MITIGATION HIERARCHY FOR BIODIVERSITY CONSERVATION – ID 497

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Introduction

Pipelines are geographically distributed systems that often cross a variety of geological environments and can be exposed to a diverse range of geological, environmental and social hazards. These hazards must be characterized for the route selection, basic design, detailed design, and construction and operations stages of a project to adequately manage all biodiversity-related risks.

The PERU LNG (PLNG) Project consists of a buried natural gas pipeline that crosses the Andes to a liquefaction plant located directly south of Lima, Peru. The 408 km pipeline traverses many diverse landscapes and ecosystems from the edge of the rainforest, crosses some of the highest peaks of the Andes, and finally descends to the arid desert of the Peruvian Pacific coastline.

The PLNG Pipeline Project (the Project) presented biodiversity risks, because of the number of sensitive species and habitats in the Project Area. Construction and operation of the Project directly and indirectly affects sensitive biological resources within and in the vicinity of the pipeline Right-of-Way (RoW). The diverse setting of the Project and the presence of biological sensitivity within the pipeline area of influence required a comprehensive strategy and specific, implementable actions aimed at the protection and conservation of biodiversity during the construction and operation of the pipeline.

Implemented Strategy

To effectively manage these risks, PLNG designed a Biodiversity Action Plan (BAP) by implementing a mitigation hierarchy that was continually revised based on an adaptive management approach. The BAP required the implementation, monitoring, and evaluation of results, and adjustment of objectives, practices and policies. Based on research findings, science-based monitoring and repeated assessment, PLNG managed to avoid and minimize some negative impacts on biodiversity.

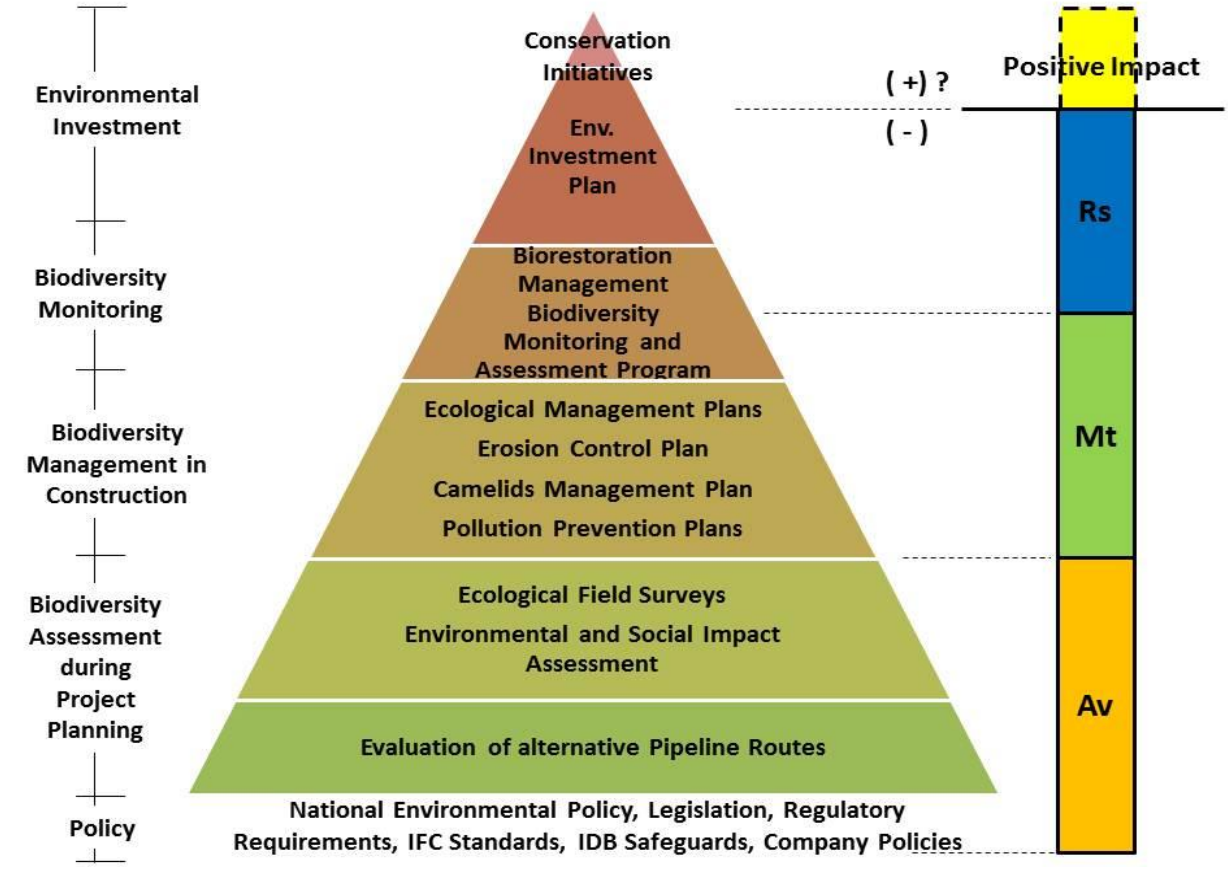
The mitigation hierarchy seeks foremost to avoid negative impacts on biodiversity. For any impacts that cannot be avoided, mitigation and restoration measures may be implemented, and, if applicable, offsets and conservation initiatives pursued. Based on this approach, PLNG's BAP was structured on five pillars, each comprised of several key components.

Table 1. PLNG BAP Pillars and Key Components

BAP PILLARS	KEY COMPONENTS
1. Policy Framework	▪ Environmental policies from the Government of Peru. ▪ International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability - PS 6. ▪ Environmental Safeguards from the Inter-American Development Bank (IADB) ▪ PLNG Environmental Policy.
2. Biodiversity Assessment during Project Planning	▪ Evaluation of alternative pipeline routes. ▪ Environmental and Social Impact Assessment. ▪ Ecological Field Surveys.
3. Biodiversity Management during Construction	▪ Ecological Management Plans. ▪ Camelids Management Plan. ▪ Biorestoration Management Plan.
4. Biodiversity Monitoring Program	▪ Biodiversity Monitoring and Assessment Program.

5. Environmental Investment Plan	▪ Environmental Investment Plan. ▪ Conservation Initiatives.

The interactions between PLNG's BAP Pillars, key components and the mitigation hierarchy[1] are represented in Figure 1, and explained below.



Av = Avoidance; Mt = Mitigation; Rs = Restoration;

Figure 1 – Mitigation Hierarchy for Biodiversity Conservation.

1. Policy Framework

The BAP was developed to be consistent with the environmental and social policies of PLNG and relevant environmental policies of the Peruvian Government, including the National Environmental Policy established under General Law of the Environment, the National Strategy on Biological Diversity, and Regional Strategies, Environmental Agendas, and Action Plans from the three regions crossed by the pipeline (Ayacucho, Huancavelica and Ica).

The BAP follows the biodiversity action planning guidance for hydrocarbon projects from the International Petroleum Industry Environmental Conservation Association (IPIECA, 2005), and is in line with IFC's Performance Standard (PS) 6, Biodiversity Conservation and Sustainable Natural Resource Management, and with IADB's Environmental and Safeguards Compliance Policy Directive B.9 on Natural Habitats and Cultural Sites.

[1] The mitigation hierarchy graphic on the left side of Figure 1 is from Business and Biodiversity Offset Programme 2011.

2. Biodiversity Assessment during Project Planning Process

The first component under this pillar was a thorough evaluation of pipeline route alternatives. In 2004, PLNG conducted a preliminary evaluation for the pipeline route, which identified the main issues regarding two alternative routes, referred to as the "direct route" that would follow an approximate straight line from a tie-in to an existing gas pipeline to the LNG Plant on the Pacific coast; and the "parallel route" that would use the same corridor as the existing gas pipeline that delivers natural gas to Lima. The evaluation aimed at establishing the advantages and disadvantages of each route from an environmental perspective. The evaluation considered aspects from different disciplines, including biology, geomorphology, archaeology, and sociology, among others.

The evaluation results showed that the corridor with the fewest environmental and social impacts would be a modified and improved "parallel route", as it would use some areas of the same corridor and much of the existing infrastructure (roads, yards, camps, etc.) as the gas pipeline that feeds Lima. After the modified and improved "parallel route" was selected, PLNG performed field work that permitted necessary changes (micro-routing) to minimize impacts. As a result, the route was modified and improved and the environmental and social impact assessment (ESIA) process began. The ESIA revisited the alternative analysis and assessed the optimized route to minimize river crossings, Andean wetland crossings, and archaeological site impacts.

Figure 2 – Modified and improved "parallel route"

As part of the consultation activities undertaken for the ESIA, discussions were held on biodiversity issues with a range of stakeholders from across the Project area. In total, the ESIA consultation process included 171 workshops[2] involving over 15,000 people from communities located in the Project's area of influence, and representatives from local and national authorities, NGOs, and other institutions.

The ESIA scope of study was comprised of a 3 - 7km wide corridor and involved the collection of biological baseline data. The study identified fifteen priority species in five sensitive habitats. The ESIA provided a solid starting point for site-specific studies such as the Ecological Field Surveys (EFS) and Ecological Management Plans (EMP).

The EFS was carried out along the selected pipeline corridor (modified and improved "parallel route") in 2006 to build on the ecological detail set out in the ESIA and narrowed down the study corridor to 50m.

[2] International Finance Corporation 2007. Environmental and Social Review Summary. IFC, Washington DC

The EFS resulted in the collection of detailed information on the sensitivities found throughout the project footprint and defined 14 macro environments or Ecological Landscape Units (ELUs) along the RoW meant to characterize broad geographical and topographical areas with distinctive and distinguishing elements of flora and fauna.

Species sensitivity was determined for each of the studied species based on four characteristics: i) conservation status; ii) endemism; iii) use by local communities, and iv) mobility. The EFS identified an additional 34 species that were added to the preliminary lists of species identified by the ESIA as potential priorities for conservation.

3. Biodiversity Management during Construction

A number of plans and programs were developed by PLNG to adequately address hazards, implement controls, ensure compliance, and promote continuous improvement of environmental management during construction. With regards to biodiversity, three management plans were developed and implemented:

Ecological Management Plan: Narrowed down the study corridor to the final 25m RoW. It describes the overarching biodiversity conservation requirements and the specific mitigation measures that must be implemented in the fourteen ELUs during construction. The EMP is a higher-level plan, under which more specific and executable plans, procedures, and projects were developed and implemented as part of the mitigation of impacts on biodiversity during construction.

Bio-restoration Management Plan: To restore the vegetation cover as quickly as possible following construction in order to stabilize the ground, prevent erosion and maintain pipeline integrity. The second phase aimed to fully reinstate the affected area to pre-construction conditions.

This plan takes into consideration the challenges associated with the harsh conditions of extremely rugged, mountainous terrain, the special requirements for sustaining vegetation growth at high altitudes, the value of non-domesticated native plant species, and the utilization of seeds and cuttings of shrubs from local communities. This bio-restoration methodology is structured around two main constraints: altitude and topography, which when considered together, result in a highly modified, region-based re-vegetation method. The plan gradually evolved from a static plan to a more “evergreen” tool, based on continuous assessment of results and constantly changing environmental and social conditions. The Bio-restoration Plan is assessed in conjunction with the Biodiversity Monitoring Program, which provides a focus on re-establishment/restoration of ecological function.

Camelid Management Plan: To ensure that the Pipeline project protects the socio-economically important herds of vicuña, alpacas, and llamas in the High Andes. Fieldwork identified highly sensitive areas (hotspots) for camelids on or close to the Pipeline RoW that could be adversely affected during construction; a Constraints Map illustrating the hotspots was prepared for use by the pipeline contractors; and operating procedures were developed to avoid and minimize impacts to camelids during construction and in the first 3-4 years of operation.

4. Biodiversity Monitoring

As part of its BAP, PLNG developed a Biodiversity Monitoring and Assessment Program (BMAP) in partnership with the Center of Conservation Biology of the Smithsonian Institution, to monitor potential impacts on biodiversity during the construction and operation phases of the Project and to provide recommendations for environmental management improvements.

The primary aim of the BMAP is to provide a reliable mechanism for assessing the effectiveness of mitigation measures and to determine any impacts that may have occurred from construction activities. Data sampling, analysis methodologies and conclusions are scientifically sound and statistically supported, thus ensuring robustness of the results of the program.

The BMAP relies on the evaluation of a large biodiversity dataset that has been collected since the early planning phases of the Project. All along the pipeline route, selected monitoring protocols were developed by experts and peer reviewed, in order to focus on the most relevant species and habitats, in terms of biological sensitivity and representativeness, understanding impacts and feasibility. These

protocols are designed to understand the distribution and abundance of the species and habitats, their conservation status, and the potential impacts from construction and operation of the pipeline, through the development of meaningful research questions. The results produced so far proved very useful for critical decision making and the program is intended to continue to ensure long-term monitoring.

5. Environmental Investment

PLNG developed an Environmental Investment Program, which is based on the environmental and social data gathered throughout the phased development of the BAP. The Program is intended to bring additional recognized environmental benefits in the Project's area of influence beyond the commitments established in the ESIA through the promotion of sustainable environmental conservation and development projects.

The Environmental Investment Program is not limited to strict biodiversity-related themes; rather, it is intended to consider the broader range of environmental issues facing the landscapes and communities in Project's area of influence.

The first component of the Environmental Investment Program was designed to improve the health of the camelid populations within the area of influence and improve the quality of the vicuña fiber. Training workshops in care and handling of newborns, treatment of infectious and parasitic diseases and in vicuña handling methodologies have benefited 1,048 families and 90 breeders.

In addition, there are a number of conservation initiatives that are being studied and designed as part of the BMAP. The first initiative is aimed at developing an Andean Forests Conservation Plan in the Patibamba area, near Kilometer Post (KP) 30 of the pipeline RoW. Although the Plan is in the very early stages, progress has been made through a pilot germination and seedling survivorship study of *Eriotheca* (sp.), and the gathering of information from the regional government to explore a future collaboration. It is expected that the design of the Conservation Plan will be completed by the end of this year and implementation will follow in 2014.

Conclusions

Pipeline projects in challenging geographical and environmental settings can potentially cause severe negative impacts to biodiversity. Experience has proven that failing to recognize and avoid sensitive areas, and to plan the minimization and mitigation of hazards in a timely manner can result in biodiversity loss and costly environmental damages.

The timely design and implementation of a BAP based on IPIECA's approach, with a strong focus on the mitigation hierarchy, has proven an effective tool to adequately address and manage the biodiversity risks associated with this Project.

The BAP provided a comprehensive strategy with specific actions aimed at the protection and conservation of biodiversity during the construction and operation of the pipeline. Based on research findings, science-based monitoring and repeated assessment, PLNG has managed to avoid and minimize negative impacts on biodiversity and foster the restoration of impacted areas.

An iterative approach, through the monitoring and evaluation of results, and review of objectives, practices and policies, exemplifies adaptive management in the implementation of the mitigation hierarchy to protect biodiversity and manage project-related impacts.

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