PERU - CHAGLLA HYDROELECTRIC PROJECT
DRAFT ENVIRONMENTAL AND SOCIAL STRATEGY[1]

1. PROJECT DESCRIPTION

1.1 **Introduction.** The Chaglla Hydroelectric Project in Peru ("Project") includes the construction and operation of a dam and 406[2] MW hydroelectric power plant on the Huallaga River, in the Chaglla and Chinchao districts of the department of Huánuco, Peru (see Figure 1). The Project will be developed by *Empresa de Generación Huallaga* (EGH), a subsidiary of the Odebrecht group incorporated under Peruvian law. Construction of the Chaglla hydropower plant is estimated to begin in April 2011. The plant is expected to be commissioned in January 2016, at a production rate of 2,545 GWh annually (plant factor 71.6%). It would represent about 15% of the projected national electricity demand for 2016.

1.2 **Background.** The energy landscape of Peru is characterized by abundant hydropower potential making it the most viable renewable energy resource within Peru. The expansion of electricity use across Peru, particularly into rural areas, has raised the national demand for energy.

1.3 Over the past decade, various studies have been conducted and presented to Electroperú for the potential construction of the Chaglla hydroelectric generation facilities, considering the feasibility of different combinations of location, generating capacity, and construction costs. EGH was awarded a temporary concession in December of 2007 by the Ministry of Energy and Mines (*Ministerio de Energías y Minas* - MINEM). Shortly thereafter, environmental and social assessments were initiated by a contracted consulting firm, Minpetel S.A., in preparation for an Environmental Impact Assessment (EIA) of the proposed Project. Upon completing the EIA and receiving approval from MINEM in July 2009, additional studies were conducted to refine the engineering design and hydrologic analysis associated with the proposed Project. A specialized hydropower consulting company, Danish Hydraulic Institute, reviewed the design and suggested that the dam be moved 28 km downstream ("new location") to optimize project design, reduce hydrologic risks, and shorten the length of river that would be affected by the diversion of water. Additionally, the new location has a higher rainfall pattern providing better conditions for flow augmentation via lateral runoff and tributary conditions. The strategy presented herein refers to the environmental and social characteristics of the Project at the new location, and has been developed on the basis of the information available at this time, while the EIA is in process of being updated.

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[1] This Environmental and Social Strategy (ESS) is being made available to the public in accordance with the Bank's Policy on Disclosure of Information. The ESS has been prepared based primarily upon information provided by the project sponsors, as of October 2010, and does not represent either the Bank's approval of the project or verification of the ESS's completeness or accuracy.

[2] A 400 MW hydropower plant and a 6 MW small plant at the bottom of the dam.

1.4 **Project Component and Facilities.** The Project design includes the construction of a 199-meter-high dam, a 466 hectare (ha) reservoir, a 1,053-meter-long diversion tunnel, and hydroelectric generation facilities including a small powerhouse at the dam's bottom, main powerhouse, substation, and transmission line. Water used for power generation will flow through a 14.7-km-long intake tunnel from the dam to the main powerhouse, and thereby divert water around an approximately 15.5-km-long reach of the Huallaga River (i.e., the bypass reach). The dam will be equipped with water regulating equipment, including an ecological flow release valve and a spillway comprised of 3 tunnels with a combined length of approximately 2,850 meters. The small power house will be constructed with a head of 199 meters and an installed capacity of 6 MW. The main powerhouse will be constructed with a head of 369 meters and an installed capacity of 400 MW, powered with 2 Francis turbines. The substation will be located on a natural platform upstream of the powerhouse. As associated facility, an 137-km-long, 220-kV transmission line will connect the substation at the Project site with the Peruvian national grid (*Sistema Electrico Interconectado Nacional-SEIN*) at the Paragsha substation.

1.5 The reservoir is estimated to have a storage capacity of 375 million cubic meters. The Project will generally operate as a run-of-the-river hydropower facility (no seasonal storage capacity), which implies that at any moment the flow downstream of the powerhouse will be approximately equal to the flow entering the reservoir and the reservoir level will remain relatively constant; however, during certain times of the year (especially during the dry season) the Project will operate in daily peaking mode.

1.6 **Project Schedule.** The overall schedule is as follows:

Completion of revised EIA, field surveys, and other reports:	October 2010
Completion of consultation workshops in new location:	December 2010
Initiation of construction:	April 2011
Commission of hydropower plant (Unit 1):	November 2015
Commission of hydropower plant (Unit 2):	December 2015

1.7 **Project Alternative Analysis.**

From the original Chaglla project, the Sponsors developed an improved solution that reduces the geological risk in the tunnel works, optimizes power generation and reduces the length of the bypass reach. Assessment of the Project's analysis of alternatives will be carried out during due diligence.

2. INSTITUTIONAL AND REGULATORY CONTEXT

A. National and International Applicable Policies and Requirements

2.1 The MINEM is the main agency that regulates the environmental and social aspects of hydropower project in Peru. Within MINEM, the General Department of Electricity (*Dirección General de Electricidad*- DGE) proposes and supervises technical policies and standards of the electricity sector; the Supervising Agency of Investment in Energy (*Organismo Supervisor de la Inversión en Energía* -

OSINERGMIN) regulates legal and technical rules relating to conservation and environmental protection for development activities in the energy sector, and the General Department of Energy-related Environmental Issues (*Dirección General de Asuntos Ambientales Energéticos* – DGAAE) oversees the technical aspects of environmental regulation within the energy sector by proposing standards, evaluating EIA's, and proposing related policy and legislation. DGAAE is ultimately responsible for the approval of the EIA.

2.2 The Peruvian Government has established the Ministry of the Environment on May 14th, 2008 by Legislative Decree No. 1013, as the administrative authority of the national environmental sector, which is managed at local, regional and national government levels.

2.3 The regulatory framework for the Project is established by various national laws, decrees and codes pertaining to environmental and natural resources, labor, and other laws specific to the electricity sector, including: General Law of the Environment (2006); Decree 25844 (General Law of Electrical Concessions, 1992); Law 28832 (Law to Ensure the Efficient Development of Electricity Generation); General Environmental Law 26410 (National Environmental Council); Article 25 of Law 26410 (Establishes general criteria for Environmental Studies); Article 26 of Law 26410 (Establishes specific criteria for each stage of the process for an EIA); Decree Law 17752 (regulates and permits the use of water under the Office of Water Resources); Supreme Decree 029-94-EM (establishes guidelines for waste and emissions produced during dam construction); Article 13 of the Rule for the Environmental Protection of Electricity-related Activities (establishes guidelines for completing and submitting an EIA); R.M. 535-2004-MEM/DM (Rule of Citizen Participation for the Performance of Electricity-related Activities); Supreme Decree 056-97-PCM (Requires the technical opinion of INRENA for activities that alter the natural state of water, soil, flora, and fauna); Environmental Impact Assessment System Law 27446 (National System of EIAs- regulates activities and corrective actions associated with negative impacts on the environment); Supreme Decree 261-69-AP (establishes water quality standards and limits for physiochemical characteristics and contaminants).

2.4 The Environmental Impact Assessment System Law 27446 establishes three categories that govern environmental assessment requirements. This scheme ranges from Category I, for projects likely to have minimal adverse environmental impacts, to Category III, for projects with the potential for significant adverse environmental impacts and which require a more detailed EIA. This Project has been categorized as Category III: those projects whose characteristics, scope and/or relocation, are likely to produce negative environmental impacts, quantitatively and qualitatively, significantly requiring a deep analysis to mitigate the impacts and propose a management strategy. As such, the Project is required to have an EIA or similar study which covers all aspects of the construction and operation phases of the Project, including the impacts of the transmission line, powerhouses, diversion tunnel, and access roads. Category III EIA reports were prepared, submitted, and approved in July 2009 by MINEM for the original Project design with no substantial requests for additional information. However,

given the revised location of the Project, a new EIA is in process, which will require approval from the MINEM.

2.5 International best practice criteria for large dams includes: the International Commission on Large Dams (ICOLD), the International Energy Agency (IEA), the World Commission on Dams (WCD) and the International Hydropower Association (IHA) Sustainability Guidelines and Assessment Protocol.

B. IDB Environmental Safeguards Policies

2.6 The project triggers several directives of the IDB's Environmental and Safeguards Compliance Policy (OP-703): Directive B.5 (Environmental Assessment Requirements), Directive B.6 (Consultations), B.9 (Natural Habitats and Cultural Sites), Directive B.10 (Hazardous Materials), Directive B.11 (Pollution Prevention and Abatement), and Directive B.9 (Involuntary Settlement); as well as IDB's OP-Involuntary Resettlement Policy (OP-710) in relation to land acquisition activities.

2.7 The IDB's Operational Policy on Indigenous Peoples (OP-765) may be triggered in relation to the possible presence of indigenous communities on project-affected land (see paragraph 4.13).

2.8 The Project also triggers the IDB's Disaster Risk Management Policy (OP-704) based on the proposed large dam and reservoir, and its location in a seismic prone area.

2.9 Per the IDB's Environmental and Safeguards Compliance Policy, the project has been classified as a Category A operation due to the construction of a "large dam," as defined by the International Commission on Large Dams[3]; and the potential for significant direct and indirect impacts on natural habitats and water uses, in particular in the future reservoir area and the 15.5-km bypass reach.

3. ENVIRONMENTAL AND SOCIAL SETTING AND CONTEXT

A. Environmental Setting

3.1 The **Huallaga River basin,** with a catchment area of 7,150 km^2 and an average annual flow, through the Huallaga River, of 146.2 m^3/s, extends across the central region of Peru, on the east side of the central cordillera. The average elevation of the basin is 3,750 meters above sea level (masl) with the highest peak, Santa Rosa, at 5,706 masl. The Huallaga River basin is asymmetric with flows from south to north. The major tributary feeding the river is the Huertas River (with a drainage area of 2,150 km^2), near the town of Ambo. The Huallaga River joins the Marañón River to form the largest tributary feeding the Amazon River. Upstream of the proposed dam location, the river basin consists of over 500 lakes, mostly very small and of glacial origin, and 15 snow-covered peaks.

[3] The International Commission on Large Dams (ICOLD) defines a large dam, in part, as that which exceeds 15 meters in height, thus qualifying the proposed Chaglla dam as such.

3.2 A recent **water quality** analysis was conducted at several points along the Huallaga River, which indicates that water quality is generally good. However mercury, copper, and nickel were detected at levels exceeding the applicable standard during the wet season. Lead was found in high concentrations, exceeding the applicable standard, at five locations in the wet season and one in the dry season. EGH's consultant (Walsh S.A.) concluded that the Huallaga River basin contains zones of mineralized rocks such as slate, phyllites, and sandstones with mineral content including pyrite and arsenopyrite, which are rich in nickel, lead, zinc, and arsenic. Therefore, the presence of nickel and lead may reflect natural geologic conditions, however, there are upstream mining activities (distance unknown at the time) that require further investigation as a potential source of metals, particularly in regards to mercury and copper.

3.3 The nearest **protected area** to the Project is the Tingo Maria National Park, which is approximately 20 km from the Project. Potential impacts from the new location of the Project on this protected area will be further investigated during due diligence.

3.4 A comprehensive **hydro-biological study** was performed as part of the EIA update process, which included monitoring upstream and downstream of the new Project location during both the dry and wet seasons. The study included a summary of findings for three key aquatic communities: plankton, benthos, and fish. Plankton and benthos serve as indicators for water quality as they are highly sensitive to ecosystem impacts. Using the %EPT index[4] for measuring water quality, the hydro-biological study recorded a low cumulative EPT of 22% during the wet season which indicates poor water quality. However the EPT for the dry season was significantly better at 70%, indicating good water quality. The combined EPT for both seasons was recorded as 52%, categorizing the river overall as having good water quality.

3.5 In regard to **fish** identified in the hydro-biological study, none of the species are found on the IUCN red list, CITES, or the INRENA database for conservation. However, a few fish species believed to be endemic to this basin were found, including fish in the genera Siluriformes, Trichomycterus, Astroblepus and Chaetostoma. The taxonomy of these genera is still being discussed, which could result in the identification of additional fish genus or species endemic to the basin.

3.6 As part of the dam design, most of the flow to a 15.5 km stretch of the Huallaga River will be diverted, with only a proposed **ecological flow**[5] provided during most of the year (except during the rainy season when some spillage may occur). The EIA for the original Project design proposes an ecological flow of 26% of the minimum monthly flow, but provides little information to justify this determination. Within the EIA update process, a new ecological flow assessment is being conducted, including the consideration of two other approaches: the wetted perimeter and the numerical modeling of habitat behavior methods. The

[4] This Index quantifies water quality using the presence of Ephemerotroptera, Plecoptera, and Trichoptera (EPT), three macroinvertebrate species which are sensitive to human disturbance and good bio-indicators of the quality of water.

[5] Defined as the minimum amount of water needed in a watercourse to preserve the integrity of ecosystems.

wetted perimeter method is one of the most commonly used hydraulic methods, based upon a full hydrological study of the river. This approach estimates flows from all tributaries within the reach under reduced flow. The conditions of this flow will be simulated and compared to the conditions required by the species *Chaetostoma* ("Carachama"), which was identified as a target species for the bypass reach.

3.7 No comprehensive **investigations of terrestrial flora or fauna** conducted for the project are currently available, as they are still being processed. Once available, the Project should determine if any species that are listed on the IUCN red list as vulnerable, threatened, or endangered as well as those endemic to the area, are present and evaluate potential project effects on these species.

3.8 The project is located in a region prone to **natural disasters**, in particular seismic activities. The Nazca Plate off the coast of central Peru is a subductive oceanic plate which meets the South American Plate to form the Peru-Chile Trench (Atacama Trench). The movement of these plates has been known to cause several highly destructive earthquakes in the general region of the Project.

3.9 Archeological investigations in the project's direct area of influence (reservoir, dam site, worker camps, etc.) have not encountered any cultural heritage artifact. It will be verified during due diligence that an appropriate chance find procedure is in place during project construction.

3.10 No information is currently available on the environmental and social setting for the **137-km-long transmission line.**

B. Social Setting

3.11 The available social baseline data is limited to the **affected individual properties** within the project's direct sphere of influence, located in Huanchag, Huanipampa, Igropampa, Puquio Chihuangala y San Juan de Monterrey. The remaining properties are communal lands belonging to "*comunidades campesinas*" known as Huanipampa, San Pablo de Pillao, San Juan de Monterrey y Puquio Chihuangala. In general terms, the national 2007 census states that the project area is located in rural districts with low population densities (13.7 inhabitants/km²) with few public services. Evidence of the scarcity of public educational facilities is reflected in the low level of education amongst those surveyed, as nearly half had not completed primary school. In terms of occupation, as the majority of the area population is below age 30, 21% is currently enrolled in school; 33% self-identify as farmers and another 20% are house-makers.

3.12 **Initial** survey of affected communities indicates that 88% of the people surveyed did not have any prior knowledge of the project. The remaining people surveyed had only heard of the access roads but had no prior knowledge of any plans to build a hydroelectric plant in the area.

4. KEY ENVIRONMENTAL AND SOCIAL IMPACTS AND RISKS

A. Environmental Impacts and Risks

4.1 **Key impacts.** Potentially significant impacts and risks to the flora, fauna, and aquatic ecosystem upstream and downstream of the Project location are generated during the i) construction phase of the Project (54 months) and ii) the operation phase.

4.2 The primary environmental impacts anticipated during the **construction phase** relate to temporary erosion and increased sedimentation; potential changes to surface water flow; clearing of vegetation for construction of the dam, powerhouse, access roads, diversion tunnel, and transmission line; flooding of natural habitats while filling the reservoir; and temporary and localized construction impacts such as air emissions, generation of dust, noise, vibrations, and pollution created by accidental spills. One major risk during construction is occupational health and safety and community health and safety due to the installation of worker camps and the import of laborers from outside communities.

4.3 The primary environmental impacts anticipated during the **operation phase** relate to significantly reduced flows within a 15.5 km reach downstream of the dam; pulsing of flows during peaking operations downstream of the powerhouse; and alteration of physiochemical characteristics of the water. Dams also change riverine sediment transport processes and can create erosion problems downstream of the powerhouse if not properly designed and operated. These changes in water quality and flow regime may represent a significant risk to the habitat requirements of potential endemic fish within the 15.5 km reach and potentially to the aquatic ecosystems downstream of the powerhouse. Additionally, the barrier created by the dam structure may greatly impact the biological processes and distribution of fish species that may be present in the Project area.

4.4 **Reduced Flows and Peaking Operations.** The proposed Chaglla hydroelectric dam will operate on run-of-river mode in the wet season and peak mode (hours of generation) during the dry season. A minimum ecological flow will be maintained at all times in the 15.5 km stretch of the river downstream of the dam that will be diverted for power generation. While this minimum flow is proposed to maintain the biological and ecological processes of the river, there still remains a significant risk that the flow regime will adversely impact aquatic ecosystems in the bypass reach. Additionally, peak mode operations during the dry season will result in reduced flows (i.e., operations would not be purely run-of-the-river); causing significant daily fluctuations of flow downstream of the powerhouse, which may affect the current habitat, disturb the steady-state ecosystem, and/or cause erosion of the riverbanks.

4.5 **Endemic Aquatic Fauna.** The possibility of the presence of endemic fish species within the area of influence of the Project introduces a potentially significant risk to species conservation. If these endemic fish are only located within the Project area, there is the potential that their existence as a species is threatened if they are unable to adapt to changing habitat conditions. However, if these fish are found

elsewhere along the River, there is opportunity for them to continue their reproduction and growth. The range of their habitat will be critical information for further assessing the significance of the risks to endemic species from the construction of the Project, and to assess whether the affected stretch of the river would constitute critical natural habitat as per Directive B.9 of the IDB's Environmental and Safeguards Compliance Policy.

4.6 **Water Quality.** Anoxic (low dissolved oxygen) conditions may occur in the proposed reservoir, which could affect aquatic life in the reservoir. Further, these anoxic conditions can be transferred downstream through water releases. In addition, the temperature, pH, or other physiochemical properties may be altered, thus compromising the water quality both within and downstream of the reservoir.

4.7 **Transmission Line and Access Roads.** No information currently is available on potential impacts of the proposed transmission line or access roads. Typical environmental impacts for transmission lines include changes in landscape, habitat fragmentation, collision risk for avian fauna, and construction related impacts (noise, air emissions, soil erosion, accidental spills, etc.). Typical environmental impacts for access roads include disturbance of natural habitats, habitat fragmentation, vehicular emissions, and vehicle collisions with terrestrial fauna.

4.8 **Cumulative Effects.** There are no large or medium-size dams or hydropower facilities, planned, existing or under construction, upstream or downstream of the Project.

4.9 **Climate Change**. The project may be vulnerable to climate change impacts, specifically to changes in average flow during its lifetime. Additionally, there is the potential cumulative impact of GHG emissions generated by the creation of a 466 ha (4.67 km^2) reservoir. The creation of a reservoir floods existing plant material thus leading to the death and decomposition of carbon-rich plants and trees. The rotting organic matter can release substantial amounts of carbon to the atmosphere. Additionally, the decaying matter at the bottom of a stagnant non-oxygenated body of water eventually releases dissolved methane. The ultimate net impact of GHG emissions will be based upon the size of the reservoir, amount of plant material affected, residence time of water in the reservoir, and carbon emissions offset from introducing hydropower as a renewable resource. Given its large capacity and high power density ratio (87 W/m^2), it is anticipated that the Project will have positive net effects.

4.10 **Seismic Hazards.** The proximity of the Project to the Peru-Chile trench fault line, located 100 miles off the coast of Peru, presents a significant risk of seismic activity, which could potentially compromise the integrity of the dam structure.

B. Social Impacts and Risks

4.11 **Land Acquisition and Involuntary Resettlement.** The sponsor's very extensive *Plan de Afectaciones* estimates that the project will require the permanent use of land affecting 124 properties. In terms of the magnitude of the impacts, 75 out of 124 properties (60%) will lose at least 10% of their land - of which 7 properties will lose 100% (located on the access road), 2 will lose

between 80-95%, 3 will lose from 50-95%, 20 will lose 30-51% and 39 will lose 11-29%). The remaining 49 parties (40% of total) will lose less than 10%. The available data also provides some information on land tenure. Out of the total 124 parties, 65% are either individual land owners with irregular titles or occupant ("*poseedores*" with pending regularization processes). See paragraph 5.5 for proposed compensation measures.

4.12 **Potential Economic Displacement** (i.e. adverse impacts on livelihoods). Economic displacement downstream involving possible recreational activities, mining activities and/or fishing (both recreational and productive) on the river or flood plain, are potential risks. In order to corroborate the extent to which these activities operate, more information is required from the pending updated EIA. In addition to these activities, the 124 affected properties must also be analyzed in terms of the type of productive activity they undertake. Specifically, although the amount and proportion of land each property will be losing has been identified, a more qualitative analysis of the activities that each land owner/resident carries out (e.g. fruit cultivation, farming, livestock grazing, etc.) will be need to conclude whether they are losing their most fertile land, currently or potentially, e.g. whether their land includes a portion of the highly fertile valley floor.

4.13 **Indigenous Peoples.** Amongst the affected properties, 48% belong to "*comunidades campesinas*" (CC) with communal land titles. In terms of land tenure, of these 60 properties, 54 have property titles, 53 belonging to CC San Pablo de Pillao and 1 to CC Chaglla. The remaining 7 properties, members of the CC Muña community, have pending property titles. In terms of cultural practices, language and traditional attachment to land, it seems that these communities all speak Spanish although some of them are possibly bilingual, conserving their native Quechua tongue. Although their livelihoods are land-based and social networks play an important role in their agricultural activities, these salaried practices do not fulfill the traits of the traditional "Ayllu" in which solidarity and collective family ownership predominate. It will be further explored during due diligence if or to what extent the affected *comunidades campesinas* qualify as Indigenous Peoples as defined in IDB's OP-765. In any case, adequacy of the compensation framework for impacts on communal lands will be assessed in detail during due diligence.

4.14 **Downstream communities.** Given the nature of the reservoir and the steep slopes, there is a substantial risk of landslides, especially seismically induced landslides. Downstream communities, the extent of which will corroborated during due diligence, would be at particular risk.

4.15 **Community Support.** There is not enough information to determine the level of community support, however the lack of knowledge among the community about the proposed project (indicated by the initial survey) suggests the need for a proactive stakeholder engagement.

5. ENVIRONMENTAL AND SOCIAL MITIGATION AND MANAGEMENT

A. Environmental Management and Mitigation

5.1 An **Environmental Management Plan** (EMP) and Environmental Management System (EMS) have not been provided yet for the proposed project. The EIA for the original Project design did include a detailed EMP to manage and mitigate, to the extent possible, impacts to the environment during the construction and operation of the dam (under Environmental Management Plan section). This plan outlines management processes for dealing with the following elements: affected soils, geodynamic risks, erosion, cross-contamination (by workers), extraction of construction materials from quarries, superficial run-off, contaminated water, air quality (gases, particulates, and odors), noise, flora and fauna. A similar EMP will need to be developed for the new proposed location.

5.2 Based on the impacts to be identified in the new EIA, it is likely that **additional mitigation measures** will need to be identified and developed to minimize project-related impacts. This may include soil stabilization, revegetation, habitat restoration, quantification and provision of an ecological base flow, and possibly biodiversity offsets. These measures should be disclosed to stakeholders.

5.3 Upon receiving all contributing information, a **final ecological flow regime** needs to be established for the bypass reach downstream of the dam. The ecological flow will be based upon an assessment that considers the conditions necessary to maintain a functioning, healthy ecosystem within the diverted section of the river. This minimum flow must be maintained at all times.

5.4 Construction-phase **monitoring** must occur monthly with the results presented to the DGAAE; operation-phase monitoring must occur at a frequency set by MINEM. Monitoring of the following conditions will be performed: gases and dust (mostly during construction), water quality (contaminants and physiochemical characteristics, i.e. pH, BOD), slope stability, solid waste, growth of re-vegetation, flow volume, bathymetry, payments to proprietors, compensation to those displaced, and the adaptation of the people. The costs of these activities have been factored into the project budget although specific details and best practices are yet to be established.

B. Social Management and Mitigation

5.5 The client has prepared a detailed **compensation plan** to address involuntary taking of land. However, the main compensation plans are based on monetary (cash) compensation. According to OP-710, there are significant risks associated with cash compensation to affected persons. Some of the most frequent and serious are (i) the risk of failing to avoid impoverishment by the inappropriate use of compensation funding for leisure or consumption good and activities by one or more members of the recipient household and/or (ii) risk of taking land with traditional land tenure or ancestral territories. For this reason, cash compensation will not be recommended. Another consideration is the lack of more detailed analysis regarding proportional impacts, based on the percentage of individual properties lost in each case as well as the quality and use of the land lost,

regardless of its proportion of total property area. For these cases, in-kind compensation, especially land-for-land options, will be prioritized.[6] Also, the total monetary estimated value for resettlement costs (US$208,549.42) does not include programs for economic and social restoration programs. Similarly, land-based compensation considerations will be promoted in the cases of economic displacement (described above) identified during due diligence.

5.6 Preparing, implementing and enforcing a rigorous and culturally-appropriate communication strategy and creating a user-friendly grievance mechanism are of utmost importance due to the population's location, dispersion and education level. Stakeholder engagement activities and strategy, including public disclosure of and public consultation, will be assessed in detailed during due diligence.

5.7 Given the risk of landslides, potential risks to downstream communities will be analyzed and corresponding mitigation measures explored and developed during due diligence.

6. ENVIRONMENTAL AND SOCIAL DUE DILIGENCE STRATEGY

6.1 The Bank will conduct an Environmental and Social Due Diligence ("ESDD"), which will include the following:

a. Further analysis to determine whether part of the Project's area of influence would constitute a critical natural habitat[7] as defined in Directive B.9 of the IDB's Environmental and Safeguards Compliance Policy and if the construction of the dam would involve the serious degradation of this natural habitat through the severe diminution of its integrity and capacity to maintain viable populations of its native species. This analysis will be based upon the results of the hydro-biological studies, ecological flow modeling and simulations, and further studies on specific species of concern that may be endemic, highly sensitive, and/or follow a critical migratory pattern. These studies are currently being carried out on behalf of EGH by Walsh S.A based on hydrology studies conducted by the Danish Hydraulic Institute (DHI). The analysis may conclude that appropriate mitigation measures or appropriate natural habitat offsets will be sufficient to comply with Directive B.9. Specifically, information required to make the critical natural habitat determination includes:
    - The geographic distribution and habitat requirements of endemic species or potentially endemic species must be accurately delineated (e.g., only upstream, only downstream of powerhouse).
    - Migratory patterns, if any, must be defined and understood fully for the fish species identified in the hydro-biological study. Potential mitigation measures will rely on this information.

[6] In cases where cash compensation is deemed to be appropriate, this mode of compensation will considered valid only if associated mitigation measures are applied, such as creating incentives for female recipients of payments, financial literacy programs for women and men and/or conditional, incremental payments upon evidence of construction-related purchases.

[7] May be highly suitable for biodiversity conservation, crucial for the survival of vulnerable, threatened or endangered species, or critical for the viability of migratory routes

b. Potential Project impacts to the Tingo-Maria National Park.

c. Disturbance to the natural flow of water, which is one of the most critical risks of this Project**.** An adequate ecological flow regime can mitigate some of the potential impacts. However, this flow regime, in particular the minimum flow, must be developed with a high level of consideration for the specific hydrological and biological conditions of the Huallaga River within the affected reach. The estimation methodologies used to determine the ecological flow, which include the wetted perimeter methodology and numerical modeling of habitat behavior for target species, will be reviewed and verified during due diligence. The modeling of habitat behaviors should, at a minimum, encompass all endemic species and affected habitats. A feasibility analysis of alternative methods for determining ecological flow and a comparison of the quality of results should be provided to justify the selected method.

d. The effects of the proposed modified peaking operation during the dry season on water level fluctuations within the reservoir and on aquatic habitat and species downstream of the powerhouse.

e. Estimation of gross and net GHG emissions.

f. Further investigation to confirm the sources of copper, lead, nickel, and mercury in the Huallaga River, determine whether or not these sources are ongoing (e.g. mining activities), and evaluate the potential for these metals, especially mercury, to enter the aquatic food chain in the reservoir, and establish a final set of baseline levels to be used for monitoring purposes.

g. An evaluation of the appropriateness of specific reference values used for water quality will ensure that these are consistent with generally accepted international criteria protective of terrestrial and aquatic resources.

h. An analysis of potential seismic activity in the Project area and surrounding region given the proximity of the Project location to the Peru-Chile trench. Additionally, the geodynamics associated with Project construction, given the significant size (199-m-high) of the dam, should be defined along with potential risks for land movement or landslides identified.

i. Potential cumulative effects related to the presence of several small dams (< 6 MW) upstream of the proposed Project location.

j. A review of the adequacy of the involuntary resettlement plan including the following points:

    1) Community participation

    2) Analysis of the proportion, use and tenure of land lost in each of the 124 cases (including communal lands), by sector of the river (e.g. downstream), as well as the productive feasibility of the remnant areas of land;

3) Land-based compensation measures proposed for all productive land lost;

4) Specific resettlement programs with social assistance for all families losing significant proportions of land;

5) Extent to which indigenous peoples are present and, if relevant, specific measures for the *comunidades campesinas* with communal land titles or claims;

6) Budgeted programs for the restoration of social and economic conditions (including educational and health access) for families to be relocated;

7) Potential adverse socio-economic impacts associated with land acquisition and/or impacts on assets, income or livelihoods differentiated by segments of the river: e.g. downstream, before powerhouse, quarries, areas of tunnel, for example, loss of especially fertile land in river basin and/or ecotourism activities due to changes in water uses;

k. A review of the social impacts along the transmission line alternative corridors being considered.

l. A detailed review of the social impacts related to land acquisition for the access roads

m. An evaluation of Project-related information disclosure and public consultation activities that have been performed, as well as of the proposed future actions to provide adequate ongoing information disclosure and public consultation with the local population.

n. A review of the adequacy of the community relations plan, including grievance mechanism for affected people.

o. A review of the adequacy of the analysis of alternatives, including possible social and economic criteria used to select new project location.

p. An evaluation of the proposed Project environmental and social documentation - including the updated EIA, any supplementary environmental or social study and the Environmental and Social Management Plan - to confirm that the Project's potential direct and indirect environmental and social impacts have been properly identified and evaluated, and will be adequately mitigated and managed.

q. A determination of key indicators and requirements for the project execution.

r. An evaluation to confirm adequacy of the disaster risk management plan and other contingency plans (i.e. spill plans), including 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 adequate implementation.

s. An evaluation of environmental, social and health and safety terms and conditions in relevant project legal documents (e.g. concession contract, construction contract, operations and maintenance contract, etc.), in terms of sufficiency, potential risks or liabilities, or issues.

6.2 As part of the Bank's environmental and social due-diligence, the Bank will prepare an Environmental and Social Management Report (ESMR).

Figure 1. Map of Project Location and Components