ALTO MAIPO HYDROELECTRIC POWER PROJECT

ENVIRONMENTAL AND SOCIAL STRATEGY[(1)]

I. SUMMARY

Country:	Chile
Sector:	Renewable Energy - Hydropower
Project name:	Alto Maipo Hydroelectric Power Project
Source of the deal:	SCF/INF
Project team:	Brian Blakely, Project Team Leader (SCF/INF), Federico Lau (SCF/INF), Joana Pascual (SCF/INF), Jose Felix-Filho (VPS/ESG), Ulrike Aulestia Vargas (SCF/PMU) and Jan Weiss (SCF/SYN)
Supervisor:	Jean-Marc Aboussouan (Chief, SCF/INF)
Borrower:	*Alto Maipo SPA ("Alto Maipo" or the "Borrower")*
Sponsor:	*AES Gener S.A. ("AES Gener")*
Total project cost:	Approximately US$1.375 billion
IDB A Loan:	Up to US$[200]million
Environmental Category:	"A"

II. BACKGROUND AND PROJECT DESCRIPTION

Introduction

2.1 The Alto Maipo Hydroelectric Project (*Proyecto Hidroeléctrico Alto Maipo – "PHAM"* or "the Project") consists of the construction and operation of two run-of-the-river hydroelectric facilities with a combined capacity of 531 MW (Alfalfal II, with a capacity of 264 MW and Las Lajas, with a capacity of 267 MW) located approximately 50 km east of Santiago, Chile **(see Figures 1 and 2)**. The two plants will use the waters of the upper basin of the Yeso and Volcán rivers, as well as the waters of the middle and lower course of the Colorado River in the Commune or Municipality of San José de Maipo.

2.2 The PHAM will capture flow from four tributaries to the Volcán River, the Yeso River, the Aucayes Stream, and the Colorado River (via the existing Alfalfal I and Maitenes Hydropower Plants), all of which are tributaries to the Maipo River, to operate the Alfalfal II and Las Lajas powerhouses in series prior to discharging to the Maipo River. Development of the PHAM will also involve the construction of approximately 67 km of tunnels, four inverted siphons to cross streams, two

(1) This Environmental and Social Strategy (ESS) is being made available to the public in accordance with the Bank's Access to Information Policy. The ESS has been prepared based primarily upon information provided by the project sponsors and does not represent either the Bank's approval of the project or verification of the completeness or accuracy of the information. The Bank, as part of its due diligence on the feasibility of the project, will assess the environmental and social aspects.

forebays[(2)] with surface areas of 0.25 ha and 7.5 ha, and associated facilities, including: approximately 31 km of new access roads, four new bridges, 17 km of new transmission lines (110/220 kV), and upgrades to existing roadways and electrical substations **(see Figures 3 and 4)**. The Project will not require dams or reservoirs.

2.3 The majority of the works will be underground, including powerhouses, siphons and water adduction systems, the last of which will be made up by approximately 67 km of tunnels. Surface civil works will include intakes, delivery canals and new bridges over the Colorado and Yeso rivers. Service roads, stocking sites of excavated and other materials, and provisional job camps and facilities must also be added.

2.4 The Project is sponsored by AES Gener, S.A., the Chilean subsidiary of AES Corporation. The construction phase is targeted by AES Gener to last approximately five years. Once operational, the PHAM will contribute an average annual net energy of approximately 2300 GWh per year to the Chilean national grid (*Sistema Interconectado Central* - "SIC").

2.5 Total Project cost is estimated at approximately US$1.375 billion with a debt to equity ratio of 60/40. Funding of the project is proposed to be US$550 million in equity and up to US$825 million in debt. Funding will be provided via an IDB A/B loan structure, co-financing and /or participation of Export Credit Agencies.

2.6 **Purpose:** The demand for energy in Chile is forecasted by the National Energy Commision (*Comisión Nacional de Energía* – "CNE") to increase by six percent per year for the next decade. To meet this demand, approximately 750 MW of new capacity are required to be added to the SIC per year. Currently, the SIC transmits 68.5% of the national generation and serves 93% of Chile's population. The PHAM is located in proximity to the highest source of demand for energy from the SIC and, by providing an average of 2300 GWh per year, is expected to contribute significantly to meeting the increasing demand and to displace the operation of new thermal plants.

2.7 **The Borrower**. Alto Maipo SPA is a special purpose company incorporated under Chilean law, to develop, build and operate the Project. Alto Maipo, as an AES Gener subsidiary, is expected to follow similar corporate governance practices.

2.8 **The Sponsor**. AES Gener, 71% owned and controlled by The AES Corporation ("AES"), is engaged in the generation and supply of electricity in three principal markets: (i) the SIC and the Sistema Interconectado del Norte Grande ("SING") in Chile; (ii) the Sistema Interconectado Nacional ("SIN") in Colombia; and the Sistema Argentino de Interconexión ("SADI") in Argentina. AES Gener is Chile´s 2nd largest electricity generation company, with a market share of approximately

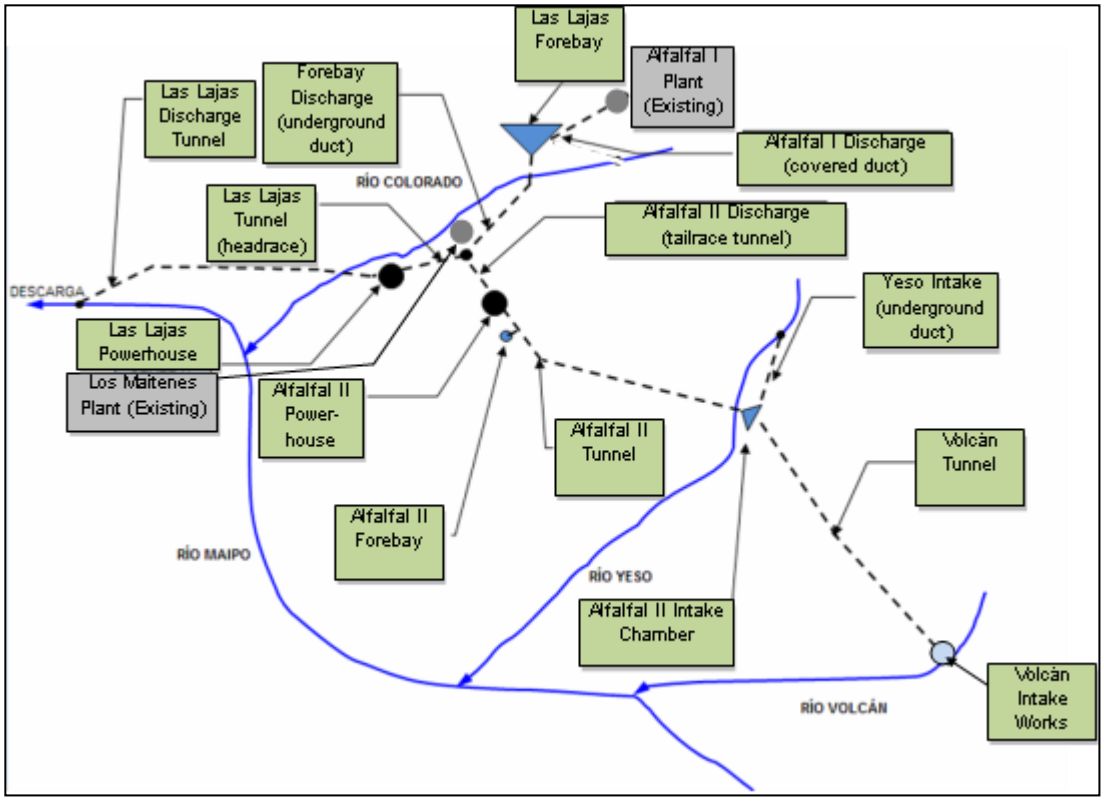
(2) Forebay: or head pond is a small pond or canal that is used to feed the penstocks of a hydropower plant.

22% as of December 31, 2011, based on installed capacity, and a significant presence in both the SIC and the SING. In Colombia, AES Gener, through AES Chivor, owns the 3rd-largest hydroelectric facility and has a 7% market share measured by installed operating capacity, making it the 6th-largest generation company in Colombia.

2.9 AES Gener is the largest thermal generator and second largest generator of electricity in Chile. Formerly a privately owned Chilean generation company (Chilgener during 1981-1998 and Gener during 1998-2001), it was acquired by AES via public offering in 2000. At present, AES Gener has an installed capacity of 78% thermal and 22% hydroelectric power, including four existing hydropower facilities in the Maipo River watershed: Alfalfal I and Los Maitenes on the Colorado River, El Volcán on the Volcán River, and Queltehues on the Maipo River just downstream of the confluence of the Volcán and Yeso Rivers with the Maipo, in addition to its 1000 MW Chivor reservoir plant in Colombia.

Project Description

2.10 A conceptual and simplified figure of the main Project facilities is presented in below. More detailed figure of the proposed Project are presented in **Figures 2 to 4**.



2.11 The PHAM can be described in five main sections, as follows:

(a) **El Volcán Intake Works and Tunnel:** Intake structures will be placed in each of the following four tributaries to the Volcán River upstream of its confluence with the Maipo River: La Engorda Stream, Colina Stream, Las Placas Stream, and El Morado Stream. The intakes will be connected in series (in the aforementioned order) to convey the combined flows via underground ducts to the Volcán Tunnel. The ducts will have a combined length of approximately 3.3 km and include an inverted siphon crossing the Morado Stream. The Volcán Tunnel, in turn, is a 14 km-long pressure tunnel conveying flow to an intake chamber at the Yeso River area.

(b) **El Yeso Intake Works and Alfalfal II Tunnel:** An intake structure will be placed on the Yeso River downstream of the Yeso Reservoir, which is used as a drinking water reservoir for the Santiago region and administered by Aguas Andinas[(3)]. Flow from the intake structure will be conveyed via a 1.35 km-long underground duct to the joint with the Volcán Tunnel, where both flows will be combined.

(c) Flow will be conveyed via a 4.7 km-long underground pipeline to the Alfalfal II Tunnel. The pipeline includes an inverted siphon crossing the Yeso River and duct to cross the Manzanito Stream. The Alfalfal II Tunnel is a 15 km-long pressurized headrace to convey flow from the pipeline to the Alfalfal II powerhouse.

(d) **Alfalfal II Powerhouse and Discharge:** Flow from the Alfalfal II Tunnel is conducted to the Alfalfal II powerhouse via a penstock (high head pressurized tunnel). Upstream of the penstock is located the surge tank which ends in a forebay that will act as a balancing reservoir, . The Alfalfal II forebay will cover an area of approximately 0.25 ha and will have a storage capacity of approximately 48,100 m^3. The powerhouse will be located in a cavern excavated in the rock mass and covering a surface area of 1500 m^2. A 2.4 km tunnel will provide access to the powerhouse, which will house two similar Pelton turbines with total installed capacity of 264 MW (each with a 13.5 m^3/s design flow), a generator, and a 220/12 kV transformer.

Discharge from the Alfalfal II powerhouse will flow via a 3.4 km long tailrace tunnel towards the Las Lajas headrace tunnel.

(e) **Colorado River Works and Las Lajas Tunnel:** Discharge from the existing Alfalfal I Hydroelectric Plant, located upstream of the proposed PHAM facilities on the Colorado River, is currently partly diverted via a channel to the existing Los Maitenes Hydroelectric Plant, which is located on the bank of the Colorado River upstream of the proposed Las Lajas powerhouse. The PHAM will intercept this existing channel and convey the flow to the Las Lajas forebay via a 0.25 km-long covered duct. The forebay will also receive

(3) The intake associated with the PHAM will receive flow discharged from the reservoir as regulated by Aguas Andinas and is not expected to impact drinking water availability or use.

the remaining discharge from the Alfalfal I Plant via a 0.40 km-long extension of the existing tailrace channel that currently discharges to the Colorado River. The forebay will have a surface area of 7.5 ha and capacity of 300,000 m^3. This forebay will have sufficient volume to mitigate variations in the day-to-day flow regime of the water sources during operation of the powerhouse under peak flow conditions. A stretch of approximately 0.82 km of the Colorado River, directly downstream of the Alfalfal I discharge, will be diverted to the southeast to allow for the formation of the Las Lajas forebay.

Discharge from the Las Lajas forebay will be conveyed to the Las Lajas Tunnel via a 1 km-long underground duct and inverted siphon crossing the Colorado River. The Las Lajas Tunnel is a 9.76 km-long headrace and conveys flow from the Las Lajas forebay as well as discharge from the Alfalfal II powerhouse to the Las Lajas powerhouse.

(f) **Las Lajas Powerhouse and Discharge to Maipo River:** The Las Lajas powerhouse will be located in an underground chamber excavated in the rock mass and covering a surface area of 1700 m^2. A 2 km-long tunnel will provide access to the powerhouse, which will house two similar Pelton turbines with total installed capacity of 267 MW (each with a 32.5 m^3/s design flow), a generator, and a 110/12 kV transformer. Discharge from the powerhouse will be conveyed via a 13.54 km-long tailrace tunnel to the Maipo River downstream of the confluence of the Colorado River.

2.12 **Associated Facilities**: Include approximately 31 km of new access roads, four new bridges, 17 km of new transmission lines (110/220 kV), upgrades to approximately 45 km of existing roadways (consisting solely of either resurfacing or improvement of signaling, with no widening required) and upgrades to an existing electrical substation. All of these associated facilities are included in the project under consideration for possible financing by the IDB.

2.13 During the construction phase, 14 waste rock disposal ranging in size from 0.83 ha to 5.61 ha will be sited throughout the Project area. Where possible, sediments from these deposits will be re-used during the construction of Project facilities..

2.14 **Social Programs.** A **Social Collaboration Agreement** was signed in 2009 amongst AES Gener, the Municipality of San José de Maipo and the Community Neighbors of San José de Maipo. The principle terms are:

(a) Gener will give priority to local labor during the construction phase for up to 25% by means of incentives to contractors. If local labor is less than 15%, penalties will be applied and if it is greater than 15% and up to 25%, bonuses will be applied.

(b) Gener will contribute approximately US$240 thousand (5087 Chilean Unidades de Fomento or UF) per year to social programs for a term of 30 years starting after Notice-to-Proceed of the Engineering, Procurement and

Construction ("EPC") contracts are issued. Funds will apply to specific programs such as education, sports activities and small local enterprises, to be determined by the local Council.

(c) This Agreement has been included in the environmental permit as obligation by AES Gener.

2.15 **Project Schedule:** Construction of both hydropower plants is estimated to begin in the fourth quarter 2012. The Las Lajas plant is expected to be commissioned in the 4th quarter 2016, and the Alfalfal II plant in the 1st quarter 2017. For other project components a general proposed schedule is as follows:

Preliminary Works	September 2011 - December 2012
Construction in El Volcán Region	October 2012 - August2016
Construction in El Yeso	October 2012 - August 2016

2.16 Generally, construction will take place in the following stages: 1) Installment and operation of work zones, worker camps, and waste rock disposal areas; 2) Construction /rehabilitation of roads; 3) Construction of access and conveyance tunnels, conveyance structures and intake structures. Underground facilities will be constructed via the "drill and blast" method or Tunnel Boring Machines (TBM) as an alternative; 4) Construction of the powerhouses and installation of equipment and surge shafts; 5) Testing and start-up of facilities; and 6) Restoration of waste rock disposal areas, worker camp areas, and reforestation activities.

2.17 **Project Workforce:** An average of 2000 workers will be required during the construction phase of the PHAM, with a peak of 2500 midway through the construction phase. These workers will be housed in five worker camps housing approximately 200-400 workers each, which will be set up throughout the Project area along with a modular wastewater treatment plant at each camp. Up to 500 workers will be hired from local communities, and are not expected to require housing.

2.18 **Project Alternative Analysis.** Documentation regarding the feasibility and consideration of energy-generating alternatives is not yet available. Therefore, it is recommended that this aspect be further reviewed during the due diligence.

III. INSTITUTIONAL AND REGULATORY CONTEXT

National Policies

3.1 Since the privatization of national generation and distribution services in 1982, the energy sector in Chile has been structured on the principle of a competitive market, and in accordance with the constitutional legislation, national agencies play a regulatory and supervisory role. The Ministry of Energy establishes, regulates, and coordinates and also publishes the semi-annual indicative investment plan for

generation and transmission activities, a document that is non-binding for companies in the industry. The Ministry of Energy also grants concessions for the provision of public electric power distribution, generation and transmission. . In addition, the Superintendency of Electricity and Fuels (*Superintendencia de Electricidad y Combustibles – "SEC"*) oversees compliance with quality and safety standards of service; the General Directorate of Water (*Dirección General de Aguas – "DGA"*) awards the rights to use water needed for hydroelectric generation activities.

3.2 **Environmental Legislation.** Until mid-2010, the National Environment Commission (*Comisión Nacional del Medio Ambiente, "CONAMA"*) administered the system of environmental impact assessment (SEIA) of projects. The SEIA Regulations, established by Law Nº 19.300, enacted in 1994, stipulate that an Environmental Impact Assessment (EIA) or Statement (EIS) be developed for certain projects. The EIA or EIS is reviewed by the CONAMA, or the Respective Regional Commission (COREMA), who would determine whether the proposed activity or project is in compliance with existing legislation. As part of the SEIA, the EIA must demonstrate compliance with the various laws and regulations regarding the following areas (including obtaining approval from the respective governing authorities): zoning/land use, air quality, noise, potable water, sanitary services, waste, flora and fauna, cultural heritage, fuels, explosives, roadways/traffic, visual impact/impact to tourism services, proximity to protected areas or populations, and social welfare. The evaluation process ultimately concludes with a resolution from COREMA (*Resolucion de Clasificación Ambiental* - "RCA") approving or denying approval of the project or activity.

3.3 Law Nº 20.417, enacted 26 January 2010 and which came into effect in mid-2010, supersedes Law Nº 19.300 and restructures the SEIA process and environmental authorities in Chile. The main changes include:

(a) Creation of a Ministry of Environment (*Ministerio del Medio Ambiente*), in charge of environmental policies, plans, and programs;

(b) Creation of an Environmental Evaluation Service (*Servicio de Evaluación Ambiental*), in charge of the administration of the SEIA;

(c) Creation of a Superintendency of Environment (*Superintendencia del Medio Ambiente*), within the Ministry of Environment, to approve and ensure compliance with the four main environmental management instruments: RCAs, Prevention and Decontamination Plans, Environmental Standards; and Management Plans.

3.4 An EIA for the PHAM was completed in May 2008 by Arcadis Geotecnica Consultores, S.A., and subsequently amended with Addenda in November 2008, January 2009, and March 2009 in response to comments from a variety of the public authorities who reviewed the EIA for approval and by members of the public who commented during the public consultation period. The EIA (and revisions)

include environmental and social mitigation measures as well as monitoring and management plans for the PHAM and associated facilities including new access roads, improvements to existing roads, new bridges, and temporary facilities such as waste rock disposal, worker camps, and construction zones. The scope of the EIA does not, however, include the proposed transmission lines. A separate EIA for the new 17 km transmission line to be constructed by the Project was submitted in September 2009.

3.5 The revised EIA for the Project was approved by COREMA on March 2009 (RCA N^0 256/09, dated 30 March 2009). The decision was subsequently challenged by community groups, including the Maipo River Supervisory Board (*Junta Vigilancia del Rio Maipo*), Pirque Channel Irrigators Association, and the Citizen Committee in the Alto Maipo (*Coordinadora Ciudadana no Alto Maipo*), mainly regarding potential impacts to drinking water from the Yeso Reservoir and downstream impacts to water quality and quantity in the Maipo River. On 28 January 2010, CONAMA upheld the approval of the PHAM EIA (and subsequent amendments) with the Resolution N° 82/2010, which contains responses to the objections presented by community groups, including further detail on monitoring and mitigation plans that must be undertaken by the Project Sponsor to ensure that negative environmental and social impacts are minimized.**(4)** Additionally, the opposition group *Coordinadora Ciudadana no Alto Maipo*, presented a constitutional protection action against the environmental permit for the Project on March 5, 2010 before the Santiago Court of Appeals. The constitutional protection action was unanimously rejected by the court on July 12, 2010 and no appeals were filed with the Supreme Court. The EIA for the transmission line was approved by COREMA on July 2, 2010.

3.6 **Environmental Licenses:** The RCA for the PHAM, as well as subsequent Resolutions (N° 82/2010, described above and N° 144/2010, dated 19 February 2010, which extends the deadlines for fulfilling certain conditions within the RCA) constitute administrative acts which cannot be impacted by subsequent legislation. As such, these environmental authorizations for the PHAM remain valid; however, any major modification or addition to the PHAM will have to be subject to the SEIA process under the legislation enacted in 2010. Other environmental permits obtained for the Project are described in Paragraphs 3.9 and 3.10 (in "Other Permits").

3.7 **Water Rights.** The Water Code, enacted in 1981 and amended in 2005, sets the basis for allocating water use rights, which are issued by the DGA and approved by the Ministry of Public Works. In 2010, the transfer of water use rights to AES Gener for the PHAM was approved by the DGA (proceeding numbers VT-1302-226; VT-1302-227 VT-1302-228; VT-1302-229; VT-1302-230 y VT-1302-231,

---

(4) As is somewhat common in the Chilean environmental impact assessment system for this category of projects, the EIA preparation, review and approval processes have generated a fairly profuse and extensive documentation; some of which can be accessed through the following link: **http://seia.sea.gob.cl/expediente/ficha/fichaPrincipal.php?modo=ficha&id_expediente=2933044**

corresponding to La Engorda, Colina, Las Placas, and El Morado Streams, and the Yeso and Colorado Rivers). In addition, AES Gener and the local water utility Aguas Andinas signed in February 2011 a water use agreement for the use of water resources from the Negra and Encañado reservoirs.

3.8 **Other Permits.** Companies interested in the generation or transmission electricity may request, and companies interested in the distribution of electricity must request, a permanent electric concession issued by the Ministry of Energy. Permanent concessions (as opposed to temporary concessions, which can be granted for conducting feasibility studies) are issued for an indefinite period, in accordance with Decree N° 4 / 20018 (2006). The concession allows a proponent to perform work and impose easements, among other actions, related to the generation, transmission or distribution of electricity. Per the EIA, the AES Gener has not yet obtained a permanent concession related to the generation of electricity. AES Gener submitted a request for an electric concession for the Project in April 2009 and for the new transmission lines in July 2010. Both concession requests are pending approval, the Project request is pending before the Ministry of Energy and the new transmission lines before the National Controller.

3.9 In accordance with Supreme Decree No. 95/01 (2002), the following additional sectorial environmental permits have been obtained as part of the SEIA process: establishment of sewage treatment facilities and sanitary services (for the worker camps); fishing license for research/monitoring; for the exploitation of forest areas, which is regulated by the National Forestry Corporation (*Corporacion Nacional Forestal* - "CONAF"); and for modifying natural surface water features, which is regulated by the Regional Water Direction – Metropolitan Region at a local level and the National Water Direction (*Direccion General de Aguas* - "DGA") at a national level.

3.10 In addition, of particular note to the Project are the following legislative bodies: the National Tourism Service, which declared the Commune of San José de Maipo (in which the PHAM is located) as a "Zone of National Tourism Interest," and as such must approve the EIA for the Project, and the National System of Protected Areas of the State (SNASPE), who manage areas under official protection, including "El Morado Natural Monument" and the "Nature Sanctuary San Francisco de Lagunillas", both of which fall within the Project's direct area of influence. The RCA includes approvals from both the SNASPE and National Tourism Service.

IDB Policies

3.11 As described above, an EIA was prepared and environmental and social management plans (ESMPs) were included to mitigate and manage the potential impacts and risks of the project. Public consultations were conducted as part of the normal approval process for the EIA.

3.12 The IDB Access to Information Policy (OP-102) is of relevance. As such, the EIAs will have to be made available for public consultation at the Bank's Public

Information Centers in Washington and Country Office, as well as the IDB's website concomitantly with the approval of this ESS and granting of project eligibility.

3.13 The following directives of the IDB Environmental and Safeguards Compliance Policy (OP-703) are of particular relevance to the Project: B.1-Bank Policies, B.2-Country Laws and Regulations, B.3-Screening and Classification, B.4-Other Risk Factors, B.5-Environmental Assessment Requirements, B.6-Consultations, B.7-Supervision and Compliance, B.9-Natural Habitats and Cultural Sites, B.10-Hazardous Materials, B.11-Pollution Prevention and Abatement, B.15-Co-Financing Operations.

3.14 The IDB's Disaster Risk Management Policy (OP-704) is also relevant based on the proposed location in an area prone to seismic activity and landslides. On the other hand, the Involuntary Resettlement (OP-710) and Indigenous Peoples (OP-765) Policies are not expected to be of relevance in the case of this project.

3.15 Because of the relatively large scale of the hydropower facilities and significance of potentially related negative environmental and social impacts **(see Section V)**, the Project Team proposes that this project be classified as a Category "A" under IDB's OP-703.

3.16 The Project's compliance with these policies and directives will be assessed during the IDB project team's Environmental and Social Due Diligence (ESDD).

IV. ENVIRONMENTAL AND SOCIAL SETTING

4.1 The Project's direct area of influence is defined by the PHAM EIA per environmental or social resource area (i.e., air, water, terrestrial and aquatic flora and fauna, etc.), but generally encompasses the above-ground areas physically affected by the proposed works, including: new access road areas, bridges, and roads to be rehabilitated, transmission line areas, intake structures, emergency discharge and discharge structures, stream crossings, two forebays, access tunnel openings, and surge shafts. Also included within the direct area of influence are temporary facilities such as waste rock disposal, worker camps, and construction zones along the banks of the Volcán River, Yeso River, Maipo, and Colorado Rivers and near the powerhouses. Regarding hydrology and aquatic ecosystems, the direct area of influence is defined as the drainage areas intercepted by the PHAM, while the larger Yeso, El Volcán, Maipo, and Colorado River watersheds were included within the indirect area of influence. With regard to social issues, settlements and villages located in the vicinity of the construction zones and worker camps were included within the direct area of influence, including: El Canelo, El Manzano, Los Maitenes, El Alfalfal, San Gabriel, El Romeral, El Volcán, Baños Morales, and Lo Valdés.

A. Environmental Setting

4.2 The environmental setting is described in the PHAM EIA, based on surveys conducted in 2005, 2006, 2007 and 2008 and an extensive bibliography of specific studies providing relevant background. Findings are discussed below.

Physical Setting

4.3 There are four main hydrological systems that can be affected by the PHAM:

(a) **The Alto Maipo River basin**, which receives input from three major tributaries that correspond to the remaining three subsystems (Volcán, Yeso and Colorado River basins). The Maipo River has a yearly mean flow (Q_{MA}) of 77.8 m^3/s at San Alfonso, located downstream of the confluence of the Yeso and Volcán Rivers with the Maipo River, and 111 m^3/s at El Manzano, located downstream of the confluence with the Colorado River. Both the Yeso and the Colorado River natural hydrological regimes have been altered by human activity prior to their confluence with the Maipo; the former by the existence of El Yeso Reservoir and the latter due to the existing Los Maitenes and Alfalfal I hydroelectric facilities.

(b) **El Volcán River basin**, which can be divided into two main upper watersheds (La Engorda Stream and El Volcán River, upstream of the confluence of La Engorda Stream). The PHAM affects only the La Engorda Stream watershed, which consists of contributions from the Conlina, Las Placas, and El Morado Streams.

(c) **The Yeso River basin**, which has major lakes: Laguna Negra, Laguna Lo Encañado, and the Yeso Reservoir, all of which are drinking water reservoirs for the municipality of Santiago and administered by Aguas Andinas. The Laguna Lo Encañado and Laguna Negra discharge to the Manzanito Stream, which joins the Yeso River downstream of the PHAM intake. The Yeso Reservoir has a Q_{MA} of 8.4 m^3/s discharged to the Yeso River upstream of the PHAM intake.

(d) **The Colorado River basin**, which has as a major tributary the Olivares River. The Olivares contributes a Q_{MA} of 10.1 m^3/s to the Colorado. Prior to its confluence with the Maipo River, the Colorado River has a Q_{MA} of 30 m^3/s.

4.4 These hydrological basins are largely fed by snowmelt from glaciers and therefore have a high variability in monthly average flows, with high flows from November to March and a marked decrease during the winter months. With regard to the current uses of the aforementioned systems, these include irrigation activities in the lower strata of the valley, hydropower generation and water requirements associated with mining, and drinking water.

4.5 Based on multiple sampling campaigns (April 2005, November 2006, and December 2007) and data maintained by the DGA, water quality in the area of PHAM is already affected to varying degrees by human intervention, which includes larger systems previously noted and smaller settlements with agricultural activity. However, with the exception of sedimentation, which markedly increases during the summer months, water quality is generally favorable and meets national standards for use in irrigation. There is also a high seasonal variability in water quantity, which increases significantly during the summer months.

4.6 In general, groundwater occurs in free or semi-confined aquifers, and the permeability is a variable rate. Numerous thermal springs associated with volcanic activity are located in the area of Tupungato - San Jose. The main sources are: Colina Baths, Morales Baths, Tupungato Baths, Salinillas Baths, Azul Baths and Piuquenes Baths.

4.7 The municipality San José de Maipo generally has low quality soils, predominantly consisting of non-arable upland soils which are limited by topography, slope and a high erosion potential.

Biological Setting

4.8 Flora and fauna (terrestrial) in the Project area were characterized via sampling campaigns carried out in April 2005, December 2006, February and November 2007, and March 2008. Regarding flora, in areas below the altitude of 1700 meters above sea level (asl), flora was characterized by forest (trees) while above 2000 m asl, shrubs dominated the landscape, interspersed with grasses. A predominance of native species exists in the region, although non-native species were found mainly in the sites altered by human activities and at higher altitudes. In the Colorado River, for example, up to 40% of the species recorded in the study area represented non-native species, while the Yeso River also has a high degree of impact from grazing activities. A total of six threatened species were found: four in the area of the Colorado River, including Frangel (*Kageneckia angustifolia*), chagual *Puya berteroniana (P. alpestris)*, quisquito (*Eriosyce curvispina (Neoporteria curvispina))*, and peumo (*Cryptocarya alba*); and two in the high Volcán River area, including llareta de Santiago (*Laretia acaulis)* and liuto de cordillera *(Alstroemeria exerens*).

4.9 Regarding fauna, the area has a high variability of species, including amphibians, reptiles, birds (including raptors), waterfowl, and mammals. In the areas of the Colorado River, La Engorda and el Morado Streams, Laguna Lo Encañado, Manzanito Stream, the Yeso River and Reservoir, and the Aucayes Stream, 16 species in a conservation category (per Chilean standards) were recorded, the majority of reptiles class, followed by amphibians, mammals and birds. Two of these are classified by the Chilean government as threatened: cururo (*Spalocopus cyanus*), a rodent, and the amphibian *Alsodes nodosus*. Eight are classified as vulnerable: two amphibians (*Pleurodema thaul* and *Bufo spinolosus*); five reptiles, four of which are lizards (*Liolaemus lemniscatus, Liolaemus monticola, Liolaemus*

nigroviridis, and *Liolaemus tenuis*) and the remaining one an iguana (*Callopistes palluma*); and one bird of prey (*Vultur gryphus*). Four are classified as rare: three reptiles, all of which are lizards (*Liolaemus altissimus*, *Liolaemus moradoensis*, and *Liolaemus valdesianus*) and a bird (*Buteo albigula*). The remaining species are not in danger or uncategorized due to insufficient information. Per the IUCN Red List, the only listed amphibian or reptile is the frog *Alsodes nodosus*[(5)], which is categorized as near threatened.

4.10 Relative to aquatic ecosystems, two field campaigns (April 2005, November 2006) were undertaken to characterize aquatic flora and fauna throughout the Project area. Sampling in April 2005 (towards the end of the rainy season) concentrated on the tributaries to the Volcán River (*i.e.*, La Colina Stream and La Engorda Stream). The November 2006 campaign (at the beginning of the dry season) included sampling throughout the water courses affected by the Project (*i.e.*, La Colina, La Engorda and El Morado Streams; and the Yeso, Colorado, Volcán and Maipo Rivers) as well as other water courses or bodies in the area, including Cortaderas and El Manzanito Streams (both tributaries to the Yeso River), Quempo Stream (tributary to the Colorado River, upstream of the Project facilities) and the Encañado Reservoir.

4.11 The Maipo River and Manzanito Stream had the highest phytobenthic taxa richness in the study area indicating that these systems are more favorable habitat for fish stocks. A lower abundance of benthos was found in the Colorado River and Aucayes, Colina and El Morado Streams, while the remaining systems present intermediate abundance values. However, the presence of fish in the study area was found to be independent of food supply, as it was largely missing from systems with a high supply, such as the Maipo River and the Engorda Stream, and was found in sectors with reduced availability of food, such as the Colorado River and the Aucayes Stream, likely due to the high load of suspended particles in the former systems.

4.12 No fish were detected in the tributaries to the Volcán River during the 2005 or 2006 campaigns. This result is common during the spring and summer in these river systems due to the high sediment load carried by the water courses. Similarly, no fish were detected in the the Maipo River (sampled at the proposed discharge point, downstream of the confluence with the Colorado River). On the Yeso River, only the brown trout (*Salmo trutta*), which is an introduced species, was detected in low volumes. The same species was found in abundance in the Yeso River tributaries, the Cortaderas and Manzanito Streams, and in the Encañado Reservoir. The stretch of the Colorado River sampled had a low abundance of fish, which can be expected due to the high sediment load of the river. However, the native catfish species *Trichomycteris aerolatus* was detected in the Colorado River, specifically in the zone of the proposed inverted siphon crossing. Another introduced species, the rainbow trout (*Oncorhynchus mykiss*) was the only fish detected in the Aucayes Stream, while no fish were detected in the Quempo Stream (both tributaries to the Colorado River).

(5) ***http://www.atlasherpetozoos.cl/Anfibios/ANodosus.html***

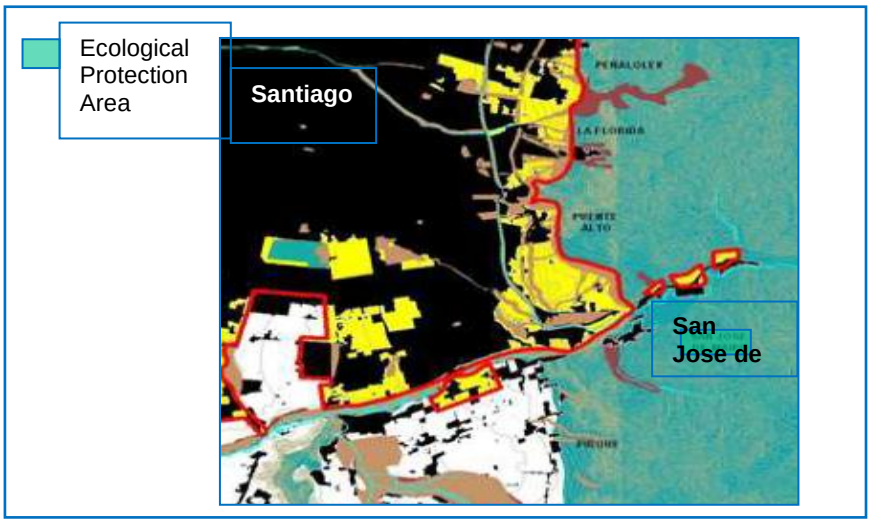
4.13 The introduction of trout (mainly for sport and recreational activities) has had historical and current adverse effects on native fish assemblages in the country and particularly in the Maipo River basin. Findings from the sampling campaigns support available literature regarding aquatic ecosystems in the area, which suggest that the ecosystems have been disturbed by anthropogenic activities mainly associated with irrigation, power generation and recreation. However, only the upper Volcán River area was sampled multiple times, while the remaining water courses were only sampled during the beginning of the dry season.

4.14 **Protected areas**. There are two protected areas that fall within the Project's direct area of influence and are officially protected under national legislation in Chile, both of which are managed by SNASPE:

(a) El Morado Natural Monument, which is considered a national monument (IUCN Category II), is a glacial cirque/valley that forms part of the Volcán River basin. El Morado mount dominates the landscape of this protected area, which is also home to the San Francisco Glacier.

(b) The Nature Sanctuary St. Francisco de Lagunillas, which was declared in 2005 as a Zone of Scientific Interest by the Ministry of Education (restricting the development of certain mining activities).

4.15 These areas are located within a greater Ecological Preservation Area established by the Santiago Metropolitan Regulatory Plan (*Plan Regulador Metropolitano de Santiago* - "PRMS"), in which any new development within the area must be approved by the Ministry of Zoning and Urbanism. The area is characterized by high meadows comprising fragile ecosystems of high ecological value and that, generally, have been exploited by grazing activities. The native fauna of the areas is representative the Andean foothills of the Central Zone of Chile and includes up to 40 species found in any category of conservation. The Ecological Preservation Area, as established within the PRMS, is shown in the figure below. The El Morado Natural Monument and Nature Sanctuary of St. Francisco de Lagunillas are depicted in **Figure 5**.



B. Socio-Economic Setting

4.16 **Commune or Municipality of San Jose de Maipo.** It is a commune in Chile located in the Cordillera Province, Santiago Metropolitan Region, approximately 50 km southeast of the capital, Santiago, bordered on the east by Argentina, across the Andes. The municipality of San José de Maipo spans an area of approximately 4995 km^2 and has a population of around 13400 inhabitants. Its population density is about 2.7 inhabitants per km^2, making it the most sparsely populated commune in the region.

4.17 The area of direct influence of PHAM includes several small villages with a low and predominantly rural population; the main urban area is the village of San Jose de Maipo. These are located along the Volcán, Maipo, Yeso, and Colorado Rivers between the Project intake and discharge structures[(6)]. About 84% of the houses in the area of direct influence of PHAM are connected to a sewer system, with the remaining serviced by septic tanks or wells. The majority of houses are also connected to the public water supply (about 70%), while the remaining use local water surface courses. The road infrastructure has limited development, with a main route (G-25) that connects and provides access to the majority of the populated areas, along with secondary roads (G-455, G-345). Internal roads in each locality are minimal.

4.18 **Main Economic Activities.** The core of economic activity for the municipality of San José de Maipo is farming and ranching, which takes place mainly in the valleys of Maipo and Colorado rivers. Industries in the area, including non-metallic mining (stone quarries, stone crafts, alabaster) and hydropower energy generation, supplement this activity. While the higher altitude areas were traditionally used for grazing, this activity has declined, leading to an increasing use of these lands for hiking and mountain climbing, with locals working as local guides and renting horses and mules. This is supported by the gradual growth of the tourism industry in the area. The Maipo River is used for rafting and kayaking from the confluence of the Yeso River to the San Jose de Maipo region, upstream of the PHAM discharge point. The Yeso Riveris also used for recreational fishing. Corroborating this growing importance of the tourist activities in the area, the National Tourism Service declared the Commune of San José de Maipo as a "Zone of National Tourism Interest". Recently, AES Gener -the Project- prepared a Tourism Guide which was donated to the Municipality.

4.19 **Cultural Heritage Sites.** Three sites with a high cultural heritage value were found in the area of indirect influence of the PHAM: "Las Morrenas" archaeological site east of the Manzanito Stream, the "Camino del Inka" pathway in the Laguna Lo Encañado area, and the "Aucayes 1" archaeological site on the Colorado River (at the confluence of the Aucayes Stream). The "Las Morrenas" and "Aucay 1" sites are in good condition, while a 30 m stretch of the "Camino del Inka" is somewhat deteriorated due to the prior construction of an aqueduct (currently defunct). None of the PHAM facilities or installations is located in the immediate vicinity of these sites.

---

(6) *http://upload.wikimedia.org/wikipedia/commons/2/20/Localidades_Cajon_del_maipo.jpg*

V. IMPACTS RISKS AND CONTROL MEASURES

A. Environmental Impacts

5.1 No resettlement, indigenous or transboundary issues are expected in relation to the Project.

5.2 **Construction Impacts.** The main potential negative environmental impacts relating to the construction phase of the Project include: (i) temporary disturbance to the natural flows of streams and rivers at the PHAM intake structures and the diversion of the Colorado River stretch at the forebay; (ii) an increase in particulate matter and combustion gases; (iii) increased noise and vibration levels; (iv) increased risk of contamination of waterways; (v) increased risk of modification of underground water courses, (vi) possibility of soil contamination; (vii) increased risk of erosion and soil compaction; (viii) loss of vegetative cover; (ix) alteration of fauna; and (x) alteration of the natural landscape; and (xi) impacts and risks associated with the transport and disposal of excavated material. Construction phase impacts are typical for projects of this type and magnitude. Most are due to the construction of worker camps, soil disturbance, generation of waste, handling and storage of fuel and other chemicals, and the creation of sediment heaps.

5.3 **Water Flow.** Following multiple consultations with the DGA, the PHAM has proposed to maintain the following ecological flows at the various intake locations, as shown in Table 5-1**(7)**.

Table 5-1: Ecological Flows for the PHAM.

Intake Location	Proposed Ecological Flow (m^3/s)	Minimum Monthly Flow (mean) (m^3/s)	Mean Annual Flow (m^3/s)
Colina Stream	0.37	0.89	3.24
La Engorda Stream	0.15	0.32	0.99
Las Placas Stream	0.10	0.13	0.47
El Morado Stream	0.17	0.56	1.71
Colorado River (at Alfalfal I)	0.66	1.49	16.05
Yeso River	0.46	0.74	7.91
Central El Volcán*	0.30	1.59	N/A

* This intake is not part of the PHAM. In order to mitigate the impacts on the Volcán River, AES Gener has agreed to allow a minimum flow of 0.30 m^3/s through this current intake for the Volcán hydropower plant located just upstream of the confluence of the Yeso River.

5.4 **Ecological Flows.** The ecological flows were calculated using a variety of hydrological modeling methods, including: the Tennant Method; New England Aquatic-Base-Flow method; and methodology promulgated by Swiss legislation,

(7) Per RCA N^0 256/09, 30 March 2009.

which incorporates a minimum depth in any given channel of 20 cm (a value based on habitat requirements for *Salmoninae* – which are present within the Project area – which is also approved by the DGA); and consideration of aquatic habitat. Although the Project is designed to operate in a run-of-river mode and provide the above referenced ecological flows, the Project will result in highly variable flows downstream under certain flow conditions. Aquatic organisms in the area are adapted to a high *seasonal* variation of flow rate and sediment load of water; however, the potential impacts due to more frequent variations, if any, have not been adequately addressed in the EIA. The Las Lajas and Alfalfal II forebays are designed, in part, to mitigate these variations, and a Limnological Monitoring Program is proposed to be undertaken throughout the life of the PHAM to identify and mitigate potential negative impacts on aquatic ecosystems.

5.5 **Other Water Uses.** In addition, the effects on other anthropic water uses in the River Maipo basin (domestic, irrigation, recreation, tourism, etc.), which could see the flow decrease substantially during the winter months, is not adequately addressed in the EIA. Therefore, it is recommended that this type of impact be further reviewed during the due diligence.

5.6 **Water Quality.** The PHAM will affect the sediment balance of water courses. During construction, a temporary impact to water quality will be generated by soil movement related to excavation and other construction works at the intake structures, discharge structures, and stream crossings. During operations, the main impact to water quality will be in the sediment balance, at a local level, of the tributaries to the Volcán River at the Project intake structures, due to the variations in flow rate discussed above. In addition, the permanent reduction of flow in the Yeso, Volcán, and Colorado Rivers, along with the abrupt increase in flow at the discharge point of the PHAM on the Maipo River, will affect the carrying capacity of sediments (i.e., sediment transport) in these courses and can lead to the degradation of the river Maipo River bed via increased sediment deposition. The presence of various other users of the Maipo River in Las Vertientes, downstream of the proposed PHAM discharge point (*i.e.*, a potable water intake structure, irrigation, and the extraction of aggregates) can intensify this impact. An Advanced Sedimentology Study, commissioned by AES Gener on March 2008, concluded that the estimated carrying capacity of sediments in the water courses after the implementation of the Project would be greater than the availability of sediment in the catchment area. However, the ecological flows used in for Study were different (and, in some cases, greater than) those ultimately agreed with the DGA, and presented in **Table 5-1**. Per the RCA, the Project Sponsor must commission a complementary Advanced Sedimentology Study to verify this conclusion and define mitigation measures for the potential impacts of the PHAM. The Project Sponsor must also develop a detailed monitoring plan, to include mitigation and compensation measures, prior to the start of Project operations. It is recommended that this type of impact be further reviewed during the due diligence.

5.7 **Flora.** As described in **Section 4**, several species exist in the PHAM area of influence that are classified as threatened. Given that the majority of the works for

the PHAM are located underground, the Project is not expected to have a significant permanent impact on terrestrial flora or these species.

5.8 **Fauna.** The ecological flows described in **Table 5-1** were developed with the aim of minimizing the negative impact on existing fish populations in the various rivers within the PHAM area of influence; however, the PHAM would result in a loss of habitat for aquatic fauna. In addition, reduction of the water levels in streams and rivers would likely result in a reduction of the habitat available for amphibian and many reptile species, as these require both aquatic and terrestrial habitats. As described in **Section 4**, one of these species, an amphibian (*Alsodes nodosus*), is listed by the Chilean government as threatened and by the IUCN as near threatened. Two other amphibians and five reptiles are classified by the Chilean government as vulnerable, while three other reptiles are classified as rare. It is recommended that this type of impact, particularly on the amphibian (*Alsodes nodosus*), be further reviewed during the due diligence.

5.9 **Protected Areas.** Due to the nature of the Project works, the majority of which are underground, the PHAM is not expected to have a permanent significant impact on the Commune of San José de Maipo as a "Zone of National Tourism Interest," the "El Morado Natural Monument" or the Nature Sanctuary St. Francisco de Lagunillas, all of which fall within the Project's direct area of influence. Approximately 5.5 km of the Alfalfal II Tunnel will traverse underneath the Nature Sanctuary St. Francisco de Lagunillas. Similarly, an approximately 3.3 km stretch of the Volcán Tunnel will traverse the El Morado Natural Monument. Explosives will not be used for the construction of tunnels under protected areas to reduce the potential impacts due to vibration. Above-ground facilities such as roads, transmission lines, bridges and intake structures are not expected to significantly degrade the larger Commune of San José de Maipo Zone of National Tourism Interest.

5.10 **Greenhouse gas (GHG) Emissions.** GHG emissions will increase as a result of due to certain Project activities (construction of PHAM facilities and access roads, clearing for transmission lines). However, no estimation or calculation of gross or net GHG emission/reduction was calculated for the sum of all Project activities (construction of access roads, forebay clearing, emissions during operation, reforestation). On the other hand, based on a preliminary gross estimate, around 1 million ton of CO2 per year can be averted due to displacement of fossil fuel based power generation. However, these data need to be refined. Therefore, it is recommended that this type of impact be further reviewed during the due diligence.

5.11 **Generation of Waste Rock and Sediments.** An estimated 1.7 million m^3 of rock and sediments will be extracted during the construction of the PHAM, which will be stored in waste rock disposal (or piles) located throughout the Project area. The waste rock and sediments will be re-used where possible. The sediment heap areas will be restored and re-vegetated prior to the completion of the construction phase of the PHAM. Nevertheless, it is recommended that the impacts associated with transport and disposal of excavated material be further reviewed during the due diligence.

B. Social Impacts

5.12 **Construction Impacts.** The principal potential negative social impacts will be associated with the significant increase in labor force in the area (non-local and local), which is estimated at an average of 2000 workers, with a peak 2500 workers mid-way through construction. Following extensive consultation activities, AES Gener has committed to giving priority to local labor up to 25% during the construction phase; with penalties applied if less than 15% of local labor is used and bonuses applied for use of greater than 15%. Nevertheless, the PHAM will require significant quantities of non-local workers during the construction phase of the Project, which could have negative impacts on the communities surrounding the PHAM. In addition, negative impacts on the workforce could arise from inadequate provision and management of accommodation. Therefore, it is recommended that these impacts be further reviewed during the due diligence.

5.13 Other potential negative social impacts relating to the construction phase of the Project include: (i) alteration of the natural landscape and land use; (ii) health and safety risks to workers and community members related to construction traffic, activities and equipment, including use of explosives; and (iii) modifications to water flow affecting downstream water users. Also, it is recommended that these impacts be further reviewed during the due diligence.

5.14 **Downstream Communities**. No physical displacement will be required as part of the PHAM. However, the PHAM may potentially affect downstream water users, including recreational activities (*i.e.*, kayaking), mining activities, agricultural uses of water for irrigation, and/or recreational fishing. The impacts on these uses is not adequately addressed in the EIA. Given the steep slopes and high erosion potential of the soil in the area, there is a substantial risk of landslides during excavations or structural failures. Downstream communities, the extent of which will be reviewed during due diligence, can be at particular risk.

5.15 **Community Support**. AES Gener developed various activities to achieve local community support, including around 100 meetings with local representatives and organizations. Furthermore, project design has been adjusted to address local community concerns. Also, the SEIA process for the PHAM included extensive community consultation activities, including ten official meetings throughout January – August 2008, and resulted in more than 350 comments on the EIA submitted by community members. Information regarding the consultation activities, including responses to comments, is publicly available and included within the annexes and addenda to the EIA. Although there was initial resistance to the PHAM, AES Gener has signed several agreements with communities, including an agreement with the El Manzano Water Community (*Comunidad de Aguas el Manzano*) in December 2008 to maintain existing water channels used by the Community and a Social Collaboration Agreement with the Municipality of San Jose de Maipo in March 2009. The Social Collaboration Agreement included the commitments to local labor described in **Paragraphs 2.14 and 5.12** and a commitment by AES Gener to contribute to social programs for a term of 30 years. These contributions will consist of US$240 thousand (5087 UF) per year to create

or support existing programs on education, sports activities, small-scale local enterprises, and other organizations or fields to be determined by the local Council.

5.16 However, as noted in **Paragraph 3.5**, the decision by COREMA to approve the EIA for PHAM was subsequently challenged (in 2009) by community groups still opposed to the Project. Although CONAMA ultimately upheld the EIA approval, some local resistance to the Project likely remains. The EIA (including all annexes and amendments) includes a commitment to develop a Social Indicators Monitoring Program, to be conducted throughout the lifetime of the Project in the various communities within the Project's area of influence, which will aim to ensure any negative impacts due to the Project are identified and adequately mitigated.

5.17 **Employment Opportunities.** Positive impacts potentially associated with this Project include: (i) generation of new job opportunities (average 2000 during construction); (ii) improvements in the local economy; (iii) improvements in social services; and (iv) improvements to area access by the construction of access roads. Approximately 300-500 jobs will be created for local labor during the construction phase of the PHAM.

5.18 **Clean Electric Energy Generation and Climate Change.** The Project will constitute a significant source of clean energy generation for the Chilean National Grid, in the region with the highest demand, and displace energy generated by the burning of fossil fuels. An estimate indicates that the operation of the Project can avert around 1 million ton of CO2 per year due to displacement of fossil fuel based power generation.

C. Risk Analysis

5.19 Chile is located in a major subduction[(8)] zone of the Nazca oceanic plate under the South American continent, which gives rise to seismic activity. The most severe and best documented earthquakes in the PHAM area occurred in 1950 and 1958, and the risk of further seismic activity in the area is considered significant in the EIA. Due to the high erosion potential of soil and steep slopes that characterize the area, landslides are also considered a significant risk. The design of the works and their operation have incorporated necessary safeguards to prevent damage in the eventual occurrence of a natural phenomenon such as seismic activity and landslides. Nevertheless, it is recommended that these risks and mitigation procedures are further reviewed during the due diligence.

5.20 Other minor anthropogenic risks associated with the construction and operation of the Project can include: (i) accidents; (ii) petroleum, oil, and lubricants or hazardous material spills; (iii) landslides in excavations or structural failures; (iv) dike overflow or failure; (v) fires, especially if they involve storage tanks; (vi) accidental explosions; (vii) inundation risks from large rain events; and (viii) conflicts involving workers at the job site or outside the job site. As indicated in the next paragraph, the Project integrates management and contingency plans to address these risks.

---

(8) Areas where two tectonic plates move towards one another causing one to slide under the other, and resulting in high incidences of volcanism, earthquakes, and mountains

D. Environmental and Social Management

5.21 **Environmental and Social Management Plans:** The EIA includes detailed environmental management and monitoring plans to manage and mitigate, to the extent possible, impacts to the environment during the construction and operation of the PHAM. These include: Ecological Flow Monitoring Plan and Limnological Monitoring Program (to be conducted throughout the life of the PHAM), Water Quality Monitoring Plan (construction phase), Effluent Monitoring and Control Plan, Air Quality Monitoring Plan (to include monitoring of particulate matter control/mitigation measures), Noise Monitoring Plan, Petroleum and Hazardous Substances Management Plan, Explosives Management Plan, Solid Waste Management Plan, Traffic Monitoring and Control Plan, Flora and Fauna Monitoring, Conservation and Trapping/Relocation Plans, Reforestation Plan (which aims to restore or compensate for 100% of impacted forest), Social Indicators Monitoring Plan (for Construction and Operations phases), detailed Geological Surveys and Vibration Monitoring Plans (prior to and during construction of tunnels under protected areas) and Emergency Response and Contingency Plans.

5.22 The environmental management and monitoring plans described above include frequency of monitoring, locations to be monitored or sampled, and type and frequency of submittals to the relevant authorities for approval. However, no information is available regarding the organizational structure within AES Gener proposed for carrying out the environmental and social management of the PHAM during construction and operation. Therefore, it is recommended that the environmental and social as well as health and safety management systems to be adopted during construction and operation be further reviewed during the due diligence.

5.23 In addition to the plans described above, the RCA calls for the Project Sponsor to develop the following additional monitoring/mitigation plans: Complementary Advanced Sedimentology Study (to include mitigation measures) and detailed water quality monitoring plan for the operations phase.

5.24 Impacts and risks associated with the Project were identified in the EIA based on the results of the baseline performed as part of the EIA. Further characterization of potential adverse impacts due to habitat loss for species that require aquatic habitat, particularly those listed as threatened or vulnerable, impacts due to frequent variations in the flow regime of the rivers and streams where PHAM intakes will be placed, and impacts to downstream users of the Maipo and Colorado Rivers should be conducted and the management plans adjusted accordingly. In addition, further analysis of potential impacts due to the significant influx of workers to the Project area should be conducted. As the scope of the EIA does not include the proposed transmission lines, an analysis of potential impacts due to these lines should be conducted.

5.25 **Cumulative Impacts:** The EIA does not include an analysis of cumulative impacts to Maipo River watershed. As various other hydroelectric facilities exist within the Alto Maipo region in addition to other water uses (*i.e.,* irrigation, drinking water), a cumulative impacts analysis should be conducted taking into consideration the development of the PHAM within the context of any foreseeable or planned expansions in current uses or new uses of the water courses within the area. Therefore, it is recommended that this aspect be further reviewed during the due diligence.

VI. ENVIRONMENTAL STRATEGY

6.1 The Project Team will perform the appropriate analysis process, or ESDD, focusing on potential impacts associated with the construction and operation phases of the Project. This will involve the social, environmental, labor, and occupational health and safety aspects of the Project, not just during construction of hydroelectric plant facilities but also during the construction of access routes and ancillary structures.

6.2 The ESDD will include an assessment of the EIAs, including their associated Environmental and Social Management Plans (ESMPs), and/or any audit reports related to the Project to confirm that the all Project's relevant direct, indirect, cumulative and regional environmental and social impacts and risks have been properly identified and evaluated. The due diligence process will emphasize the following key aspects:

(a) An assessment of PHAM project compliance with all applicable IDB social and environmental directives and policies.

(b) Confirm the status of the environmental licensing of the transmission lines.

(c) Confirm that the Ministry of Zoning and Urbanism has participated in the approval process in view of the location of the Project in an Ecological Preservation Area established by the Santiago Metropolitan Regulatory Plan (*Plan Regulador Metropolitano de Santiago* - "PRMS"), in which any new development within the area must be approved by the Ministry.

(d) Confirm that the Ministry of Energy, development and reconstruction has granted the permanent concession and that the transmission lines are included in the process.

(e) Potential impacts that were not adequately addressed in the EIA, including the following (it is critical that all potential impacts be further assessed, and, if found significant, additional mitigation measures, including appropriate changes in project design must be considered, developed, and implemented):

(i) Environmental and social impact assessment associated with the transmission lines, which were left out of the scope of the EIA, particularly in relation to the impacts caused by the transmission line route on the communities.

(ii) Review of information regarding possible cumulative effects of the Project including the operation of the PHAM and other uses of the rivers or the transmission lines. Also, the significance of potential cumulative effects from other hydropower projects , particularly the two other planned upstream, should be further assessed.

(iii) Review of documentation relating to Project Alternative Analysis, particularly regarding the feasibility and consideration of energy-generating alternatives.

(iv) Evaluation of natural disaster risks and management procedures, particularly in relation to landslides and seismic activity.

(v) Get more information to clarify whether the recommended Protected Area "El Volcán" is within the Project area

(vi) Review the scope of the Social Indicators Monitoring Plan and the mechanisms to implement corrective measures, if the monitoring identifies issues that need to be carefully analyzed and clarified and may need to be strengthened. It is also important to verify if a baseline of certain aspects has been established so that claims against the Project can be assessed properly later on (e.g., condition of housing and other local infrastructure versus vibration from truck traffic, excavation of tunnels, use of explosives, etc.).

Construction-related

(vii) Impacts and risks of project-related traffic of equipment and vehicles on existing roads and day-to-day life of the existing communities, including increased risks of accidents.

(viii) Impacts and risks of civil works activities on erosion process, water quality and silting of water courses.

(ix) Impacts and risks of civil works activities and traffic of project-related equipment and vehicles on noise levels and air quality in the communities nearby.

(x) Impacts and risks to the communities in association with tunnel excavation and blasting, including risks of accidents and damage to terrain and properties.

(xi) Impacts and risks associated with the transport and disposal of excavated material.

(xii) Confirm that community alert and information programs are included in the context of the contingency plans, with particular attention to the issue of landslides.

(xiii) More information is needed on the specific impacts of road (construction and use) and the specific plans to mitigate these, including addressing the concerns of specific communities.

(xiv) Impacts due to a significant influx of workers from outside of the Project area and potential social impacts from the installation and management of worker camps. Consider how the area of the Project (with only around 13,400 inhab.) could be affected by the high influx of the external workforce. Camp location and management (camp regimen, code of conduct, community relations). Grievance management system. Impacts of retrenchment of the labor force on local labor and indirect jobs. Scope of community investment relative to localized impacts. Need for a community health and safety plan.

(xv) Impacts associated with alteration of the natural landscape and land use.

Operation-related

(xvi) Impacts and risks of river diversions on other water uses (domestic, irrigation, recreation, tourism, etc.) in the nearby communities, as well as in Santiago. Particularly, obtain more information about impacts on other water uses, including in the context of cumulative impacts. Investigate claims related to the overall hydrology of the Maipo River Basin, including impacts of a global nature, so that validity can be assessed and appropriate responses are documented.

(xvii) Identify the main tourism attractions (kayaking, rafting, recreational fishing, thermal waters, etc) that could be affected by the Project to determine if mitigation measures are needed. A full mapping of the uses and of the mechanisms available to ensure that sufficient flows remain for all competing uses, or are compensated.

(xviii) Potential impacts and risks of river diversions on aquatic life due to flow reductions, including on the near threatened amphibian *Alsodes nodosus* .

(xix) Obtain more information regarding the ecological flow values of the rivers that are in the project area.

(xx) Review the adequacy and robustness of the ecological flow studies performed and analyze the need for further studies and/or evaluations, which may possibly lead to new recommendations in terms of mitigation measures.

(xxi) Review flow studies to assess to what extent the reductions in flow may be considered to have an effect in terms of conversion of natural habitat in the Project area.

(xxii) Review water quality impact documentation and confirm that the Project Sponsor will commission a complementary Advanced Sedimentology Study to verify that the estimated carrying capacity of sediments in the water courses after the implementation of the Project would be greater than the availability of sediment in the catchment area , and define mitigation measures for the potential impacts of the PHAM. The Project Sponsor must also develop a detailed monitoring plan, to include mitigation and compensation measures, prior to the start of Project operations.

(f) A thorough assessment (appropriateness, monitoring, and implementation) of Management Plans will include: all plans listed in **Paragraphs 5.21 – 5.23**, above, Occupational Health and Safety Plans, Labor and Accommodation Management Plans, and any additional Social Plans (including communication and grievance mechanisms and community health and safety plans).

(i) Health and safety management systems, plans and procedures to be implemented for the PHAM need to adequately address potential worker health and safety risks. This should also include whether workers have an adequate level of training for each specific job, and that sufficient resources are available to ensure adequate implementation. Health and safety management should include a comprehensive monitoring and reporting system during construction and operations phase.

(ii) Monitoring plans need to be consistent with the local laws and regulations and monitoring results submitted to the appropriate regulators. Monitoring should be conducted during both the construction and operations phases and include gases and dust (mostly during construction), water quality (contaminants and physiochemical characteristics, i.e. sedimentation), slope stability, solid waste, flow volume, flora and fauna (including aquatic ecosystems, protected/threatened species, and growth of re-vegetation), noise, and social indicators (including downstream users of water courses).

(iii) Contingency plans (*i.e.*, emergency response and spill plans), should include confirmation that all relevant project-specific environmental risks have been identified, proper procedures have been developed, and sufficient resources will be made available to ensure their adequate implementation.

(g) Assessment of Company's Environmental, Social, Health and Safety and Labor Management Systems and of the capacity of the Company to adequately manage environmental and social impacts and risks, including plans and procedures, to assess their adequacy in terms of responsibilities, training, auditing, reporting, and resources to be made available to ensure adequate implementation, and specifically all the system components

necessary to ensure that Project's works that will be implemented will not generate significant negative impacts.

(h) Assessment of corporate social responsibility programs and other initiatives developed by the Company in local communities as part of the Social Collaboration Agreement with the Municipality of San Jose de Maipo. Evaluation of Company's programs intended to maximize the positive outcomes of the Project.

(i) An evaluation of project-related information disclosure and public consultation activities that have been performed and the proposed future actions to provide adequate ongoing information disclosure and public consultation with the local population. While the project has an impressive record of consultation and already has an agreement with the San Jose de Maipo municipality, in further evaluating the process as proposed in the ESS it is important to ascertain that proper feedback was given, that there was participation (or participation is planned) in the mitigation design phase, that mechanisms will be in place for continuing communication and to address issues during implementation. Additional specialized agreements with localities and user groups affected by differentiated impacts may also be assessed, and reputational questions need to be addressed even though they may be related to perceptions and fears.

(j) Explore with the Borrower the possibility of setting up a participatory monitoring program. This type of program has been successful in improving communication and credibility in contexts where the community has heightened concerns about project claims regarding impact management.

(k) Review of gross and net GHG emissions, including emissions and/or reductions from all project activities (construction of access roads, forebay clearing, emissions during operation, reforestation, and emissions averted due to displacement of fossil fuel based power generation).

(l) Hiring policies and specific measures and programs to include local labor to the extent possible in the 2500 direct construction jobs to be created as a result of this project.

6.3 Following the analysis of the Project and based on its findings, as part of the Bank's Environmental and Social Due Diligence, the Project Team will develop an Environmental and Social Management Report (ESMR) which will detail measures and steps necessary to diminish, mitigate, and/or avoid negative environmental and social impacts, and measures to stimulate the positive impacts related to the Project. The ESMR will also identify, if deemed necessary, appropriate studies and plans complementary to the Project which are still needed.

Figure 1. General Location Map

Figure 2. Location of Tunnels

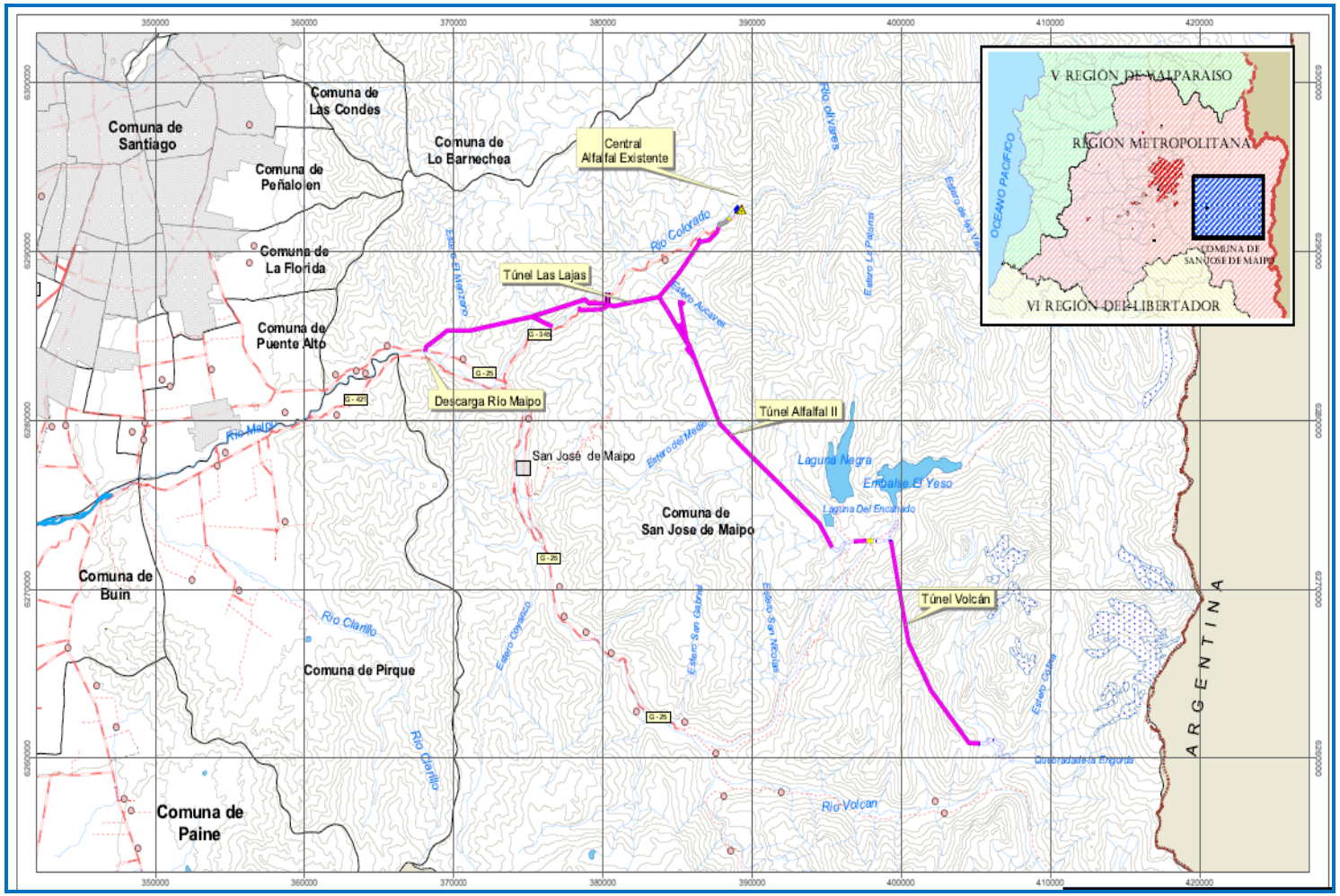


Figure 3. Detailed PHAM Facilities Plan – Alfalfal II Discharge and Colorado River Area

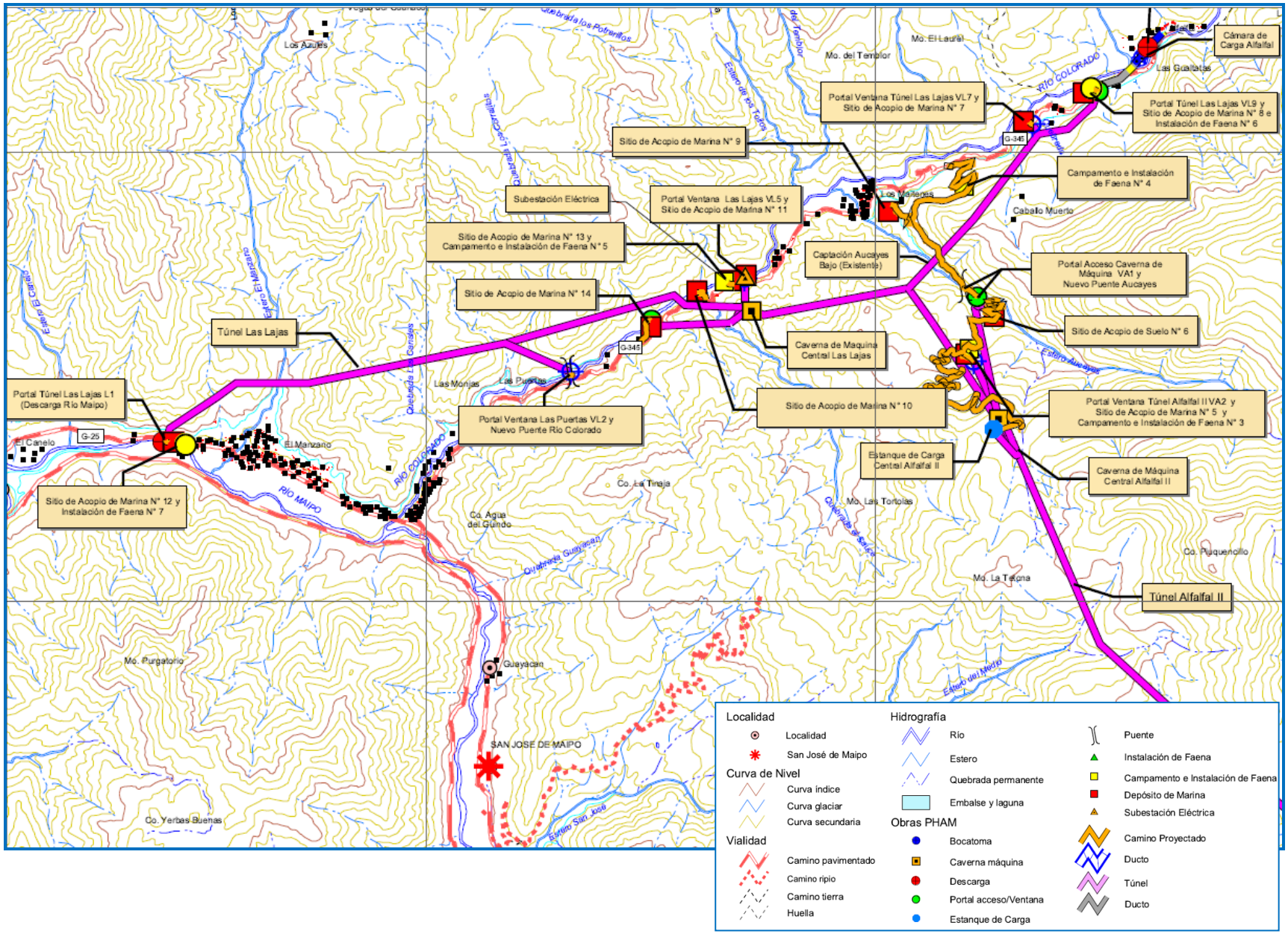


Figure 4. Detailed PHAM Facilities Plan – El Volcán and El Yeso River Areas

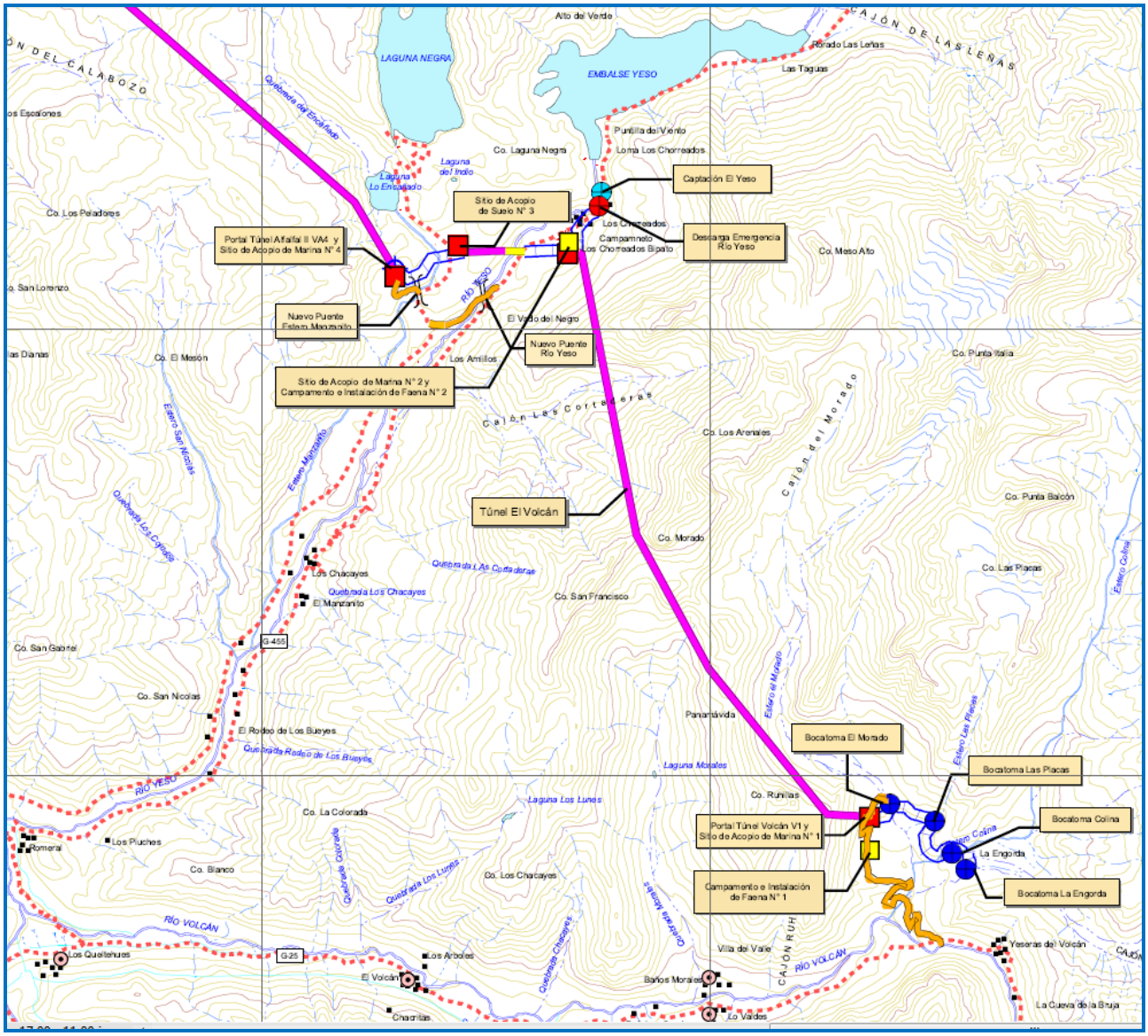


Figure 5. Protected Areas