

Cumulative Impact Assessment - Alto Maipo Hydropower

Pablo Baranao, Mejores Prácticas, pbaranao@mejores-practicas.com

Ximena Espoz, DAES Consultores, xespoz@daesconsultores.cl

Juan Quintero, international consultant, eecjdq@gmail.com

Abstract

A Cumulative Effects Assessment Study (CEA) was performed to Alto Maipo Hydroelectric Project (AMHP), located south-southeast of the City of Santiago, Chile, which consists of a 531 MW hydroelectric complex comprised of two run-of-river plants hydraulically arranged in series. The AMHP was environmentally approved by the Chilean authorities on 2009, but the CEA was required by international funding organizations. The AMHP and its transmission line will be developed in a watershed that already has several hydroelectric and potable water supply operations, all of which have affected not only its hydrology (from the 1910s) but also other environmental attributes. To perform this evaluation, both existing and potential projects that might have cumulative impacts on valued ecosystem components (VEC) were considered. Thirteen existing projects and activities and/or those in the reasonably foreseeable future were identified in the AMHP area of influence. The following cumulative effects were assessed: other water uses, exploitation of aggregates from the Maipo River, erosion, tourism, traffic and road safety, basic services, cultural changes and climate change. In addition to the mitigation measures already included in the previous environmental permit, this study recommended additional mitigation, reparation and compensation measures. The cumulative impact assessment was prepared considering the potential worst-case scenario from the environmental standpoint, and therefore, deviations from the behavior described for the VECs are not expected. Nevertheless, the adaptive management of some cumulative effects is desirable to ensure an adequate environmental performance of the AMHP.

Introduction

Alto Maipo Hydroelectric Project (AMHP), is a hydroelectric complex compounded by two run-of-river plants and their corresponding transmission lines. It is located south-southeast of the City of Santiago, in the municipality of San José de Maipo, Metropolitan Region, Chile.

The AMHP was environmentally approved by the Chilean authorities on March, 2009, through Exempt Resolution (Resolución Exenta N° 256) of the Regional Environmental Commission of the Metropolitan Region (RCA 256/09). This approval was based on the presentation of the Environmental Impact Assessment (EIA) that was registered on May, 2008, in the Environmental Impact Assessment System (EIAS), (Sistema de Evaluación de Impacto Ambiental, SEIA).

To complement the Project's EIA, another EIA was presented in September 2009, "Power Transmission Lines S/E Maitenes – S/E Alfalfal and Central Alfalfal II – S/E Alfalfal," for the environmental approval of the transmission lines required to evacuate the power generated by the plants Alfalfal II and Las Lajas. This EIA, approved in July 2010 by Resolution N° 443/2010 (RCA), also included a public participation processes that collected all stakeholders' concerns associated with the transmission lines.

Chile's Environmental Impact Assessment System (EIAS) corresponds to a regulated process established by Law 19.300 of General Environment Basis enacted in 1994, which lists all projects susceptible to cause environmental impacts. According to the provisions of this law, the project must enter the assessment process by conducting an EIA when the project can potentially generate or have significant environmental impacts. Throughout this process a public participation also takes place, which can later be translated into mitigation, compensation, or restoration measures approved by the environmental authorities.

The AMHP and its transmission lines will be developed in a watershed that already has several hydroelectric and potable water supply operations, all of which have affected not only its hydrology (from the 1910s) but also other environmental attributes. Additionally there are issued and pending permits for new projects in the area of influence of the AMHP, all of which have affected and/or will affect valued ecosystem components in the watershed.

Thus, and in accordance with the international standards of financial institutions, it is necessary to carry out a Cumulative Effects Assessment Study (CEA) of the AMHP.

Methodology

To perform this evaluation, both existing and potential projects that might have cumulative impacts on valued ecosystem components (VEC) were considered. This includes: power plants in operation that AES Gener has in *Cordillera* Complex, other hydroelectric plants in the area (existing and future), potable water operations, and mining exploration or exploitation projects.

For each potential cumulative environmental interaction detected between the AMHP and the other projects reviewed, its effect on valued components of the Project area, which were identified as recommended by the IFC, was analyzed as follows: hydrology, sediment transport, landscape and local communities.

When cumulative effects that could affect any valued component of the Project area were detected, its potential effects were analyzed on other water users (including recreational uses, potable water, and irrigation); the exploitation of aggregates from the Maipo River; possible erosion events in the Maipo River; tourism, traffic, road safety, basic services in the municipality of San José de Maipo, and any cultural traditions changes in the area of influence of the Project.

To prioritize the relevant VECs for the assessment of cumulative effects, the decision-making flow chart presented in Figure 1 was applied. In this manner, only those VECs of importance, when identified as such by neighboring communities and/or for the scientific community that may be affected by the AMHP and that have been or might be affected by other projects in the past or in the reasonably foreseeable future were selected. It is important to clarify that the exclusion of a VEC does not imply that it is not important or that the AMHP has no effects over that VEC.

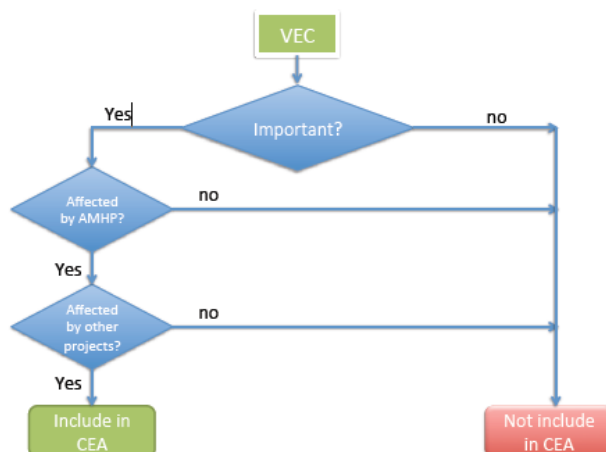


Figure 1: Flow Chart for the Selection of VECs for CEA

Finally, the effects of climate change were evaluated from two different perspectives: the cumulative effects of the Project on climate change and the cumulative effects of climate change on the VECs that are also affected by the Project.

Description of the Alto Maipo Hydroelectric Project and its area of influence

The project consists of a hydroelectric complex comprised of two run-of-river plants arranged in series—the Alfalfal II and Las Lajas hydroelectric plants—and around 17 km of transmission line. The hydraulic works will be constructed almost underground entirely with pressure tunnels, cavern powerhouses, and a network of conduits that will also be mostly underground. The project will be located in Maipo River upper basin, (see Figure 2), will have an installed capacity of 531 MW and will generate 2,350 GWh per year on average.

The Alfalfal II Plant will receive water collected from rivers in the upper part of the Volcan River, and then conducted to the El Yeso River valley through the Volcan tunnel, 700 meters downstream of Yeso Reservoir. Four intakes will be constructed to collect the water from four rivers that converge and form the northern branch of the Volcan River (La Engorda, Colina, Las Placas, and El Morado), which is tributary the Maipo River assuring an ecological flow. From Yeso river, the flow will be conducted to the inflow tunnel of the Alfalfal II Power Plant via a pressure tunnel. Once the flow is turbined at this plant, it will be discharged to the inflow tunnel of Las Lajas Power Plant. The powerhouse will be located on the left bank of the Colorado River in a cavern. Finally, the discharge tunnel of the Las Lajas Hydroelectric Plant will deliver its waters directly into the Maipo River.



Figure 2: General Location of Alto Maipo Hydroelectric Project

Identification and description of the VECs in the Maipo River Upper Basin

As a result of the application of the methodology detailed above, it was possible to identify the following Valued Ecosystem Components (VECs) or environmental, social, and economic values that could be affected by the AMHP, either individually or together with other activities in the area of influence: river continuity, biodiversity of water courses, flow of water courses, availability of water for irrigation, surface water quality, recreational uses of water courses, sediment dynamics, economic and social environment, local infrastructure (mainly roads), air quality, cultural and archeological heritage and protected areas and/or areas with touristic, cultural, or heritage interest.

From the valued components previously identified, those that met the conditions for inclusion in the Cumulative Effects Assessment of the AMHP (see Figure 1), by their importance, by being affected by the Project, and also by other projects (either past or reasonably foreseeable future projects) were: hydrology, sediment transport, landscape, and local community.

The current status of significant VECs of the Maipo River upper basin showed that, regarding hydrology and sediment dynamics, the area started to be affected since 1917, when first drinking water project (Laguna Negra Aqueduct) was built in the area, and were also significantly affected after 1965, with the operation of El Yeso Reservoir and the construction of other drinking water and hydropower projects. At the current date, almost 45% of river lengths are affected by some projects, as well as 27% of their flows.

Regarding landscape and local community, those VECs has been gradually affected during the last two centuries, as a consequence of the historical development of the mountain valleys population, which has a fairly homogeneous culture as a product of the strong linkage with Santiago city. There are not indigenous communities in the area nor other potentially vulnerable groups from the cultural point of view.

Cumulative Effects Assessment on VECs

Thirteen existing projects and activities and/or those in the reasonably foreseeable future were identified in the AMHP area of influence, which have affected or could affect the VECs, mainly related to hydropower generation, drinking water and non-metallic mining activities. The identified cumulative impacts between AMHP and other projects are shown, for operational phase in Figure 3.

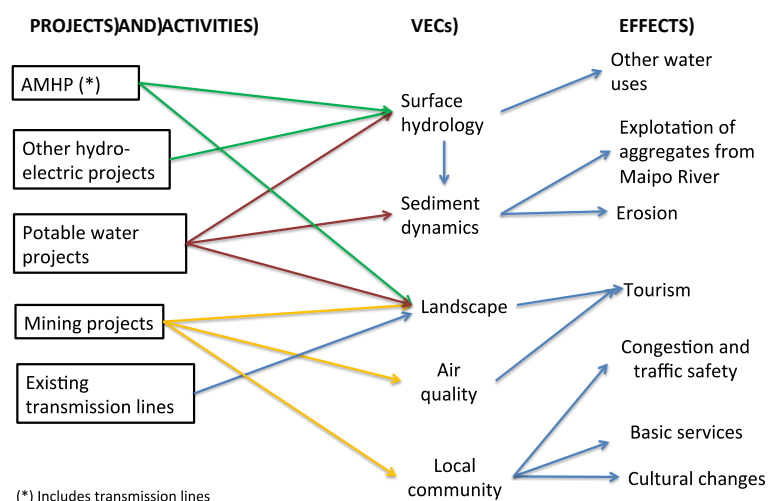


Figure 3: Diagram of Cumulative Impacts during AMHP Operation Phase

The main cumulative effects caused by the AMHP on VECs identified will be observed in the Maipo River, together with drinking water projects and climate change, affecting 21 km of additional river lengths and 24% of their average water flow. However, according to the assessment of the significance of these incremental effects, it was concluded that the effects are not significant, as the other water users will not see their activities affected even with the start of operations of the AMHP, because the water rights used for hydropower are for *non-consumptive use*, which means that the water is returned to the rivers of the basin after its use for power generation.

Overall, the AMHP could have the potential to affect sediment dynamics of the Maipo River upper basin, which has been previously affected by other operations and will continue to be affected by future projects. Nevertheless, the extraction of aggregates from the Maipo River, at the sector La Obra located downstream of the AMHP area of influence, as well as eventual changes in the erosion processes, deserve special attention. The assessment of the significance of these effects and their magnitude has been analyzed in several studies to date, which generally show that the effects of the AMHP on this variable are not relevant. Such studies are being complemented by a new advanced study with results available in 2014.

All other cumulative effects (tourism, traffic congestion, road safety, basic services, cultural changes and climate change) were also analyzed and concluded that those effects were not significant, based on the application of the methodology and because of the implementation by AMHP of additional cumulative effect managements activities or programs, described in the following Section.

Management of Cumulative Effects

From its beginning, the AMHP incorporated ninety-seven measures in terms of its potential impacts on the following VECs: air quality, noise, vibration, temporary modification of riverbeds, water quality, vegetation, wildlife, ichthyic fauna, economic and social environment, interference with tourism, and traffic impact.

However, as a consequence of this CEA, some additional measures were taken by the project. Because of the nature of some cumulative effects, the Project and the environmental authorities have agreed upon an adaptive management approach of these effects, based on monitoring and analysis to identify VECs that behave in a way different from the one described above as their impacts can occur unforeseen, and also to identify environmental or social variables that do not evolve according to the provisions of the EIA of the AMHP. The main cumulative effects that will be adaptively managed are the effects from traffic congestion and road safety, sediment transport and erosion, and climate change.

Conclusions

This Cumulative Effects Assessment, required by international organizations, was useful to complement the two EIAs of AMHP, performed under Chilean regulation, in order to guarantee the future ecological and social sustainability of the Project.

References

- AES Gener, 2008a, Alto Maipo Hydroelectric Project Environmental Impact Assessment, its Addendas and environmental permit associated.
- APR Ingeniería S.A., 2012, Evaluación de Efectos Acumulativos, Hidrología y Dinámica de Sedimentos, Revisión A, Febrero de 2012.
- Boulet, E. y Beaulac, G., 2012, Managing Cumulative Effects of Cascade Hydropower Development Challenges and Options, Energy Future: The Role of Impact Assessment, Porto, Portugal, May-June de 2012.
- Cardinale, P., Athie, M., Greig, L., Boardley, S. y Pooley, J., 2012, Good Practice Note: Cumulative Impact Assessment and Management: Guidance for Private Sector in Emerging Market – International Finance Corporation, Energy Future: The Role of Impact Assessment, Porto, Portugal, May-June de 2012.
- Centro de Cambio Global de la Pontificia Universidad Católica de Chile y POCH, 2010, “Análisis de opciones futuras de mitigación de gases de efecto invernadero para Chile en el Sector Energía”, available at http://www.sinia.cl/1292/articles-50188_recurso_6.pdf
- CEPAL, 2010, La Economía del Cambio Climático en América Latina y el Caribe. Síntesis 2010.
- Hegmann, G., Cocklin, C., Creasey, R., Dupuis, S., Kennedy, A., Kingsley, L., Ross, W., Spaling, H., and Stalker, D. 1999. Cumulative Effects Assessment Practitioners Guide. Prepared by AXYS Environmental Consulting Ltd. and the CEA Working Group for the Canadian Environmental Assessment Agency, Hull, Quebec.
- IFC, 2012, Normas de Desempeño sobre Sostenibilidad Ambiental y Social, Norma de Desempeño 1: Evaluación y Gestión de los Riesgos e Impactos Ambientales y Sociales, IFC, January de 2012.
- Ministerio de Medio Ambiente, Gobierno de Chile, 2011, Segunda Comunicación Nacional de Chile ante la Convención Marco de las Naciones Unidas sobre Cambio Climático.
- UNTEC, 2013, Cambio Climático y su impacto en la disponibilidad de recursos hídricos del Proyecto Alto Maipo, Informe Final, Borrador.