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A Case Study of Environmental Social Impact Assessment Methodology - Kajaki Hydropower Plant Project, Helmand, Afghanistan

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***Abstract*— Construction activities in general have adverse effects on the surrounding environment. One of the efforts to keep the impact on the environment on check is Environmental Social Impact Assessment (ESIA). The most convincing definition of ESIA is a comprehensive document of a project's potential environmental, social risks and impacts (IFC – 2012). This paper aims to delineate the process involved in assessing the impacts of one such construction, a construction of a powerhouse in Kajaki Dam, Afghanistan. This powerhouse was constructed next to pre-existing powerhouse which comprises of three units. Along with the construction of a powerhouse an emergency spillway was also constructed and the penstock (4.9-meter diameter) was installed from the existing concrete plug in the tunnel to the powerhouse. This paper aims to identify and assess the impacts and also provide the mitigation measures by providing Environmental and Social Management Systems (ESMS) which was involved in this construction activity.**

Keywords*—Environmental Impact Assessment, Social Impact Assessment, Environmental Social Management Systems.

INTRODUCTION

The Kajaki Dam was built in the 1950s by the American firm Morrison-Knudsen on contract with the then Afghanistan's Royal Government. Two 16.52 megawatt (MW) hydroelectric turbines were installed by USAID in 1975, along with 110 volt (v) transmission lines and substations that distributed the generated energy to the region.The dam's power station has space between the two existing turbines (One and Three) for a third turbine (Turbine Two), which was not installed before the US withdrew from Afghanistan in 1979 following the communist coup and subsequent Soviet military intervention. The Kajaki Dam is a 90-m high embankment dam with an uncontrolled open channel spillway, which was constructed on the Helmand River in Afghanistan in the early 1950s to provide river control and irrigation benefits Fig. 2.1. A 33 MW powerhouse was added to the project in 1975. An additional 18.5 MW turbine was recently added to the existing powerhouse. Work on the planned service spillway radial gates, emergency spillway alternative, and raising the dam crest commenced during the late 1970s but construction activities ceased during the Soviet occupation and these facilities were never completed. Consequently, the reservoir has never been impounded to its design level of 1045 m.

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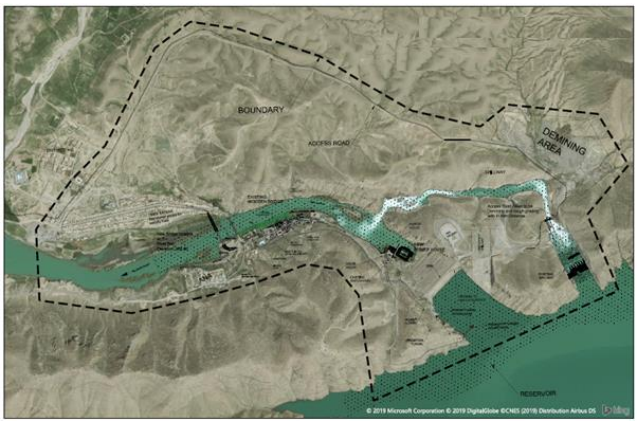
FIGURE 2.1 SATELLITE IMAGE OF THE KAJAKI DAM



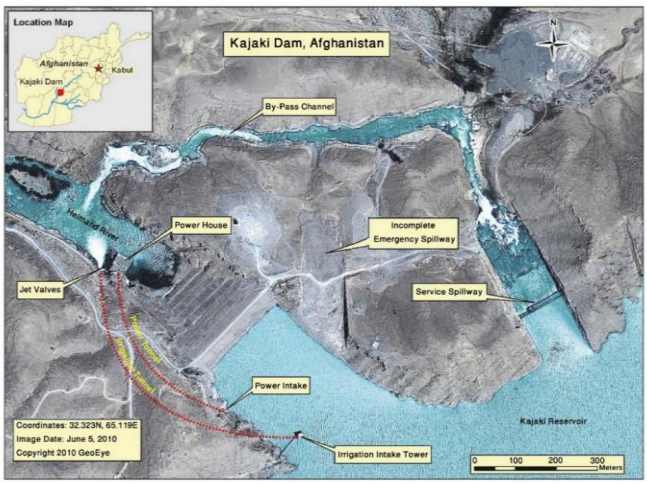


FIGURE 2.2 PROJECT FOOTPRINT AREA

Methodology:
The key objectives of the ESIA are to assess the potential environmental and social impacts associated with the construction and operation of Kajaki Dam Phase I and to identify measures that can be adopted to avoid, minimize or offset adverse impacts and enhance beneficial impacts.
With reference to the level of impacts of a project on its surrounding environment, the World Bank classifies a proposed project into four different categories as Category A, B, C and FI as follows :

Category A: Projects with likely significant negative impacts those are sensitive, diverse or unprecedented. For this category, the borrower needs to develop a comprehensive and detailed ESIA.

Category B: Projects with potential less adverse environmental impacts on human surrounding environment. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigation measures can be designed more readily than for Category A projects.

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Usually, ESIA investigation for these kinds of projects is very limited.

Category FI: A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts. Table 3.1 contains the risk summary of the Environmental and Social impacts of the project.

EVALUATION OF RISK

Physio-Chemical Impacts

Potential Impact Category: Water Quality

Table 3.1 Risk Summary of Environmental and Social

Potential Impact (Outcome/Receptor)	Consequence Level	Impact Significance	Impact Significance with Mitigation
Solid waste leading to waterlogging and blockage of drainage lines	Minor	Low	Low
Liquid waste and contaminated stormwater leading to pollution of soil, surface, and groundwater	Minor	Medium	Low
Solid and liquid waste mismanagement leading to the risk of disease transmission	Moderate	Medium	Low
Clearing and grubbing activities leading to soil erosion	Minor	Low	Low

Impacts

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Potential Impact Category: Air Quality

Potential Impact (Outcome/ Receptor)	Consequence Level	Impact Significance	Impact Significance with Mitigation
Off-site (residential, institutional, educational) human health impacts from construction noise	Minor	Low	Low
Off-site (industrial, commercial) human health impacts from construction noise	Minor	Low	Low
General nuisance (non-health impact) from construction noise	Low	Low	Low

Potential Impact Category: Noise

Potential Impact (Outcome/ Receptor)	Consequence Level	Impact Significance	Impact Significance with Mitigation
Human health impacts from combustion gas emissions and dust	Minor	Medium	Medium
Localized ambient air quality degradation	Minor	Medium	Medium
Regional ambient air quality degradation	Minor	Low	Low

Potential Impact Category: Landscape and Visual

Potential Impact (Outcome/Receptor)	Consequence Level	Impact Significance	Impact Significance with Mitigation
Short-term quality of life impacts from alteration of the existing landscape	Low	Low	Low
Long-term quality of life impacts from alteration of the existing landscape	Minor	Low	Low

Potential Impact Category: Downstream

Potential Impact (Outcome/Receptor)	Consequence Level	Impact Significance	Impact Significance with Mitigation
Rapid fluctuations in downstream flow	Moderate	High	Medium

Potential Impact Category: Sedimentation

Potential Impact (Outcome/Receptor)	Consequence Level	Impact Significance	Impact Significance with Mitigation
Massive earth moving within the river flood plains and sections of the adjoining riverbanks and lands	Major	Medium	Medium

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Potential Impact Category: Climate Change

Potential Impact (Outcome/Receptor)	Consequence Level	Impact Significance	Impact Significance with Mitigation
Impact on water flow and power generation	Low	low	low

Potential Impact Category: Fish

Potential Impact (Outcome/Receptor)	Consequence Level	Impact Significance	Impact Significance with Mitigation
Fish may encounter potential impacts from the proposed project activities.	Major	Likely	High

Biological Impacts

Potential Impact Category: Impacts on Flora and Fauna

Potential Impact (Outcome/Receptor)	Consequence Level	Impact Significance	Impact Significance with Mitigation
Short-term destruction of habitats and displacement of fauna	Low	Low	Low
Long-term destruction of habitats and displacement of fauna	Low	Low	Low
Short-term destruction of flora	Low	Low	Low
Long-term destruction of flora	Low	Low	Low
Irreversible impacts to ecological systems or functions	Low	Medium	Low

Socio-Economic Impacts

Potential Impact Category: Transport Impacts

Potential Impact (Outcome/Receptor)	Consequence Level	Impact Significance	Impact Significance with Mitigation
Public health and safety impacts from vehicles moving at high speeds and accidents	Moderate	Likely	Medium
Vehicle noise impacts for the surrounding community and on-site workers	Minor	Likely	Medium
Human health impacts from vehicle exhaust and fugitive dust	Minor	Likely	Medium
Road congestion and nuisance issues for the surrounding community	Low	Likely	Medium

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Potential Impact (Outcome/Receptor)	Consequence Level	Impact Significance	Impact Significance with Mitigation
Migrant labour force could disturb the privacy of the local population.	High	Likely	High
The influx and accommodation of workforces will result in increased concerns for the safety of women and children.	Minor	Unlikely	Low
Due to the movement of vehicles elderly people, women and children will be more exposed to dangerous situations;	Moderate	Likely	Low
Potential burdens for the local population, especially for elderly people	Moderate	Likely	Low

Potential Impact Category: Labor Influx

Potential Impact Category: Public Health and Safety Impacts

Potential Impact (Outcome/Receptor)	Consequence Level	Impact Significance	Impact Significance with Mitigation
Human health impacts from construction noise, vibration, and air pollution	Minor	Unlikely	Low
Human health impacts from improper management of solid and liquid wastes	Minor	Unlikely	Low
Human health and safety impacts from release or mismanagement of hazardous materials	Moderate	Unlikely	Medium
Safety risk associated with security breach and targeting by anti-government groups	Major	Unlikely	Medium
Vulnerable individuals and groups in the affected communities being differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status	Moderate	Unlikely	Medium

Potential Impact Category: Employment Impacts

Potential Impact (Outcome/Receptor)	Consequence Level	Impact Significance	Impact Significance with Mitigation
Health and safety impacts from improper	Moderate	Medium	Low

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management of labor camps			
Adverse social and health-related impacts from the influx of outside workers	Minor	Unlikely	Low
Impacts/stress on local public service systems (health centers, food markets, etc.)	Moderate	Very unlikely	Low

Potential Impact Category: Occupational Health and Safety Impacts

Potential Impact (Outcome/Receptor)	Consequence Level	Impact Significance	Impact Significance with Mitigation
Construction health and safety risks resulting in injury or death	Major	High	Medium
Construction health and safety risks resulting in impairment or long-term health issues	Moderate	Medium	Medium

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN:

The objectives of this ESMP are to:

- Collate and describe all mitigation measures and actions identified in the ESIA process to enhance positive benefits and to eliminate/reduce key environmental, socio economic and health impacts to acceptable levels
- Identify and describe the monitoring required to ensure compliance with reporting commitments

The ESMP includes environmental and social requirements that are common to most construction projects, as well as specific environmental and social initiatives unique to this project. Table 4.1 contains the Environmental and Social Management plans which addresses the mitigation measures to counter the Impacts.

Table 4.1 ESMP for Construction phase:

Environmental Issue	Air Quality
Impact Source	Operation of heavy machinery and transport vehicles Overall construction activities
Potential Impacts	Air Quality Impacts
Proposed Mitigation and Enhancement Measures	Cover stockpiles and loads to avoid fugitive dust emissions Minimize idling of vehicles and operation of combustion machinery and equipment to the greatest extent possible Hard pack or spray access roads and driveway areas to reduce dust generation Place washed stone at site exit to minimize off-site tracking of soil and debris Generators and vehicles will be kept in good working order to minimize exhaust emissions Fugitive dust emissions will be minimized by appropriate methods, such as spraying water on soil, where required Environmental Code of Practice (ECP) 8 will be implemented
Responsibility for Mitigation Implementation	Site Management Team (Operator/contractor)

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Environmental Issue	Noise
Impact Source	Overall construction activities
Potential Impacts	Noise Impacts
Proposed Mitigation and Enhancement Measures	Set and enforce standard daytime working hours, recommended to be 06:00 to 21:00 Maintain equipment and use low noise equipment and methods where feasible ECP 9 will be implemented.
Responsibility for Mitigation Implementation	Site Management Team

Environmental Issue	Soil Quality
Impact Source	
Potential Impacts	Accidental release of solvents, oils and lubricants can potentially result in the contamination of soil and consequent deterioration of groundwater and surface water quality. Soil contamination may also reduce the soil fertility reducing suitability for agriculture.
Proposed Mitigation and Enhancement Measures	Fuel tanks will be appropriately marked by content and will be stored in safe areas where storage capacity is 10% greater than the fuel tank. The area will be lined with an impervious base. Grease traps will be installed on site, wherever needed, to prevent the flow of oily water. Spill cleaning kit (shovels, plastic bags, absorbent materials) will be available near fuel and oil storage areas. An emergency plan for spill management will be prepared, all staff will be trained in the plan for the case of any spill. The bottom of any soak pit or septic tank shall be at least 10 m above the groundwater table. The distance may be reduced, based on soil properties, if that distance will not result in contamination of groundwater.
Responsibility for Mitigation Implementation	Site Management Team

Environmental Issue	Soil Erosion
Impact Source	
Potential Impacts	Land clearing, excavation, tunnel boring, and other construction activities may loosen the top soil in the Project area resulting in loss of soil and possible acceleration of soil erosion and landslides, especially in the wet season.
Proposed Mitigation and Enhancement Measures	Vegetation loss will be limited to the demarcated construction area; Areas such as muck disposal area, batching plant, labor camp and quarry sites shall be covered with grass and shrubs after project completion. Slope stabilization measures will be adopted, for example adequate vertical and horizontal drains, drainage along roadsides, cross drainage and retaining walls. Slope movements will be monitored around excavation work areas. Local species shall be selected for planting to restore the biodiversity of the area in consultation with local stakeholders.
Responsibility for Mitigation Implementation	Site Management Team

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Environmental Issue	Groundwater Quality
Impact Source	Wastewater Discharges Fueling of heavy machinery and transport vehicles Storage, handling and disposal of solid waste Storage, handling and disposal of hazardous waste
Potential Impacts	Water Quality and General Environmental Impacts
Proposed Mitigation and Enhancement Measures	Recycle waste to the maximum extent, provide for the proper temporary staging and storage of waste and debris on-site, implement good housekeeping in work areas Transport, or oversee the subcontract for transport, of non-recyclable waste to the municipally-approved disposal site and periodically verify delivery. Segregate domestic waste in appropriate receptacles and dispose at municipally-approved disposal site, manage sanitary waste systems in a manner protective of human and environmental health. Minimize erosion, grade and replant disturbed areas. Protect against accidental releases of hazardous materials through training, spill prevention measures, recycling and if necessary, timely cleanup and disposal. Enforce Chance Find Procedures and cease work if historic/ archeological finds are encountered. Design, construct, operate, and decommission the structural elements or components of the project in accordance with good international industry practice, taking into consideration safety risks to third parties or affected communities. Environmental Code of Practice (ECP) 1, 2, 3, 4, 5, 6, and 7 will be implemented.
Responsibility for Mitigation Implementation	Site Management Team

Environmental Issue	Biological Environment
Impact Source	Land clearance Construction activities
Potential Impacts	Impacts on Flora, Habitat loss, Noise disturbance Increased exposure to atmospheric pollutants Protected fish species
Proposed Mitigation and Enhancement Measures	Use fencing, flagging and site boundary controls during construction to minimize disturbance to off-site habitats; ECP 10, 11, and 12 will be implemented. Minimize removal of vegetation and replant disturbed areas using native plant species, The security management plan is in place; Traffic safety rules have been implemented in the scope of the HSE plan
Responsibility for Mitigation Implementation	Site Management Team

Environmental Issue	Traffic
Impact Source	Transportation of construction equipment to Project site
Potential Impacts	Transport Impacts
Proposed Mitigation and Enhancement Measures	Manage haulage routes to avoid sensitive establishments and use barriers as appropriate. Maintain vehicles in good working condition.
Responsibility for Mitigation Implementation	Site Management Team

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Responsibility for Mitigation Implementation	Site Management Team

Environmental Issue	Local Employment
Impact Source	Employment of Afghan nationals during the construction phase
Potential Impacts	
Proposed Mitigation and Enhancement Measures	Follow a transparent hiring process to help the community understand strategic staffing decisions and avoid conflict over hiring with the local communities. Develop a training and skills program to impart best practice when training local people for construction and operational jobs. Encourage Contractors to provide apprenticeship opportunities to local people, encourage supply chain partners to recruit local people. Establish a local job readiness program and encourage the construction supply chain to continue to invest in workers. Establish a local employment brokerage that will publicize job vacancies and put in place initiatives to ensure employment opportunities for hard-to-reach groups. ECP 13 will be implemented.
Responsibility for Mitigation Implementation	Site Management Team/Human Resource

Environmental Issue	Labour Influx
Impact Source	Employment of international workers for the Project Goods and services received from the locals
Potential Impacts	Disturbance of Social Cohesion Indirect job opportunities Contribution to the local businesses
Proposed Mitigation and Enhancement Measures	Alcohol and Drug Policy is in place Disciplinary Action Procedure is in place Local procurement plan will be developed.
Responsibility for Mitigation Implementation	Site Management Team

Environmental Issue	Labour and Working Conditions
Impact Source	Employment of multinational groups
Potential Impacts	Employment Impacts
Proposed Mitigation and Enhancement Measures	Consult with local authorities on hiring local workers and enforce a transparent "no-gatekeeping" policy. Manage construction work camps (if used) according to WB PS2 guidelines, processes and standards. Provide workers with clear, understandable documentation explaining workers' rights and refrain from harassment, intimidation, and exploitation. Enforce Human Resource policies specifically outlawing underage workers and forced labor. Implement employee grievance policy for on-site workers as part of the worker's rights program. Ensure proper security protocols and staff are in place throughout construction to provide security and safeguard property. ECP 13 will be implemented.

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Responsibility for Mitigation Implementation	Site Management Team

Environmental Issue	Public Health and Safety
Impact Source	Project site
Potential Impacts	Public Health and Safety Impacts
Proposed Mitigation and Enhancement Measures	Road signage will be fixed at appropriate locations to reduce hazards associated with project-related vehicular traffic. Project drivers will be trained on defensive driving. Vehicle speeds near/within the communities will be kept low, to avoid hazards and dust emissions.
Responsibility for Mitigation Implementation	Site Management Team

Environmental Issue	Cultural Heritage
Impact Source	Construction activities
Potential Impacts	Impacts/disturbance to unforeseen cultural heritage through project activities.
Proposed Mitigation and Enhancement Measures	Procedures shall be developed in the event that cultural heritage is discovered during the project construction. ECP 14 will be implemented. If cultural resources are found during construction follow the cultural heritage law of Afghanistan using the chance find procedure to identify and analyze the heritage and archeological resources during construction
Responsibility for Mitigation Implementation	Site Management Team

Environmental Issue	Landscape
Impact Source	Construction activities and borrow area.
Potential Impacts	Visual amenity
Proposed Mitigation and Enhancement Measures	Landscaping of the site when construction is complete. This will mitigate the visual impact and reduce soil erosion during heavy rains and flood periods. Soils excavated during construction (borrow material) may be used for landscaping if suitable.
Responsibility for Mitigation Implementation	Site Management Team

Environmental Issue	Borrow Area and Borrow Materials
Impact Source	Borrow Site
Potential Impacts	Soil Erosion
Proposed Mitigation and Enhancement Measures	Reduce the volume of material requiring disposal as far as possible. Remaining material will be disposed of in an environmentally sound manner Disposal sites will be properly filled, shaped and reworked and where feasible planted with trees. Borrow material should be obtained (as much as possible) from licensed quarries and borrow areas. Where necessary, appropriate restoration of the borrow area such as recontouring should be carried out, and no deep ditches should be left behind. ECP-7 will be implemented.
Responsibility for Mitigation Implementation	Site Management Team

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RESULT:

Many factors were considered for the environment and social impact. The consequence and impact significance are also considered along with impact significance along with the mitigation measures. Likelihood of the impact also proves to be of great significance in the impact matrix. The category of the impacts was classified only based on rough estimation. Numerical data is not available for this construction activity and hence numerical analyses are not provided in this study.

Local impacts and mitigation measures which are negligible are not mentioned in this paper for which mitigation measures were provided then and there. Data from Environmental safety Impact Assessment (ESIA) report submitted by Green Tech Construction and Engineering was only considered in preparing this paper.

This paper however delineates the application of Environmental safety Impact Assessment (ESIA) and how mitigation measures are provided through Environmental Social Management System (ESMS) in a construction activity.

Data Availability:

Some or all data, models, or code used during the study were provided by Green Tech Constructions and Engineering, Kabul, Afghanistan. Direct request for these materials may be made to the provider as indicated in the AcknowledgmentsIdentify the Headings

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