EXECUTIVE SUMMARY

1 GENERAL ASPECTS

In the pipeline of potential hydroelectric projects identified by HMV Ingenieros Ltda. ("HMV") is the San Matías project, which takes advantage of the waters of the San Matías River and is intended to be registered as a clean energy project under the CDM framework. The project is located in the eastern area of Antioquia, approximately 95 km away from the city of Medellin, in the jurisdiction of the municipalities of Cocorná and Granada.

To develop the project, HMV requested the Corporación Autónoma Regional Rionegro Nare ("CORNARE")-, the local environmental authority, to express its pronouncement on the need to develop an Environmental Assessment of Alternatives ("EAA") for the hydroelectric development of the San Matias River. CORNARE provided an affirmative response and afterwards, selected the project that required an Environmental Impact Study ("EIS") as stated in Resolution 112-0306 dated as of August 23rd, 2010.

As required by CORNARE under the terms of reference for the EIS, HMV performed field work from September 2011 through March 2012 in order to complement the information previously collected during the EAA.

The EIS consists of 11 chapters:

- **Chapter 1. Introduction**. This chapter describes the general characteristics of the project such as its background, goals, scope, and work methodology.
- **Chapter 2**. **Project Description**. This chapter: (i) contains the technical specifications of the project in terms of its feasibility during both the stages of construction and operation; and (ii) presents project facilities design.
- **Chapter 3**. **Description of the Area of Influence**. This chapter contains an identification of the project's area of influence and describes the current state of the elements and components of the area's environment (physical, biological, and social). This chapter presents a comprehensive analysis of these components in order to establish its environmental sensitivity.
- **Chapter 4**. **Demand for natural resources**. This chapter contains an identification and quantification of the natural resources that may be affected by the project. This chapter also enumerates the permits, concessions, or authorizations required by the project.
- **Chapter 5**. **Identification and assessment of environmental impacts**. This chapter contains an identification and evaluation of the main environmental impacts of the project. Also, the chapter presents an analysis of potential cumulative impacts and their economic assessment.

- **Chapter 6**. **Zones for environmental management.** This chapter contains a synthesis of the vulnerability of the identified environmental units and a classification of the exclusion and intervention areas with, or without, restrictions.
- **Chapter 7**. **Environmental Management Plan.** This chapter presents the environmental management programs designed to prevent, mitigate, correct, and compensate for the project's impacts during construction and operation.
- **Chapter 8**. **Monitoring and follow up Plans.** This chapter describes the main measures that will allow us to effectively monitor and keep track of the implementation of the prevention, mitigation, remediation, and compensation programs described in the Environmental Management Plan for the physical, biotic, and social components.
- **Chapter 9**. **Contingency Plan**. This chapter presents the project's risk analysis and the emergency and contingency measures designed for the project's construction and the guidelines for its operation.
- **Chapter 10**. **Abandonment and Final Restoration Plans**. This chapter describes the various activities aimed to restore the initial conditions of the areas directly affected by the project.
- **Chapter 11**. **1% Investment Plan.** This chapter presents the technical and economic proposal for the implementation of the investment of the "1 % plan", as regulated by Decree 1900 of 2006.

2 PROJECT DESCRIPTION

2.1 LOCATION

The San Matías hydroelectric project is located in the eastern part of the department of Antioquia, about 95 km away from the city of Medellin, in the jurisdiction of the municipalities of Cocorná (Los Mangos, La Inmaculada, and San Lorenzo counties) and Granada (La arenosa and Las Faldas counties).

2.2 TECHNICAL DESCRIPTION OF THE PROJECT

The San Matías hydroelectric project will take the turbinated waters from the El Molino hydroelectric project, which in turn will take a portion of the flow from the San Matias River for electric energy generation.

At the exit of the El Molino's power house, a tank will be installed to: (i) slow down the turbinated waters and take them into the El Molino's discharge channel (assuming San Matías is not in operation); and (ii) supply water to the San Matias project (if San Matías is operating).

The San Matías hydroelectric project will have an installed capacity of 21 MW, a design flow of 10 m^3 /s and a net head of 239.2 m. The conduction facilities are approximately 3.4 km long.

In general, the project consists of a still tank, a box culvert, a conduction tunnel, a relief pipeline (*almenara*), a valve house, a pressure line, an overground power house, and a discharge channel.

2.2.1 Intake facilities

The still tank, which will guarantee the required level of submergence for the El Molino's turbines, will also be the cargo tank for the San Matias project. This tank is 31.7 m in length, 8.0 m in width, with a normal level of waters at 1,016.8 meters above sea level ("MASL") and a floor level at 1,011.3 MASL, while the tank's walls will be located at 1,018.2 MASL (see chart 2148-12-CV-DW-20).

Located on an edge of the still tank, there will be a descending ramp with a slope of 2 H:1V to decrease from the 1011.3 MASL level down to the a 1010.7 MASL level in a distance of 1.2 meters. This will guarantee enough submergence level as to prevent the creation of vortices in the entrance of the pressure system.

2.2.2 Conduction facilities

The conduction starts at one end of the still tank with a square box culvert of 3.9 m in width, 15.8 m in length and a longitudinal slope of 0.8%. The culvert or conduction gallery will run perpendicular to the El Molino's power house, right under its assembling room.

The last two meters of the box culvert will be comprised of a transition section of 2.0 m in length beginning with a square section of 3.9 m in width to a horseshoe amended section of 3.1 m in diameter of excavation. The tunnel will be 2,249.6 m long and will have a slope of 0.8 %. The first 100 m of the tunnel will be covered with hydraulic reinforced concrete to form an effective circular section of 2.5 m in diameter.

After the tunnel, the conduction will continue with a pressurized pipe made of Glass Reinforced Polyester (GRP) of 1,131.6 m in length. The GRP pipe will start in the exit portal of the tunnel and will run down the natural hillside towards the San Matías project's power house. The GRP pipe will be buried most of the way and will have a first tranche of 1.90 m in internal diameter and 865.2 m in length, followed by a tranche of 266.4 m in length and 1.80 m in diameter.

2.2.3 Power house

The power house will be overground and it's projected on a high plain area located at the confluence of the San Matias and Cocorná rivers, on a small square at 768.00 MASL, in a point where good founding conditions are expected for both the power house and the main equipment. Moderate excavations will be required for the square and the substructure. The power house of San Matías will be a continuation of the power house of El Popal, a small hydroelectric project currently under construction. The San Matías' power house can be reached by a road of approx. 3.3km, derived from the Medellin – Bogota highway, about 95 km away from the city of Medellin, in the jurisdiction of the municipality of Cocorná. The discharge system for the turbinated waters will take those waters into a free flow channel, which in turn will them back into the San Matias River, at an elevation of 752.0 MASL.

The drawing of the power house contains a building with two adjacent galleries. The main gallery will host two generating units equipped with Francis turbines of horizontal axis, 10.5 MW each, and their corresponding synchronous generators and intake valves. The second gallery will contain the auxiliary services room, the control room, and the administrative offices, kitchen, and sanitary services.

The water discharge from each unit will be made through a suction tube and a channel - tank that will guarantee the submergence level required by the turbine. These structures will take the waters into a discharge channel and carry them into the San Matias River, at an elevation level of 752.0 MASL, at the point of coordinates and 885,088 and 1,159,736 N, measured at the intersection of the axis of the channel and the river bank.

2.2.4 Tailrace

The waters turbinated by the project will be discharged into the San Matias River at the coordinates 885,088 and 1,159,736 N, elevation level of 752.0 MASL. Initially, the waters will be conducted through two box culverts of 15.6 m and 5.7 m in length and 2.8 m in width and 2 m in height, one per unit with a slope of 0.2 %. Downstream the connection point between the two culverts, the water will be conducted through a square box culvert of 1.8 m in width and a slope of 1%, in a length of 268.8 m, with a free flow operation and supercritical regimes.

The next tranche will consist of an open channel of 11.8 m in length and a slope of 0.4% whose designs foresee the formation of a hydraulic jump and the establishment of a flow of subcritical regime before the discharge structure. This structure will consist of a transition section to an open channel of 5 m in width, a descending ramp of 4.0 m, a still pool of 5.0 m and a structure of power dissipation of 30.4m, with a gradient of 50%. At the base of the structure, various stoppers, or concrete blocks for the dissipation of energy, will be located.

2.2.5 Connection to the grid

The project will be connected to the substation Nueva Cocorná through two air circuits at 110 kV of 80 m in length that will be derived from the transformers. This connection to the National Transmission System ("STN") will be located close to the project's power house and will be owned by the grid operator, or the agent appointed by the Mining and Energy Planning Unit -UPME- for such purposes, with the exception of the arrival bays of the lines, which will be owned by the project.

2.2.6 Access roads

The project area can reached by the Medellin - Bogota Highway, which is close to the municipality of Cocorná. Since the water intake of the San Matias project corresponds to the discharge system of El Molino project and to the entrance of the San Matías' conduction tunnel, the access road to the tunnel entrance will be the same as the road used to reach El Molino's power house.

The access road to the San Matías' power house will be the same as the road used to get to El Popal project. This road starts in the Bogotá - Medellin Highway, in the location known as "La Mañosa".

Therefore, the San Matías project will require the construction of only 610 m of new access roads running towards the exit portal of the project's conduction tunnel which will depart from the exit portal of El Popal's tunnel, with an average gradient of 11 %.

3 ENVIRONMENTAL CHARACTERISATION

3.1 AREAS OF INFLUENCE

3.1.1 Area of direct influence (ADI)

According to the Terms of Reference of the Ministry of Environment, Housing and Territorial Development, for Environmental Impact Studies, for the Energy Sector, and the Construction and Operation of Hydroelectric Power Stations Generating I-B-1-01, *"the area of direct influence of a project is where the environmental impacts of the activities of construction and operation are manifested; the area is related to the project's site and corresponding infrastructure."*

For the abiotic and biotic environments, the area of direct influence is composed of those areas to be occupied by the project's works: intake, power house, workshops, industrial squares, camp, access roads, and reservoir zones. Total area is 8.42 ha.

Also, the area includes those locations adjacent to the San Matias River, between the project's intake and tailrace, where a reduction of flow rates is expected.

Regarding the socio-economic component, the area of direct influence includes the municipal territories affected by the project's works and the associated reduction in the river's flow. Total area includes the following counties: (i) La arenosa and Las faldas (municipality of Granada), which will be affected by the reduction in river flow; and (ii) Los mangos, La inmaculada, and San Lorenzo, which will be affected by the project's works and the reduction in river flow.

3.1.2 Area of indirect influence (AII)

The area of indirect influence is defined in the Terms of Reference of the Ministry of Environment, Housing and Territorial Development for hydroelectric projects as: *"the area where the environmental impacts transcend the physical space of a project and its associated infrastructure, i.e. the area outside the reach of direct influence and extends on to where such impacts are manifested".*

According to this definition, for the physical and biotic environments, the project's impacts would be perceived in the following sites: (i) a land strip of watershed between the San Matias and Cocorná rivers, on the right bank of the San Matias River; and (ii) a land strip between the existing roads to La arenosa and Las Faldas, up to where the effects of a reduction in the river flow would be perceived.

As for the socio-economic environment, the AII comprises the municipalities of Cocorná and Granada because they constitute the administrative centers and social and cultural units around the San Matias hydroelectric project.

3.2 ABIOTIC ENVIRONMENT

By communication number 47308 dated as of December 12th of 2011, HMV required from CORNARE information on the existing water uses in the project's area of influence. By memorandum number 134-0241 dated as of December 21st of 2011, CORNARE reported that, according to its database, there are no other water concessions for use of the basin or its drainages.

In general, we can state that the relevant sector of the San Matias River has good sanitary conditions (category 4 of 5). During the studies, we observed that 71% of the variables of interest presented high levels (>80), except for the coliform, which presented low values in all the evaluation sites. It's important to highlight the high values observed for OD, pH, T and nitrates which is characteristic of a healthy river in terms of its capacity to sustain a diverse aquatic biota.

According to the air quality study we performed in the San Matías' area of influence, which included the installation of monitoring stations in Los mangos and La Inmaculada, the levels of PST, PM10, SO2, NO2 and CO comply with the requirements of the current legislation and therefore, do not represent a risk for the health of the people.

During the noise monitoring studies, we found that in all the evaluation points, the existing noise levels are higher than the maximum regulatory levels. However, the sources of the existing noise are the water streams and animals surrounding the project's area of direct influence.

3.3 BIOTIC ENVIRONMENT

In the project's area of indirect influence, we observed a prevalence of the secondary low vegetation (SLV), followed by the clean pastures (CP), the secondary high vegetation (SHV), and the arboreal pastures (AP). This fact shows the high degree of intervention traditional to this area and the low natural regeneration in the abandoned zones.

As for the project's area of direct influence, the dominant coverings are the clean grass (31.18%), the secondary high vegetation (22.22%) and the arboreal pastures (15.42%). The coverings with lower levels of intervention are the forests (dense, dense with guadua, and open), thin arboreal pastures (0.41%), and forests with medium and high intervention (3.12% and 1.98% respectively). The low percentage of natural coverage in this area reflects the area's high degree of intervention, dominated by the agricultural activity.

Regarding the terrestrial fauna, the mammals in particular, we identified three endemic species *Saguinus leucopus* (gray titi monkey), *Proechimys magdalenae* (spiny rat), and *santanderiensis Microsciurus flaviventer* (cusca ardita) and three species categorized as vulnerable: *Saguinus leucopus* (gray titi gray monkey), *Aotus lemurinus* (marteja or night monkey) *Lontra longicaudis* (Otter) and *Leopardus wiedii* (Margay).

Regarding the birds, we identified two endemic species: *Habia gutturalis* (Habia ahumada) and *Ortalis columbiana* (Colombian guacharaca).

As for the amphibians, most of the species were found to inhabit the coverings with the higher structural complexity, indicating a high availability of shelter, food, breeding areas, and, in general, conditions favorable to the maintenance of populations of this group.

Regarding the presence of fish in the area, we identified only 15 individuals grouped into five species: *Astroblepus homodon* (capitancito), *Hemibricon boquiae* (sardine), *Trichomycterus caliense* (briola), C*haetostoma leucomelas* (Cucho) and *Cordylancistrys sp* (Cucho). **None of the species is migratory**.

Some of the flora species categorized as threatened or included in the CITIES list show today good population sizes inside CORNARE's jurisdiction. According to Agreement 262 dated as of November 22nd, 2011, which declares an undefined ban on some forest species inside CORNARE's jurisdiction, none of the identified species in the region is categorized as threatened.

As for the fauna species, although some are registered as endemic in Colombia they have good population sizes inside CORNARE's jurisdiction (e.g., Saguinus leucopus) and therefore are not threatened in the region.

3.4 SOCIAL ANDECONOMIC ENVIRONMENTS

3.4.1 Demographic aspects

There are five counties (in Spanish "*veredas*") that will be affected by the San Matías hydroelectric project, representing a combined population, according to the data obtained during field work, of 893 people. Of this population, 709 live in the municipality of Cocorná and represent only 4.68% of Cocorná's total population (15,119 persons). The remaining 184 people live in the municipality of Granada, representing 1.87 % of the municipality total population (9,789 persons) and covering a total area of 20.77 Km². Almost 100% of the population that inhabit the affected *veredas* live under poverty conditions, reflecting the area's harsh conditions.

3.4.2 Spatial Dimension

The urban sectors of both Cocorná and Granada enjoy a high percentage of utilities coverage; On the contrary, in the rural areas the coverage is much lower. This contrast is explained by the high dispersion among the rural homes, which complicates the access to the public services, and by the collective equipment of each one of the *veredas*. Electric power is the big exception: almost 100 per cent of the inhabitants of the area of direct influence, as well as the populations of the rural areas of both municipalities, have access to this service.

Also, in terms of social services such as health and education, the urban sector enjoys a better supply than the rural area; the inhabitants of some *veredas* have to travel to more populated towns or to the urban sector when they require access. Even the *veredas* that offer these services have significant gaps in terms of staffing and infrastructure. It is important to point out, however, that in terms of education, the number of students enrolled in the rural area of Cocorná proves to be greater than the number of students in the urban area.

In regard to the supply of served waters and garbage, the *veredas* do not have access to these services whereas in Cocorná and Granada, the supply of these services is quite precarious.

The municipality of Cocorná has an infrastructure that, in general terms, provides its citizens with the basic health care services (first level of complexity). In Granada, a general ignorance prevails among the communities about the health care services, particularly the complex services, and therefore the potential users do not demand the services. The low demand is also explained by the transport limitations and the lack of economic resources to pay the cost.

3.4.3 Cultural aspects

The inhabitants of the project's area of influence are farmers who, after the end of the forced displacement created by the Colombian armed conflict, have returned to their places of origin and are currently growing cane, banana, coffee, beans, maize, cassava, and citrus fruits. In the *veredas* of the municipality of Granada, the main crops are tomato and cucumber. The

cultural traditions of the area's inhabitants correspond to the much broader context of the *paisa* culture (i.e., characteristic to Antioquia), where food, popular festivals or patron saints, labor and productivity to achieve the daily support, family, and religion are critical elements.

3.4.4 Economic aspects

The productive processes of Granada and Cocorná are characterized by a predominance of the agricultural activity, followed by livestock production, and trade. The most representative crops are coffee, sugarcane, and bananas. There are also transitory crops (semi-annual cycle) such as *chonto* tomato, corn, beans, potatoes, carrots, cabbage, and cucumber. It's also important to highlight the relative increase in the growing of fruit trees, a diversifying type of crop. Because of the high unemployment level of these two municipalities, a significative portion of the population usually migrates to other municipalities for work opportunities. Regarding land tenure, there is a prevalence of the small property scheme in the municipalities and in the *veredas* inside the project's area of influence. Under this scheme, farms' size range between one half and three hectares, although some farms may have 20 ha in extension. There is also a prevalence of ownership with payment to others.

Today, the populations of Cocorná and Granada seek to restore their ancient socio-economic and cultural dynamics, following the alleged culmination of a war that affected their economic activities, forcing them to the displacement and the abandonment of their land, and to the adoption of a new way of life in urban and strange contexts, usually in cities such as Cali, Barranquilla, and Bogota.

3.4.5 Political-Administrative dimension

During the last decade, the municipalities of Cocorná and Granada were the stage of a humanitarian tragedy of serious proportions; a territorial armed struggle was developing among the Country's regular forces, two armed fronts from the ELN guerrilla, two fronts from the FARC guerrilla, and three paramilitary fronts.

Following the demobilization process of paramilitary groups started in 2006, which reconfigured the war scenario between the guerrillas and the paramilitaries, and after many years of abandonment of both the urban sector and rural areas of these municipalities, people started to return home, about five years ago, supported by the Department for Social Prosperity and other institutions.

Today, Cocorná and Granada enjoy closer relationships among the municipalities' administrative bodies and also among those bodies and the communities. These relationships are developing outside the scope of traditional political associations. Now, the previous statement does not imply an end to the patronage or sponsorship to political organizations, nor does it mean that these organizations have stopped framing their actions in the traditional bipartisanship.

Regarding the credibility and image of the local institutions, perceptions vary from one municipality to another, as well as among the various entities, whether local, national, or departmental. This situation depends largely on the degree of commitment, performance, and continuity of the officer in duty.

4 IDENTIFICATION AND ASSESSMENT OF IMPACTS

In the qualitative evaluation, we identified 30 potential impacts of the San Matias project: seven in the abiotic environment, six in the biotic environment and 17 in the socio-economic environment, including one with both positive and negative consequences.

Abiotic environment:

- Three out of the seven identified negative impacts were categorized as "irrelevant": (i) increase in levels of sound pressure (2.2); (ii) alteration to river dynamics (2.2); and (iii) changes to the physical and chemical properties of the soil (1.7) in areas where this latest effect cannot be prevented as the ground will be replaced by a hard surface. Now, although this effect will be compensated by reforestation programs and mitigated with proper management of the excavations made during construction, its low rating is explained by the fact that the affected area is less than 2% of the project's area of influence.

  As for the "alteration to river dynamics", this impact was categorized as "irrelevant" because the changes in the river dynamics are mainly generated by the presence of the El Molino hydroelectric project, which requires the construction of a diversion dam on the San Matias River and the establishment of a flow for environmental guarantee. The San Matias hydroelectric project takes advantage of the turbinated waters from the El Molino project, without interfering with the dynamics of the river. The San Matias project will prolong only a stretch of around 3 km with the remaining flows from the El Molino hydroelectric project.

- Three impacts classified as "moderate" can be prevented or mitigated: (i) increase in the concentration of particulate material (3.1); (ii) changes in the water quality (3,3); and (iii) modification of the landscape (4.1).

  A fourth "moderate" impact is the decrease in water availability (4.5) related to the possible effect that the conducting tunnel may generate on the surface currents located along its alignment. Now, the present EIS describes a program designed to monitor the surface waters and establish if this effect is actually occurring.

  It is also worth mentioning that the Environmental Management Plan for the San Matías hydroelectric project sets out a hydrogeological study of the entire area in order to establish the actual effect of this impact.

Biotic environment:

- The biotic environment is affected by the greatest negative impact of the San Matias project: Increased pressure on natural resources. This impact was categorized as "relevant" with a rating of 6.64, a grade that nets the positive impacts of the project: improved local transportation as the community will gain access to the forest areas.

  The impact will be mitigated with: (i) environmental education programs aimed at the population of the project's area of influence; and (ii) joint work between the project's sponsor and the municipal administrations of Cocorná, Granada, and CORNARE.

- Besides the above mentioned effect, the project generates five additional negative impacts to the Biotic environment, including two categorized as "Irrelevant": (i) changes to the fish community of the San Matias River (2.3); and (ii) changes to the structure of the aquatic biotope and biocoenosis (2.3). The impacts are explained by the presence of the El

Molino hydroelectric project whose intake facilities will alter the ecosystems of the San Matias River. The San Matias hydroelectric project uses only the turbinated waters from El Molino.

As for the remaining three negative impacts (changes to vegetation 4.9, loss or fragmentation of habitats 4.7, and death and displacement of terrestrial animals 3.4), the environmental management is very much related to the mitigation of changes in the vegetation covering and the establishment of environmental education programs including topics such as management of natural resources.

Socio-economic environment:

- Of the 17 identified impacts, five are positive, including two categorized as "relevant": (i) improved governance; and (ii) modifications to the municipal finance and regional corporations, with ratings of 6.2 and 5.7, respectively. The remaining three positive impacts were categorized as "moderate": (i) increase in the demand for goods and services (3.4); (ii) generation of temporary employment (4.5); and (iii) changes to the local mobility (3.8).

- One impact was regarded both as positive and negative: the effect on the archaeological heritage, an impact categorized as "moderate" with a rating of 3.6. The positive effect is the compliance with the provisions of Act 163 of 1959 and decree 264 of 1963 that demand from hydroelectric projects to perform preventive archeology works to help in the recovery of the knowledge of the early inhabitants of the project's area of influence.

- Twelve impacts were identified as negative, although they are preventable, including:

    a. Two impacts categorized as "Relevant": (i) generation of expectations (5.09); and (ii) generation of problems for the community (5.95). The impacts are explained by the former living conditions in the project's area of influence and the position of some organizations on power generation projects. These two effects can be prevented with the development of an information program, the community participation, and the establishment of environmental education and labor recruitment programs.

    b. Four impacts categorized as "Irrelevant": changes in population dynamics (1.8), pressure on the real estate market (0.8), increases in the risk of accidents (2.2) and variation in the levels of sanitation (1.0) .

    c. The remaining six impacts were categorized as "Moderate": effects on economic activities (2,8), effects on the cultural heritage (3,8), strengthening of conflicts (2.6), displacement of infrastructure and housing (3.8), changes in the uses of the soil (3.3) and effects on cultural heritage (3.8)

5 TO MITIGATE AND PREVENT THE PROJECT'S IMPACT THREE PROGRAMS WILL BE DEVELOPED: INFORMATION AND COMMUNITY INVOLVEMENT, INSTITUTIONAL AND COMMUNITY STRENGTHENING, AND EDUCATION. AN ECONOMIC ASSESSMENT OF THE IMPACTS IS PRESENTED IN SECTION 5 OF THIS DOCUMENT.ENVIRONMENTAL MANAGEMENT PLAN

In the following table it is presented a summary of the Environmental Management Plan and a summary of their costs:

Management plan	Impacts to be managed	Cost ($)
Environmental interventory group		378.000.000
Environmental management group		430.267.600
Handling and disposal of materials	Increasing of concentration of particulate material and gases Changes in the physical and chemical properties of the soil Landscaping modification	The costs of this project are included in the civil work.
Handling of sources of particulate material, gases y noise emissions	Increasing of concentration of particulate material and gases Increasing of the sound pressure levels Potentiation of conflicts Generation of expectations	84.000.000
Handling of liquid residuals	Changes in water quality Decreasing of water availability Alteration of flow dynamics. Changes in the physical and chemical properties of the soil	The costs of this project are included in the civil work.
Handling of solid, domestic, industrial and dangerous materials	Increasing of concentration of particulate material and gases Changes in water quality Decreasing of water availability Changes in the physical and chemical properties of the soil Potentiation of conflicts Generation of nuisances to the community Variation of sanitation levels	98.000.000
Management of vegetal coverage and soil removal		10.810.000
Flora rescue	Changes on the vegetal coverage Increasing of pressure on natural resources	71.223.085
Compensation for allocation to hedges woodlands - shaping biological corridor	Changes on the vegetal coverage Increasing of pressure on natural on natural resources Habit losses or fragmentation	435.201.400
Information and community participation	All the identified impacts	60.760.000
Environment education for the workers	Affectation of cultural heritage Potentiation of conflicts	57.260.000

Management plan	Impacts to be managed	Cost ($)
	Changes in the population dynamics Demand of goods and services Variation of sanitation levels	
Environmental education to the community		
Environmental Education project	Generation of expectative Generation of nuisances to the community Potentiation of conflicts Increasing in the concentration of particulate material and gases Increasing in the sound pressure Water quality changes Changes in the vegetal coverage Death and displacement of terrestrial fauna Increasing of pressure on natural on natural	156.000.000
Reading and writing for adults		32.400.000
institutional and communitarian strengthening	Generation of expectatives Temporal generation of work Modification of local mobility Increasing demand of goods and services Modification of the municipal finances and the environmental corporations. Affectation of cultural patrimony Potentiation of conflicts Variation of sanitation levels	40.000.000
Relocation of infrastructure and houses	Displacement of infrastructure and housing Changes of the population dynamics Generation of expectations . Potentiation of conflicts Affectation of economic activities Generation of nuisances to the community	101.003.000
Hiring of labor work	Generation of expectations . Generation of temporal work Affectation of economic activities Generation of nuisances to the community Potentiation of conflicts Displacement of infrastructure and housing	The costs are included in Environmental management group expenses
Restoration of economic conditions	Generation of expectatives Modification of local mobility Displacement of infrastructure and housing Affectation of economic activities Generation of nuisances to the community Changes in the use of soil	42.000.000
Rural entrepreneurship	Generation of expectations .. Potentiation of conflicts Changes on the population dynamics Increasing demand of goods and services. Affectation of economic activities Displacement of infrastructure and housing	459.500.000
Memory and cultural patrimony	Generation of expectations Affectation of the cultural patrimony Modification of local mobility Displacement of infrastructure and housing Changes of the population dynamics	37.200.000

Management plan	Impacts to be managed	Cost ($)
	Pressure on the real estate market Generation of nuisances to the community Affectation of the archaeological patrimony.	
Restitution of affected infrastructure	Affectation of the cultural patrimony Potentiation of conflicts. Damages caused to third parts Generation of expectatives	The cost are included in the Environmental management group and the civil work
Monitoring and follow up plan		271.791.400
Contingence plan		303.570.000
Total		**3.068.986.485**

6 FOLLOW UP AND MONITORING PLAN

In the following table it is presented the programs of monitoring and follow-up and a summary of the costs.

Programs	Costs ($)
Monitoring of residual waters	30.608.000
Monitoring of superficial waters	70.000.000
Monitoring of quality of air and noise	128.000.000
Monitoring of terrestrial habitat	30.733.400
Monitoring of social environment	12.450.000
Total	**271.791.400**

7 CONTINGENCY PLAN

The general criteria of the Contingency Plan that are presented must be specified and detailed by the constructor and the owner of the project, in the stages of construction and operation respectively, depending on how it is organized to develop the activities of the focused

To evaluate the contingency are used the criteria of menace, vulnerability and risk, which are defined as follows:

- Menace. It is understood as the probability of occurrence of the phenomenon, with certain intensity and potentially harmful to people, property, infrastructure, or the environment, within a specific period of time and in a geographically limited area.
- Vulnerability. Degree of loss or damage to an item or group of elements at risk, as a result of a likely occurrence of a disastrous event.
- Risk. Destruction or expected loss obtained from the convolution of the threat or probability of occurrence of hazardous events and the vulnerability of the exposed elements to such threats; mathematically is expressed as the probability of exceeding a level of economic and social consequences in a certain site, in a certain period. Principio del formulario

For the risk assessment was used the methodology raised by Arboleda and Zuluaga that define the risk such as:

$$R = A \times V = P \times I$$, where

- R = Qualitative value of the risk.
- P = Probability of occurrence of a threat = A.
- I= Intensity and severity of potential consequences V.

And establishes the following classification

- Acceptable Risk (1-4), which do not represent a significant threat to the environment and their consequences are minor.
- Tolerable risk (5-9), which are those that can cause more significant damage to the environment, thus requiring the design of care plans.
- Critical Risk (10-20), which can result in serious damage on the environment and require priority care plans and in the short term, with high availability of resources and with an intense monitoring.

In the hydroelectric project in San Matias the identified events are classified as follows:

- Acceptable risks. In this category were classified contingencies generated by flood, earthquake, Failure of the tunnel driving, fire.
- Acceptable risks. In this category were classified contingencies generated by flood, earthquake, Failure of the conducting tunnel, fire.
- Critical Risk: Are associated events associated with public order

The previous rating served to design the programs of the attention to these events..