, clearings) was removed in its entirety and capped in the area of the Surplus Material Deposit, mentioned areas where the contaminating material was removed were covered at the base of the soil with lime, then with a layer of clay, granular material, Top Soil, all in layers of 20 cm high and finally the planting of cuttings (ichu, oatmeal). At present, the recovery of the areas can be observed in relation to the natural environment. With these environmental remediation activities in this area, there is no longer any dragging of polluting material in the Jatun Mayu River in the rainy seasons to the adjacent areas. In this regard we have a story (INF-7):

Currently, with the work of Consorcio Santo Toribio for environmental remediation, the tailings are covered and there are natural pastures on it, in the rainy season it looks green as a natural area and the river is no longer polluted. When it is dry season there is no longer dust that drags polluting material, very close to the remediation work we already have potato cultivation plots and we can graze the cattle.

In relation to these assertions, the pollution that was generated before, in the context is no longer carried contaminated material. The entire area where the environmental remediation works were carried out, especially the tailings area (can be used for agriculture) and the area of deposit of surplus material (can be used for grazing area), after the completion of the works enters a Post-Closure phase that will last approximately 5 to 7 years. after that time it can only be used as an agricultural and grazing area.

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Discussion

In our country, there are regulations for mining extraction. According to Baca (2013) in his study "on the regulatory framework, he states that this entire process of extractive policies is based on the approach of the policies of the Washington Consensus, strongly implemented in Peru, since the early 90s, whose main objectives were to promote investments in the mining sector" (p. 5). So for this activity, the State has a regulatory framework for investments. But, on the other hand, there is a requirement in the mining concession system, the environmental regulatory framework, according to Domínguez (2014): "The concession grants its holder a real right, subject to said legal norm. Article 67. The State determines the national environmental policy. It promotes the sustainable use of its natural resources. These provisions are the basis for mining regulation in the country". (p. 9-11)

These extractive activities have always generated socio-environmental conflicts, so it is essential to understand about the environment in Law No. 28611, General Law of the Environment: The environment includes the physical, chemical and biological elements of natural or anthropogenic origin that, individually or in association, make up the environment in which life develops, being the factors that ensure the individual and collective health of people and the conservation of natural resources. biological diversity and the cultural heritage associated with them, among others. In the Peruvian environment, many mines are in operation and other mines have been abandoned for various reasons, where environmental rehabilitation activities were not carried out, which led to the generation of Mining Environmental Liabilities (PAMs). In our region, the former Aladino VI Mining Unit operated until approximately 1986. "These liabilities are presented in the form of waste, mining work, infrastructure, machinery, etc. of different types and in different quantities, which trigger risks for humanity and the environment" (Azcona, 2022, p. 10). In 2003, the Peruvian State enacted the Law on Mine Closure, Law No. 28090, to avoid a permanent and potential risk to the health of the population due to unclosed work, to the surrounding ecosystem and to property. In addition, concrete measures were incorporated for the closure stage. In 2004, the law regulating PAMs (Law No. 28271) was published, previously detailed. The objective of these two laws was to prevent the emergence of new PAMs.

Another important aspect of our country's environmental legislation that is based on the concept "the polluter pays" and on Law No. 28271 that regulates the environmental liabilities of mining activity are defined in Article 2, as: "those facilities, effluents, emissions, remains or deposits of waste produced by mining operations, currently abandoned or inactive and that constitute a permanent and potential risk to the health of the population, the surrounding ecosystem and the property." For Wong and Bernardo (2018), these mining liabilities have become one of the most serious pollution problems in the country. The genesis of an environmental liability is related to imbalance of nature, that is, land degradation, climate change, water pollution. According to Jensen and Birche (2018), these are combined with government policies, culture of use, management and protection of natural resources, the environment, the biophysical characteristics of the terrestrial space and climate variability. Since 2004, interest has been taken in our Peruvian context with the aim of identifying, characterizing and evaluating Mining Environmental Liabilities in order to allow their prioritization and remediation.

In this context, Activos Mineros S.A.C. (AMSAC), the state-owned company that is a leader in mining environmental remediation that is recognized for recovering areas altered by mining and that contributes to the sustainable development of the country, in alliance with private investment. In accordance with Ministerial Resolution 482-2012-MEM/DM and Ministerial Resolution 094-2013-MEM/DM, AMSAC was commissioned to remediate 475 mining environmental liabilities, distributed in the regions of Cajamarca, Lima, Ancash, Puno, among others (Chappuis, 2019, p. 15).

In compliance with current environmental legislation on the Closure of Environmental Liabilities of mining activity, Activos Mineros S.A.C., hereinafter AMSAC, commissioned the consulting firm CESEL S.A. to prepare the Closure Plan for the Mining Environmental Liabilities of the former Aladino VI Mining Unit located in the district of Mañazo. province of Puno, Puno region. The former Aladino VI Mining Unit is composed of twenty-four (24) liabilities, the presence of mining environmental liabilities indicates

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previous work of exploitation of an underground mine, the area where the PAMs are located is a currently altered environment. There is the PAM Closure Plan, as a technical document that made it possible to determine the most viable strategies, criteria and measures for the closure of liabilities. The closure of the PAMs includes the stabilization and environmental rehabilitation of the same, as well as their subsequent maintenance and monitoring. In this case, on environmental remediation developed by the Santo Toribio Consortium in the peasant community of Cari-Cari - Mañazo - Puno. It is with a positive perception for the community members that PAMs are being made invisible in this area.

Another important aspect is that when we see the effects of environmental pollution, we are already recognizing the environmental conflict, and it helps us to understand "the divergences of perspectives and interests and the relations of power and resources that exist between the parties that make up the conflict" (Urkidi, 2008). In the cases of the visibility of PAMs, the experience in the community is substantial, the collateral effects of environmental pollution require immediate intervention for environmental remediation.

The perception of environmental remediation in the peasant community of Cari-Cari is positive, where the inhabitants experience it within their own cultural structure of beliefs, values, experiences, knowledge in their environment. "The perception of reality is defined as the personal vision that the producer has of his objective situation based on factors exogenous and endogenous to the company. It is constructed from three indicators: the perception of the internal environment, the perception of the external environment and the perception of the future situation" Vargas, 1994, p. 48). "The perception of external reality in a selective and organized way and not exactly as reality objectively is, constitutes a human characteristic. It is transformed in order to be assimilated through previous repertoires." Díaz and Mantins (1986) cited by (Muani, 1994). For its part, Careddu (1996) considers that "perception is the personal vision that the producer has of his situation, giving meaning and meaning to reality within the framework of his experiences, values and needs" (p. 28).

Mining activities have generated future damage, "related to the existence of certain latent conditions in society" Lavell (1996). These realities have to be remedied at some point according to the regulations in force. But, in this context. perception is substantial. For this reason, "the surrounding environment and the degree of perception that the population has of this condition, will be shaped by culture, education and social influences, and as indicated" (Sánchez-Vázquez et al., 2015, p. 10), the notions of harmony with the natural community are fundamental, so when an action such as mining exploitation generates or alters the harmony of the fluidity of natural life in the community, generates environmental conflict.

The research of Cortes (2009) presents us with the analysis of the perception of the population from the qualitative and quantitative paradigm. Regarding the qualitative method, he focused that: "qualitative methodologies have been used to evaluate the perception of risks in environmental exposures. Particularly to know how various groups understand environmental risks." There are ways to present the perceptions of risk in a community testimony on environmental problems, according to Cortes (2009) it is mentioned that: "the perception of risk is determined by emotional aspects". Emotional aspects determine the perception of risk and these are also shaped by the way in which local actors relate, in the sense of attachment, that they may have with their immediate geographical environment, indicating it according to Sánchez-Vázquez et al. (2015) as "identity of place". In this research, "it is explained that this variable is key when analyzing socio-environmental conflicts and the community's perception of themselves." "This is why the emotional state of the population acquires great relevance in the analysis of perception, since exposure to recent conflicts or greater personal value could affect the response that the population has about the general perception associated with other environmental risks" (Poma, 2012).

Conclusions

The presence of mining environmental liabilities (PAMs) is a clear testimony to the underground mining operations carried out in the past, whose activities left a significantly altered environment. These liabilities represent a latent and permanent risk to the health of nearby populations, due to mining operations that were not properly closed, which has allowed continuous exposure to toxic materials and unsafe conditions.

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The impact of these PAMs is not limited only to human health, but extends to the surrounding ecosystem, affecting the quality of soil, water and air. These alterations have generated a deterioration in ecosystem services, essential for the well-being of the community.

The environmental remediation actions are related to the assets Mineros S.A.C. (AMSAC) commissioned the consulting firm CESEL S.A. to prepare the Plan for the Closure of Mining Environmental Liabilities and the Santo Toribio Consortium was in charge of environmental rehabilitation, these interventions have been essential for sustainable development, since they have minimized impacts, they restore ecosystems, control pollution and properly manage waste. These initiatives strengthen trust with the community, which promotes a healthy environment and generates development opportunities, highlighting the importance of responsible mining management committed to environmental, social and ethical criteria.

The perception of the residents about the execution of environmental rehabilitation activities by the company Consorcio Santo Toribio is positive, they assert that mining pollution is gradually disappearing in the community. The community has the main activities such as agriculture, and currently the animals are no longer sick with grazing, the breeding of agriculture is normal. In the research we found that the environmental restoration carried out by the Santo Toribio consortium is having achievements and meeting the objectives of environmental rehabilitation in the Cari-Cari community.

Acknowledgments

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Conflict of Interest Statement

There is no conflict of interest.

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