



A subsidiary of The Hub Power Company Limited

84 MW

**New Bong Escape
Hydropower Project**

Initial Environmental Examination

Updated and Revised March 2009

By:

**M/S Sustainable Solutions (Pvt.) Ltd.
Islamabad**

Executive Summary

Laraib Energy Limited (LEL) has the exclusive rights to build, own, operate and transfer the 84-MW New Bong Escape Hydropower Project, about 120 km from Islamabad, and downstream of Mangla Dam in Azad Jammu and Kashmir (AJK). To fulfill the national law requirements of that time, an Environmental and Social Soundness Assessment (ESSA) of the project was carried out in 1996.¹ In year 2004 LEL commissioned an Initial Environmental Examination (IEE), in order to update and augment the environmental assessment carried out under the ESSA study, and to document its findings in accordance with the relevant Asian Development Bank (ADB) guidelines. In order to update the data the IEE has been revised again in 2009 to further update and document the social and environmental status of the project according to the IFC and ADB guidelines (the “Guidelines”).

Study Methodology

The revised IEE study was conducted using a standard methodology prescribed by the national and international agencies. Various phases of the study included screening, scoping, data collection and compilation, public consultation, impact assessment, and report compilation.

Legislative Framework

The apex environmental law in the AJ&K is the AJ&K Environmental Protection Act, 2000, which has been derived through enactment or adaptation of the Pakistan Environmental Protection Act, 1997. The Act is applicable to a broad range of issues and extends to air, water, soil, marine and noise pollution, as well as the handling of hazardous waste. The requirement of conducting Environmental Assessment (Initial Environmental Examination or Environmental Impact Assessment) emanates from this Act.

Project Overview

The proposed project having a maximum capacity of 84-MW is planned to be built about 7.5 km from the Mangla Dam, which was built in 1967 on the Jhelum River. The water from the Mangla reservoir is released, through its powerhouse, in the Bong Canal. Part of the water in the Bong Canal is diverted to the Upper Jhelum Canal (UJC) for irrigation purposes; the surplus water is released back in the Hari channel (a channel of Jhelum River), through Bong Escapes. The proposed hydropower project will be built at the end of the Bong Canal, utilizing the water that is currently released in the Hari channel. There is no water reservoir envisaged for the project.

The key components of the project include the Headrace Channel, Powerhouse Complex, Tailrace Channel, Diversion Channel, Switchyard, Road Bridge and Subsidiary Outfall Structure. The Headrace Channel is around 175 meters (574 ft.)

¹ The ESSA was submitted to the AJK Environmental Protection Agency, and its approval obtained.

long, and will connect the Bong Pond and the proposed Powerhouse. The Headrace Channel is concrete lined, with a capacity of 38,000 cusec (1,080 cumec) of water flow. The Powerhouse Complex will house 4 sets of turbines and generators, and associated electrical and mechanical systems. The Tailrace Channel is about 7.5 Km (7,500 m) long, and will release water from the Powerhouse to the River Jhelum. The New Bong Diversion Channel will be constructed to temporarily divert the flows to the Jhelum River to ensure excavation in the Tailrace Channel relatively dry. NBE Diversion Channel will be about 1,190 meters long and it will release 41,000 cusecs water from NBE to Jhelum River on its right side, which has a combined carrying capacity of more than 850,000 cusecs (flood of record in 1992). The Switchyard will provide connectivity with the WAPDA's existing 132 kV system.

The project is the first-ever hydroelectric Independent Power Producer (IPP) in the country. The project is being set-up under the Built-Own-Operate and Transfer (BOOT) arrangement, and the ownership of the powerhouse will be transferred to the Government of Azad Jammu and Kashmir (GoAJK) at the end of the concession period of 25 years.

The overall duration of the construction period is around 36 months. Of these, civil works would take around 24 months, and electro-mechanical works, around 33 months. The powerhouse will start producing electricity after 27 months of the project start, while the maximum capacity would be achieved by the end of 33rd month.

Hydrological Regime

The proposed powerhouse will rely on water releases from the existing Mangla Powerhouse. The Mangla reservoir is fed by the Jhelum, Kanshi and Punch rivers, with an average annual inflows of about 23 MAF ($2.8 \times 10^{10} \text{ m}^3$). Of this, around 2.6 MAF ($3.18 \times 10^9 \text{ m}^3$) has been passing through the spillway annually, 6.6 MAF ($8.07 \times 10^9 \text{ m}^3$) has been the annual requirement of the UJC, thus leaving an average of about 13.6 MAF ($1.66 \times 10^{10} \text{ m}^3$) annually (18,640 cusecs or 534 cumecs) for the New Bong Escape hydropower project.

The proposed project will not alter the existing water regime of the area. As stated above, the water which is currently released in the New Bong Escape will be utilized for the proposed project.

Description of the Environment

The proposed project site is located in the Potwar region of Upper Indus Basin, among low hills composed of beds of the Siwalik system of Plio-Pleistocene age. The Siwaliks are the freshwater sediments deposited in the Indo-Gangetic Basin by the streams rejuvenated by Himalayan uplift initiated in the Miocene age. The project area is a part of the Jhelum valley located on the left bank of the river Jhelum and situated a short distance downstream from the point where the river leaves the gorge and opens in the plains, and where the Mangla Dam was constructed in late 60s.

The soils in the project area consist of loose, yellowish brown, sandy silt, loose yellowish brown silty fine sand and trace of gravel, extending to depths from 5 to 10 feet. Topsoil is underlain by layers of rounded to sub-rounded gravel, cobbles, and boulders with voids filled with sandy silts and silty sands.

The groundwater in the area is generally expected to be greatly influenced by the water bodies in the vicinity. The groundwater table in the area is at about 1 m from the existing ground level.

Jhelum River is the main natural surface water body in the area. A seasonal stream – Jabbar Nullah – also exists near the project area and falls in Bong Canal upstream of the New Bong Escape. In addition to these natural water bodies, there are a number of man-made water structures in the area, including Mangla reservoir, UJC, Bong Canal, New Bong Escape and Old Bong Escape.

The ambient air quality in the area is expected to be good, since there are no major pollution sources in the vicinity of the project area.

The project site falls in the Oriental Zoogeographical Region of the world. The tributary rivers of Indus after their exit from mountainous regions flow through a floral eco-zone called Tropical Thorn Forests. However, the tropical thorn forests eco-zone and the riverine habitats are now almost totally modified to agricultural habitats, urban habitats, factories, railways and roads network. This modification process is in fast progress day by day.

Present floral pattern around the project site has mostly been modified to agricultural habitats, urban areas with exotic and endemic trees, canal and roads with side plantations of *Delbergia* (shisham) and *Acacia* (kikar). There are a variety of exotic trees in the area. The riverine tract is badly degraded and also has agricultural encroachments. The edge vegetation includes *Typha angustata*, *Saccharum spontaneum*, *Saccharum munja* and *Tammarix aphylla*.

The faunal species found in the area are those which have fully adjusted to the human and agriculture environment. The migratory birds annually visit this area in the winters.

The settlements of Lehri and Ferozabad are in the immediate vicinity of the project site. Out of these, Lehri is the larger village situated on the right bank of New Bong Escape, while Ferozabad is a small settlement of around twelve houses on the left bank of Old Bong Escape. Chechian and Afzal Pur are larger settlements located on left side of the tail race channel but are not in the immediate vicinity of the project site.

The total population of Lehri, more than 170 households, the village is located on right side of New Bong Escape. In original design the construction camp was proposed to be constructed in the southern outskirts of the village, but in the updated design the construction labour camp has been shifted in the proximity of power house. A majority of the households subsists on remittances from migrant workers, mostly in the United Kingdom. Local trade and government and private employment is a secondary source of income. Agriculture and Livestock are a fringe activity, practiced at a level that is less than even self-subsistence. The educational and social amenities level of the village is low and apparent from the meager social infrastructure such as schools, hospitals or even paved streets.

The population of Ferozabad is about 15 households which consist of an extended local family and some small families who have come to the area after being displaced from their native northeastern AJK. The primary source of livelihood for these families is government and private jobs; agriculture is a secondary economic activity. Young men from a few families are working abroad and remit money to support their dependents. The social infrastructure is poor with an unpaved road and no school or clinic. Most of the agricultural land sown by the inhabitants of Ferozabad is deeper on the left bank of the Old Bong Escape and is not being affected by the project.

There are no sites of archeological, cultural, historical or religious importance at or in the immediate vicinity of the proposed site.

Environment Screening, Impact Assessment and Mitigation

During the environmental assessment of the project, environmental screening of the potential impacts was carried out. A screening matrix was used for this purpose, which examined the interaction of project activities with various components of the environment. Both project and environment were broken down in their respective segments (project in its activities, and environment in its components), in order to have an in-depth analysis of the interaction. The screening matrix of unmitigated impacts is provided in **Exhibit ES.1**.

The potential impacts of the various phases of the project, and the mitigation measures required to minimize if not eliminate these adverse impacts have been summarized below.

- Issues related to unauthorized landuse
 - ▶ Since possession of the Project land in 2003, the unauthorized landuse has been ceased and currently no such activity was observed.
- Blocked Access
 - ▶ The existing routes will not be blocked as far as possible.
 - ▶ If such blocking of the routes is unavoidable, alternate routes should be made available in consultation with the affected communities.
 - ▶ River crossing through boats at 4 locations along the proposed tail race channel will be affected. Alternate crossing and/or a foot bridge should be provided at locations decided in consultation with the communities.
- Loss of Livelihood
 - ▶ There is no major loss of livelihood as a result of the project activities. However boatmen who are currently earning livelihood by providing services to the communities for the channel crossing will be compensated through alternative employment or other means of livelihood to maintain his present living standards.
 - ▶ Project employment opportunities, to suit the particular skills or enhanced skills, should be open to the local communities, particularly the affected people, if any. Discussion should be started with the project area

communities to inform them of the project design and its boundaries to bring the communities at a good understanding level with LEL at construction stage.

■ **Safety Hazards**

- ▶ Protective measures including adequate warning signs to be displayed around key project components to avoid any mishaps or accidents.
- ▶ Road signage should be fixed at appropriate locations to reduce safety hazards associated with project-related vehicular traffic.
- ▶ Necessary environmental, social, and operational health and safety training should be provided to the project staff, EPC labor (skilled/unskilled) before start of physical work on the project.
- ▶ The project vehicle/construction equipment drivers/operators should be trained in defensive driving before start of the project. Vehicle speeds near / within the communities will be kept low, to avoid safety hazard and dust emissions.

■ **Public Health**

- ▶ Appropriate solid waste disposal sites should be designated at the project site and the staff should be sensitized in waste disposal and management practices.
- ▶ The construction labour camp should have appropriate latrines, bath rooms, and enough space for the total workforce to house. There should be at the minimum some recreation and resting facilities for the workforce after working hours.
- ▶ Reduction of dust emissions (covered under air quality deterioration)

■ **Alternative Recreational Site**

- ▶ A new recreational site will be developed, as corporate social responsibility (CSR), LEL has identified land (approx 3 Ha) on the right bank of the Bong Canal and will take steps to obtain permission from the relevant authority to develop such land as an alternative recreational site and hand it over to local authority.
- ▶ The new recreational site should be developed in such a way that it should have designated play area for children. Planned tree plantation will be carried out at the proposed recreational site.

■ **Loss of Vegetation**

- ▶ Cutting of trees and other natural vegetation will be avoided as far as possible
- ▶ Tree plantation of local species will be undertaken at appropriate location. The number of trees thus planted will be at least five times more the ones that are cut. The trees to be planted should be an appropriate mix of fast and slow growing trees.

- ▶ In the entire project area, a comprehensive plantation plan should be developed, with due consideration given to landscaping. The plantation plan should be implemented as early as practicable.
- ▶ The construction crew will be provided with LPG as cooking (and heating, if required) fuel. Use of fuel wood will not be allowed.
- Threat to Wildlife
 - ▶ The project staff will not be allowed to indulge in any hunting or trapping activities.
- Soil Erosion and Contamination
 - ▶ Excavated slopes will not be left untreated/unattended for long durations. Appropriate slope stabilization measures will be taken as per design (e.g. stone pitching and compaction).
 - ▶ The embankment filling operation will be carried out in a manner that minimizes chances of soil erosion. This may include construction of embankment in stages, and completing the side slopes of each segment, before moving to the next segment.
 - ▶ Temporary soil stockpiles will be placed where there is no risk of soil erosion.
 - ▶ Vehicle and construction machinery movement very close to the canal/channel banks will be minimized, as these may cause soil erosion.
 - ▶ Management practices will be employed to minimize leakage and spillage of oils, chemicals and fuels to the ground. These includes building containment dikes around fuels/oils/chemical storage, storing these in covered areas, constructing a concrete pad for machinery/vehicle maintenance areas, inspecting machinery and vehicles for any leakage, and removing contaminated soils for appropriate disposal.
 - ▶ Regular monitoring and maintenance of Tailrace channel and flood protection embankment will be carried out, in order to detect and forestall any possible soil erosion.
- Water Turbidity in Hari Channel
 - ▶ Diversion of the flow from the New Bong Escape into the main channel of the Jhelum River through NBE Diversion Channel will address the issue of water turbidity in Hari Channel.
 - ▶ However, if required, appropriate measures should be taken for excavation during monsoon season in order to minimize the turbidity issue.
- Air Quality Deterioration
 - ▶ Construction machinery and vehicles will be kept in good working condition and properly tuned, in order to minimize the exhaust emissions.
 - ▶ Fugitive dust emissions will be minimized by spraying water on soil, where required and appropriate.

- Surface and Groundwater Contamination
 - ▶ For the domestic sewage during the construction phase, septic tanks and soakage pits will be constructed having adequate capacity.
 - ▶ Waste oils will be collected in drums and handed over to the recycling contractors or disposed off in a safe manner.
 - ▶ The recyclable waste from warehouse and workshop (such as card board, drums, broken/used parts, etc.) should be handed over to recycling contractors or disposed off in a safe manner.
 - ▶ Segregation of solid waste into recyclable and non-recyclable material should be carried out at the project site.
 - ▶ Recyclable material should be disposed off in a safe manner or to be handed over to the recycling contractors.
 - ▶ Composting the biodegradable waste
 - ▶ Land filling the remaining waste
- Noise
 - ▶ Construction equipment and vehicles will have exhaust mufflers (silencers) to minimize noise generation.
 - ▶ Noise levels will be measured at Lehri, Ferozabad Chechian and Afzal Pur. If found more than 65 dB, appropriate sound reduction mechanism will be put in place.
 - ▶ Nighttime work should be avoided near the communities. Local population will be taken in confidence, if such work is unavoidable.
 - ▶ Vehicular traffic through the communities will be avoided as far as possible. Vehicle speeds will be kept low, and horns will not be used while passing through or near the communities.
- Damage to Infrastructure
 - ▶ All damaged infrastructure will be restored to its original and/or better condition.
- Gender Issues
 - ▶ Camp location (tentatively decided) and O&M housing colony will be finalized in consultation with the local population in order to avoid any privacy issues restricting the female mobility.
 - ▶ Construction and O&M crew will avoid entering the villages and settlements. Awareness about gender and cultural sensitivity of the area will be provided to the staff involved in construction and operation stages of the project.

The matrix of the residual impacts (i.e. mitigated impacts) is provided in **Exhibit ES.2**.

Public Consultation

Public consultation was held with the stakeholders of the project area as an important process adopted to update and revise the IEE and to seek informed apprehensions of the communities before identifying and analyzing the likely impacts of the project on the well being of the inhabitants. The discussion did not reveal any apprehension about the impacts of the project.

Environmental Management Plan

An EMP has been developed and updated to provide implementation mechanism for the mitigation measures identified during the revised IEE. The EMP provides the organizational structure for the environmental management system during the project, and defines roles and responsibilities of various entities of the project. The EMP also includes a mitigation plan, which precisely defines the mitigation actions, executing persons and monitoring persons for the implementation of the EMP.

An environmental monitoring and training needs assessment plan is also included in the EMP, in addition to communication and documentation requirements, in the context of environmental management.

Conclusions and Recommendations

On the basis of the overall impact assessment, it is concluded that the proposed New Bong Escape Hydroelectric project is unlikely to cause any significant, lasting impact on the social, physical and biological environment of the area, provided that the proposed activities are carried out in accordance with recommendations of this report, and the mitigation measures included in this report are completely and effectively implemented. The key recommendations are as follows:

- ▶ It is considered, that due to the low environmental impacts of the Project, there is presently no need for an EIA of the proposed project.
- ▶ LEL in collaboration with GoAJK should continue dialogue with the villagers to reach at a better understanding about project design, construction alignment, and land use issues.
- ▶ Social and Environmental requirements and specifications should be made part of the EPC Contract.
- ▶ An environmental management system (EMS) shall be established as soon as possible for the timely and effective implementation of the EMP. The EMS would normally be required by the international lenders.
- ▶ As part of the EMS, LEL should formulate an environmental policy to guide environmental management and enhancing corporate image.

Exhibit ES.1: Environmental Screening Matrix (Unmitigated)

	<i>Physical</i>					<i>Biological</i>			<i>Social and Socioeconomic</i>													
	Soil	Air Quality	Surface Water	Groundwater	Water Regime	Natural Vegetation	Terrestrial Wildlife	Aquatic Biota	Access	Noise	Cultivation	Livestock Grazing	Resettlement / Compensation	Safety Hazard	Employment	Infrastructure	Public Health	Cultural Issues	Gender Issues	Recreational Sites	Historical / Archeological Sites	Population Influx
Construction Phase																						
Site Preparation	N	N	N	N	N	N	N	N	-1	N	-1	-1	-1	N	N	-1	N	N	N	-1	N	N
Transportation of Powerhouse Equipment	0	-1	0	0	N	N	0	N	0	-1	N	0	N	-1	0	-1	0	0	0	N	N	N
Contractor Mobilization	0	-1	0	0	N	N	0	N	0	-1	N	0	N	-1	0	-1	0	0	0	N	N	N
Construction Camp Establishment	-1	-1	-1	0	N	-1	0	N	-1	-1	0	0	N	-1	+1	0	0	0	-1	N	N	0
Construction Camp Operation	0	-1	-1	-1	N	-1	0	0	0	-1	0	0	N	-1	+1	0	-1	0	-1	N	N	0
Excavation and Construction of Headrace Channel	-1	-1	-1	0	N	-1	0	0	-1	-1	0	0	N	-1	+1	-1	0	0	0	0	N	N
Construction of Powerhouse	-1	-1	-1	0	N	0	0	0	0	0	0	0	N	-1	+1	0	0	0	0	N	N	N
Excavation and Construction of Tailrace Channel	-1	-1	-1	0	0	-1	0	-1	-1	0	0	-1	N	0	+1	0	0	0	0	N	N	N

	<i>Physical</i>					<i>Biological</i>			<i>Social and Socioeconomic</i>													
	<i>Soil</i>	<i>Air Quality</i>	<i>Surface Water</i>	<i>Groundwater</i>	<i>Water Regime</i>	<i>Natural Vegetation</i>	<i>Terrestrial Wildlife</i>	<i>Aquatic Biota</i>	<i>Access</i>	<i>Noise</i>	<i>Cultivation</i>	<i>Livestock Grazing</i>	<i>Resettlement / Compensation</i>	<i>Safety Hazard</i>	<i>Employment</i>	<i>Infrastructure</i>	<i>Public Health</i>	<i>Cultural Issues</i>	<i>Gender Issues</i>	<i>Recreational Sites</i>	<i>Historical/ Archeological Sites</i>	<i>Population Influx</i>
Excavation and Construction of NBE Diversion Channel	-1	-0	-0	0	0	-1	0	-0	-0	-1	0	-0	0	-1	+1	0	0	0	0	N	N	N
Construction of Flood Protection Embankment	-1	-1	-1	0	0	0	0	-1	0	0	0	0	0	0	+1	0	0	0	0	N	N	N
Construction of Residential Colony	-1	-1	-1	0	N	-1	0	0	-1	-1	0	0	0	-1	+1	-1	0	0	0	N	N	0
Construction of Road Bridge	-1	-1	-1	0	N	0	0	0	-1	-1	0	0	0	-1	+1	-1	0	0	0	0	N	N
Construction of Access Road	-1	-1	-1	0	N	0	0	0	-1	-1	0	0	0	-1	+1	-1	0	0	0	N	N	N
Construction Materials Supply	0	-1	0	N	N	0	0	0	0	-1	N	0	N	-1	+1	-1	0	0	0	N	N	N
Other Supplies	0	-1	0	N	N	0	0	0	0	-1	N	0	N	-1	+1	-1	0	0	0	N	N	N
Construction Crew Transportation	0	-1	0	N	N	0	0	0	0	-1	N	0	N	-1	+1	-1	0	0	0	N	N	N
Solid Waste Disposal	-1	-1	-2	-2	N	-1	-1	-1	N	N	0	0	N	0	0	N	-2	0	0	N	N	N
Waste Effluents Disposal	-1	-1	-2	-2	N	-1	-1	-1	N	N	0	0	N	0	0	N	-2	0	0	N	N	N

	<i>Physical</i>					<i>Biological</i>			<i>Social and Socioeconomic</i>													
	<i>Soil</i>	<i>Air Quality</i>	<i>Surface Water</i>	<i>Groundwater</i>	<i>Water Regime</i>	<i>Natural Vegetation</i>	<i>Terrestrial Wildlife</i>	<i>Aquatic Biota</i>	<i>Access</i>	<i>Noise</i>	<i>Cultivation</i>	<i>Livestock Grazing</i>	<i>Resettlement / Compensation</i>	<i>Safety Hazard</i>	<i>Employment</i>	<i>Infrastructure</i>	<i>Public Health</i>	<i>Cultural Issues</i>	<i>Gender Issues</i>	<i>Recreational Sites</i>	<i>Historical/ Archeological Sites</i>	<i>Population Influx</i>
Demobilization of Contractors	0	-1	0	N	N	0	0	0	0	-1	N	0	N	-1	0	-1	0	0	0	N	N	N
Operation Phase																						
Powerhouse Operation	N	0	0	N	0	N	N	0	N	0	N	N	N	0	+1	0	0	0	0	N	N	0
Maintenance	N	0	-1	N	0	N	N	-1	N	0	N	N	N	0	+1	0	0	0	0	N	N	0
Staff Transportation	0	-1	0	N	N	N	0	0	0	-1	N	0	N	-1	+1	-1	0	0	0	N	N	N
Supplies	0	-1	0	N	N	N	0	0	0	-1	N	0	N	-1	+1	-1	0	0	0	N	N	N
Solid Waste Disposal	-1	-1	-2	-2	N	-1	-1	-1	N	N	0	0	N	0	0	N	-2	0	0	N	N	N
Waste Effluents Disposal	-1	-1	-2	-2	N	-1	-1	-1	N	N	0	0	N	0	0	N	-2	0	0	N	N	N

Key: -2: High negative impact; -1: Low negative impact; 0: insignificant/negligible impact; +1: low positive impact; +2: High positive impact, N: no impact.

Table ES.2: Impact Matrix – Residual Impacts (Mitigated)

	<i>Physical</i>					<i>Biological</i>			<i>Social and Socioeconomic</i>													
	Soil	Air Quality	Surface Water	Groundwater	Water Regime	Natural Vegetation	Terrestrial Wildlife	Aquatic Biota	Access	Noise	Cultivation	Livestock Grazing	Resettlement / Compensation	Safety Hazard	Employment	Infrastructure	Public Health	Cultural Issues	Gender Issues	Recreational Sites	Historical/ Archeological Sites	Population Influx
Construction Phase																						
Site Preparation	N	N	N	N	N	N	N	N	0	N	0	0	-1	N	N	0	N	N	N	0	N	N
Transportation of Powerhouse Equipment	0	-1	0	0	N	N	0	N	0	-1	N	0	N	0	0	0	0	0	0	N	N	N
Contractor Mobilization	0	-1	0	0	N	N	0	N	0	-1	N	0	N	0	0	0	0	0	0	N	N	N
Construction Camp Establishment	0		0	0	N	0	0	N	0	0	0	0	N	0	+1	0	0	0	-1	N	N	0
Construction Camp Operation	0	0	0	0	N	0	0	0	0	0	0	0	N	0	+1	0	0	0	-1	N	N	0
Excavation and Construction of Headrace Channel	-1	-1	-1	0	N	0	0	0	0	-1	0	0	N	0	+1	0	0	0	0	0	N	N
Construction of Powerhouse	-1	0	-1	0	N	0	0	0	0	0	0	0	N	0	+1	0	0	0	0	N	N	N
Excavation and Construction of Tailrace Channel	-1	0	-1	0	0	-1	0	0	0	-1	0	0	N	0	+1	0	0	0	0	N	N	N

	<i>Physical</i>					<i>Biological</i>			<i>Social and Socioeconomic</i>													
	<i>Soil</i>	<i>Air Quality</i>	<i>Surface Water</i>	<i>Groundwater</i>	<i>Water Regime</i>	<i>Natural Vegetation</i>	<i>Terrestrial Wildlife</i>	<i>Aquatic Biota</i>	<i>Access</i>	<i>Noise</i>	<i>Cultivation</i>	<i>Livestock Grazing</i>	<i>Resettlement / Compensation</i>	<i>Safety Hazard</i>	<i>Employment</i>	<i>Infrastructure</i>	<i>Public Health</i>	<i>Cultural Issues</i>	<i>Gender Issues</i>	<i>Recreational Sites</i>	<i>Historical/ Archeological Sites</i>	<i>Population Influx</i>
Excavation and Construction for NBE Diversion Channel	-1	-1	-1	0	0	0	0	0	-1	-1	0	0	0	-1	+1	0	0	0	-1	N	N	N
Construction of Flood Protection Embankment	-1	0	-1	0	0	0	0	-1	0	0	0	0	0	0	+1	0	0	0	0	N	N	N
Construction of Residential Colony	0	0	0	0	N	0	0	0	0	0	0	0	0	0	+1	0	0	0	0	N	N	0
Construction of Road Bridge	-1	-1	-1	0	N	0	0	0	-1	-1	0	0	0	0	+1	0	0	0	0	0	N	N
Construction of Access Road	-1	-1	-1	0	N	0	0	0	0	-1	0	0	0	0	+1	0	0	0	0	N	N	N
Construction Materials Supply	0	0	0	N	N	0	0	0	0	0	N	0	N	0	+1	0	0	0	0	N	N	N
Other Supplies	0	0	0	N	N	0	0	0	0	0	N	0	N	0	+1	0	0	0	0	N	N	N
Construction Crew Transportation	0	0	0	N	N	0	0	0	0	0	N	0	N	0	+1	0	0	0	0	N	N	N
Solid Waste Disposal	0	0	0	0	N	0	0	0	N	N	0	0	N	0	0	N	0	0	0	N	N	N
Waste Effluents Disposal	0	0	0	0	N	0	0	0	N	N	0	0	N	0	0	N	0	0	0	N	N	N

	<i>Physical</i>					<i>Biological</i>			<i>Social and Socioeconomic</i>													
	Soil	Air Quality	Surface Water	Groundwater	Water Regime	Natural Vegetation	Terrestrial Wildlife	Aquatic Biota	Access	Noise	Cultivation	Livestock Grazing	Resettlement / Compensation	Safety Hazard	Employment	Infrastructure	Public Health	Cultural Issues	Gender Issues	Recreational Sites	Historical/ Archeological Sites	Population Influx
Demobilization of Contractors	0	-1	0	N	N	0	0	0	0	-1	N	0	N	-1	0	0	0	0	0	N	N	N
Operation Phase																						
Powerhouse Operation	N	0	0	N	0	N	N	0	N	0	N	N	N	0	+1	0	0	0	0	N	N	0
Maintenance	N	0	0	N	0	N	N	0	N	0	N	N	N	0	+1	0	0	0	0	N	N	0
Staff Transportation	0	0	0	N	N	N	0	0	0	0	N	0	N	0	+1	-1	0	0	0	N	N	N
Supplies	0	0	0	N	N	N	0	0	0	0	N	0	N	0	+1	0	0	0	0	N	N	N
Solid Waste Disposal	0	0	0	0	N	0	0	0	N	N	0	0	N	0	0	N	0	0	0	N	N	N
Waste Effluents Disposal	0	0	0	0	N	0	0	0	N	N	0	0	N	0	0	N	0	0	0	N	N	N

Key: -2: High negative impact; -1: Low negative impact; 0: insignificant/negligible impact; +1: low positive impact; +2: High positive impact, N: no impact.

Acronyms

ADB	Asian Development Bank
AJK	Azad Jammu and Kashmir
ASTM	American Society of Testing Materials
BOOT	Build, own, operate and transfer
CT	Current transformer
Cumec	Cubic meters per second
Cusec	Cubic feet per second
EIA	Environmental impact assessment
EPA	Environmental Protection Agency
EPC	Engineering, procurement and construction
ESOHSM	Environmental and Social and Occupational Health and Safety Manager
ESOHSO	Environmental and Social and Occupational Health and Safety Officer
GWh	Gega watt-hours
GoAJK	Government of Azad Jammu and Kashmir
HSE	Health, Safety and Environment
IEE	Initial environmental examination
IFC	International Finance Corporation
IFI	International Financial Institutions
IPP	Independent Power Producer
ESSA	Environmental soundness and social assessment
KESC	Karachi Electricity Supply Company
km	Kilometer
KV	Kilo-volts
KWh	Kilo watt-hours
LEL	Laraib Energy Limited
LOI	Letter of Interest
LOS	Letter of Support
MAF	Million acre feet

MGD	Million gallons per day
MW	Mega watts
MWH	Montgomery Watson Harza
M/s	Meter per second
NBE	New Bong Escape
NCS	National Conservation Strategy
NEQS	National Environmental Quality Standards
NTDC	National Transmission and Dispatch Company
O&M	Operation and maintenance
OHS	Occupational Health and Safety
PCS	Plant Control System
PEPA	Pakistan Environmental Protection Act
PES	Pakistan Engineering Services
PPA	Power purchase agreement
PT	Potential transformer
SCADA	Supervisory control and data acquisition
UJC	Upper Jhelum Canal
UL	Underwriters Laboratory
UNEP	United Nations Environment Program
UNIDO	United Nations Industrial Development Organization
WAPDA	Pakistan Water and Power Development Authority
WB	World Bank

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1. Introduction

This document is the revised and updated Initial Environmental Examination (IEE) report for the proposed 84-MW New Bong Escape Hydropower Project. The IEE report for 79-MW project was prepared in 2004 to fulfill the ADB requirements. Later on the generation capacity of the project was optimized to 84 MW. In order to cater for the increased plant capacity there were minor changes in the original design and construction features of the project. One of the main design change features was the increase in the length of the tail race channel, which was increased from 4.5 Km to 7.5 Km. Furthermore, during the construction period, discharge from New Bong channel will be diverted to Jehlum river to ensure excavation in relatively dry conditions. The diversion was part of the project design and was also suggested as a mitigation option in order to avoid pooling of water in the Hari Channel during construction time.

The project is being developed on Build Own Operate and Transfer (BOOT) basis by Laraib Energy Limited (LEL), downstream of Mangla Dam in Azad Jammu and Kashmir (AJK) (see **Exhibit 1.1** for the project location). LEL is a special purpose public limited company, and was formed in Pakistan on August 9, 1995. LEL is subsidiary of the Hub Power Company Limited, which is a Pakistan's first and largest Independent Power Producer. The Company maintains a website: www.laraibenergy.com. LEL obtained, under a Letter of Support (LoS) issued by the Government of Azad Jammu & Kashmir (GoAJK), the exclusive rights to develop, design, implement and operate the New Bong Escape Hydropower Project.

1.1 Project Background and Justification

The project has been initiated to bridge an anticipated gap between electricity supply and demand in the country, and support the GoP policy of encouraging private sector participation in the development of the energy sector. In particular, the project will be the most cost effective and environment-friendly way to harness the available hydropower potential of the Mangla downstream. In addition, it will pave the way for further private-sector investment in the hydropower generation, which has traditionally been in the public sector.

Compared with a conventional thermal power plant of the same generation capacity, the project, once operational, will result in substantial quantities of fossil fuel (and associated \$ amounts) savings, annually. The Project has the distinction of being first renewable project in Pakistan to get registered as a CDM project activity with UNFCCC under the Kyoto Protocol with an entitlement of 218,988 Carbon Emission Reduction (CER) certificates per annum.

1.2 Project History

The hydropower potential at the New Bong Escape was recognized by the Sponsors of the New Bong Escape hydropower project way back in 1993-94. At that time the Sponsors applied and received "No Objection Certificate" (NOC) from the

Government to construct an 18 MW hydropower project at the New Bong Escape through mounting nine, 2-MW turbines on each of the 9 gates of the Escape.

The project, with enhanced capacity of 45MW, was approved by the GoP under its new hydropower policy “Policy Framework and Package of Incentives for Private Sector Hydel² Power Generation Projects in Pakistan 1995” announced in May 1995. Under the new policy the Project was issued a Letter of Interest (LOI) and Letter of Support (LOS) dated May 18, 1996. The LOS was for the development of a 45-MW project near the New Bong Escape, based on a feasibility study carried out by Pakistan Engineering Services (PES). The environmental and social clearance of the project was obtained from AJK Environment Protection Agency (EPA), with a condition that the project will include a sewage treatment facility for treating wastewater from the residential colony and offices, before discharging.

The project experienced delays due to number of barriers relating to lower tariff, constitutional issues due to its location in AJ&K, non availability of standard, project documents package and other areas which impeded the development of the Project. The Power Purchaser encouraged the company to develop the full potential of the site which resulted in increasing the project capacity and changing its operating philosophy from a base load plant to a peaking plant. Subsequently, Montgomery Watson Harza (MWH) prepared and updated feasibility study and recommended a plant capacity of 79 MW which was updated to 84MW after completion of an independent hydrological and energy assessment study and approval of the enhanced capacity by the various stakeholders.. The IEE report for 79 MW project was prepared and EPA AJK accorded “No Objection Certificate” for this project in 2004. Without significant changes in the physical features of the project the design of this project was revised in 2007 and the capacity of the project was increased from 79 MW to 84 MW. In this new design the length of tail race channel has increased from 4.5 Km to 7.5 Km. Another design change was the diversion of NBE channel into the Jhelum River during the construction phase in order to provide dryer working conditions and also to mitigate the problem of water stagnation in the Hari Channel. This feature of the design was based on the recommendation proposed in the IEE report of 2004. Apart from these two physical features there has been no other change in the physical design of the original 79MW project.

1.3 Revised IEE Study

1.3.1 Need for Revised IEE Report

An Environmental and Social Soundness Assessment (ESSA)³ of the originally conceived project with a 45-MW capacity was carried out in 1996, and subsequently approved by the AJK EPA and endorsed by Federal EPA, in 1997. As result of new

² Hydroelectric.

³ Environmental and Social Soundness Assessment, New Bong Escape Hydropower Project; Pakistan Engineering Services; 1996.

feasibility report the project capacity was increased from 45-MW to 79-MW in 2004 and IEE report was prepared. AJK EPA issued a No Objection Certificate for the project vide its letter dated 23rd August 2004. The 79 MW design capacity was reviewed by technical experts (MWH) and was upgraded to 84 MW in 2007. Accordingly, "No Objection Certificate" for the new design of the project was accorded from EPA AJK vide letter dated February 26, 2007 with the condition that there will be no significant changes in the project design. Considering the requirements of project financiers, LEL has commissioned to revise the Initial Environmental Examination (IEE) report, in order to update and augment the findings of 2004 IEE study and to confirm that the findings of earlier ESSA and IEE reports were still valid. This IEE does not need any clearance from the AJK EPA, as AJK EPA has already given "No objection Certificate" for the latest design (84 MW capacity) of the project mentioned above. However, the updated IEE is to include social and environmental aspects of project as per the latest design.

1.3.2 Study Scope

The IEE study addresses the environmental impacts of the proposed New Bong Escape Hydropower project. The project components included in the study are Headrace Channel; Tailrace Channel; New Bong Escape diversion Channel; Powerhouse including turbines, generators, transformers, and associated systems; Auxiliary structures; Switchyard; Offices, warehouse, Labour camp, workshop; Residential colony; and Access roads.

The revised IEE study analyzes the environmental and social impacts associated with the following stages of the project:

- Construction.
- Operation.
- Decommissioning.

1.3.3 Study Methodology

The present IEE study, being an update of the existing IEE study in 2004 drew heavily on the existing report, and the project Feasibility Study report. As part of this revised IEE, additional field surveys were carried out to study the site conditions with respect to the social, biological, human and physical environment. Further, public consultation was also carried out to disseminate the project information to the nearby communities and other stakeholders (such as WAPDA, Irrigation Department, etc.), and to learn about their expectations and concerns regarding the project if any.

The environmental conditions have been documented in this report per the prevailing practice followed in the country for such reports. For impact assessment, relevant social and environmental guidelines (of project financiers) and checklists, and industry practice have been followed. The IEE report also follows the Guidelines as much as practicable.

The key steps that were followed while conducting the revised IEE are briefly described below.

Screening

During this phase, information on the project was compiled and reviewed. Most of this information was obtained from the project feasibility report. In addition, information on relevant legislation, regulations, guidelines and standards was reviewed and compiled.

The report of the project's ESSA conducted in 1996 and IEE conducted in 2004 were also reviewed and this revised IEE is based on IEE report 2004.

Scoping

The information collected in the previous steps was reviewed and potential environmental issues were identified.

Data Collection/Compilation and Public Consultation

During this phase, additional environmental data was collected and compiled, in order to develop and update an environmental baseline of the project area. For this purpose, both review of secondary sources as well as field data collection were carried out and updated. The previous ESSA and IEE reports provided the bulk of the environmental baseline information collected earlier.

During this phase, public consultation was also carried out in order to disseminate project information to the project's key stakeholders, and to solicit their concerns, suggestions, recommendations and expectations.

Environmental Screening and Impact Assessment

During the environmental screening, the environmental, socioeconomic, and project information collected in previous steps was used to determine the potential impacts of the proposed project. Subsequent to this, the potential impacts were characterized in order to determine their significance. Mitigation measures were identified where required to minimize the significant environmental impacts.

Report Compilation

Report compilation was the last step of the study. The report includes a brief description of the proposed project, a review of environmental legislation relevant to the project, a description of baseline environmental and socioeconomic conditions in the project area, and potential project impacts and mitigation measures. The report is revision of IEE conducted in 2004 for 79 MW project design, the contents of the 2004 IEE report have been followed. Changes have been made wherever it was felt necessary, as per the changed situation of the project.

1.3.4 Study Team

A team of environmentalist, engineers and social scientists having relevant experience of conducting environmental and social impact assessments participated in the revision of this IEE study.

The key members of the team are listed below; their bio-sketches are provided in the **Appendix A**.

- Sher Khan Environmental Engineer
- Ayaz Asif Environmentalist
- Ali Ahmad Jan Socioeconomic and Public Consultation Expert
- Mohammad Omar Khalid Environmentalist
- Zahid Beg Mirza Flora and Fauna Expert
- Usman Qazi Socioeconomic and Public Consultation Expert
- Javaid R Chaudhry GM Public Relations, LEL
- Sultan Ahmad GM Project Development LEL
- Mustafa Umar Riaz Assistant Manager Technical, LEL

In addition to the above, LEL management, project team, GM Technical and engineer concerned has provided technical material and support during the study by providing project details, maps and CAD facilities.

1.4 Report Structure

Chapter 2 describes the legislative and institutional setup in the country, relevant to the environment and environmental assessment. **Chapter 3** describes the project and its components. Baseline environmental conditions are presented in **Chapter 4**, whereas environmental assessment and associated mitigation measures are discussed in **Chapter 5**. **Chapter 6** introduces the institutional and environmental management/monitoring requirements during the project execution. **Chapter 7** covers the public consultation process and findings. Finally, **Chapter 8** provides the conclusions and recommendations of the study.

Exhibit 1.1: Project Location

(Please see the following page.)



2. Legislative and Institutional Framework

This Chapter discusses the legislative framework and institutional set-up that currently exist in the country, relevant to this revised IEE. Also included in the Chapter are the environmental guidelines from the national agencies as well as international donors and other organizations.

2.1 National Conservation Strategy

The National Conservation Strategy (NCS) is the first policy document that pledges to balance Pakistan's economic development with the conservation of natural resources. It is the underlying goal of this document that all economic and statutory development in the country should be such that it does not conflict with the interests of nature conservation. The Pakistan Environmental Protection Act, 1997 is the basic legislative tool empowering the government to frame regulations for the protection of the environment. While a basic policy and legislative framework for the protection of the environment and overall biodiversity in the country is now in place, detailed rules, regulations and guidelines required for the implementation of the policies and enforcement of legislation are still in various stages of formulation and discussion. The World Bank environmental guidelines are used to bridge the gaps, wherever needed. The policy, laws, regulations and standards relevant to the proposed project in the context of environmental protection are described in the following sections.

2.2 Biodiversity Action Plan

Pakistan is a signatory to the Convention on Biological Diversity, and is thereby obligated to develop a national strategy for the conservation of biodiversity. The Government of Pakistan has constituted a Biodiversity Working Group under the auspices of the Ministry of Environment, Local Government and Rural Development to develop a Biodiversity Action Plan for the country. After an extensive consultative exercise, a draft Action Plan has been developed. The draft Plan⁴, which has been designed to complement the NCS and the proposed provincial conservation strategies, identifies the causes of biodiversity loss in Pakistan and suggests a series of proposals for action to conserve biodiversity in the country.

2.3 Laws and Regulations

Pakistan's statute books contain a number of laws concerned with the regulation and protection of the environment which are promulgated and adopted by AJ&K. However, the enactment of comprehensive legislation on the environment, in the

⁴ The plan needs approval from the Ministry of Environment.

form of an act of parliament, is a relatively new phenomenon. . The laws relevant to the developmental projects are briefly reviewed below.

2.3.1 AJ&K Environmental Protection Act, 2000

The AJ&K Environmental Protection Act, 2000 (the Act) is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The Act is applicable to a broad range of issues and extends to air, water, soil, marine and noise pollution, as well as the handling of hazardous waste. The discharge or emission of any effluent, waste, air pollutant or noise in an amount, concentration or level in excess of the National Environmental Quality Standards (NEQS) specified by the AJ&K Environmental Protection Agency (AJK-EPA) has been prohibited under the Act, and penalties have been prescribed for those contravening the provisions of the Act. The powers of the AJ&K Environmental Protection Agency (AJK-EPA) have also been considerably enhanced under this legislation and they have been given the power to conduct inquiries into possible breaches of environmental law either of their own accord, or upon the registration of a complaint.

The requirement for environmental assessment is laid out in Section 11 (1) of the Act. Under this section, no project involving construction activities or any change in the physical environment can be undertaken unless an initial environmental examination (IEE) or an environmental impact assessment (EIA) is conducted, and approval is received from the EPA. Section 11 (6) of the Act states that this provision is applicable only to such categories of projects as may be prescribed by the Government.

2.3.2 National Environmental Quality Standards (NEQS), 2000

The NEQS, promulgated under the PEPA 1997, specify the following standards:

- Maximum allowable concentration of pollutants (16 parameters) in gaseous emissions from industrial sources,
- For power plants operating on oil and coal:
 - ▶ Maximum allowable emission of sulfur dioxide,
 - ▶ Maximum allowable increment in concentration of sulfur dioxide in ambient air,
 - ▶ Maximum allowable concentration of nitrogen oxides in ambient air, and
 - ▶ Maximum allowable emission of nitrogen oxide for steam generators as function of heat input.
- Maximum allowable concentration of pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment and sea (three separate set of numbers).

Selected NEQS for liquid effluents discharged to inland waters and gaseous emission from industrial sources are provided in **Exhibit 2.1** and **Exhibit 2.2**,

respectively. Being a hydropower project, these standards relevant to this project are those for waste effluents. It is noted that the biological oxygen demand (BOD) limit of 80 mg/l as prescribed in the NEQS is much higher than the conventional standards of 20 mg/l, adopted by the financiers guidelines.

2.3.3 Azad Jammu & Kashmir Wildlife Protection Act, 1975

This law was enacted to protect AJK's wildlife resources directly and other natural resources indirectly. It classifies wildlife by degree of protection, i.e. animals that may be hunted on a permit or special license, and species that are protected and cannot be hunted under any circumstances. The Act specifies restrictions on hunting and trade in animals, trophies, or meat.

2.3.4 Antiquity Act, 1975

The Antiquities Act of 1975 ensures the protection of cultural resources in AJ&K. The Act is designed to protect 'antiquities' from destruction, theft, negligence, unlawful excavation, trade and export. Antiquities have been defined in the Act as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments, etc. The law prohibits new construction in the proximity of a protected antiquity and empowers the Government of AJ&K to prohibit excavation in any area that may contain articles of archeological significance. Under the Act, the project proponents are obligated to:

- Ensure that no activity is undertaken in the proximity of a protected antiquity, and
- If during the course of the project an archeological discovery is made, it should be reported to the Department of Archeology, Government of AJ&K.

2.4 Environmental Guidelines

Two sets of guidelines, the Pak-EPA's Environmental Guidelines and ADB Environmental Guidelines and IFC performance standards are reviewed here.

2.4.1 Environmental Protection Agency's Environmental Guidelines

The Federal EPA has prepared a set of guidelines for conducting environmental assessments. The guidelines derive from much of the existing work done by international donor agencies and NGOs. The package of regulations, of which the guidelines form a part, includes the PEPA 1997 and the NEQS. The guidelines themselves are listed below.

- Guidelines for the Preparation and Review of Environmental Reports,
- Guidelines for Public Consultation,
- Guidelines for Sensitive and Critical Areas,
- Sectoral Guidelines.

2.4.2 ADB Guidelines

The principle ADB guidelines relevant for this project are the Environmental Assessment Guidelines (ADB, 2003). The guidelines has two parts; the first providing an overview of the environmental assessment requirements and procedures, and the second, the technical guidelines. In addition, the guidelines include Rapid Environmental Assessment checklists for different sectors, and contents and formats for EIAs as well as IEEs.

2.4.3 IFC Guidelines

The main IFC Guidelines relevant for this project are “IFC Performance Standards on Social and Environmental Sustainability (April 30,2006)”. There are eight IFC performance standards; the first is Social and Environment Assessment and Mitigation Systems; second is Labour and Working Conditions; third is Pollution Prevention and Abatement, fourth is Community Health, Safety and Security, fifth is Land Acquisition and Involuntary Resettlement, sixth is Biodiversity Conservation and Sustainable Natural Resource Management; seventh is Indigenous Peoples and the eighth standard is Cultural Heritage. The IFC's Policy on Social and Environmental Sustainability is another relevant document for this project. There are other sector specific guidelines of IFC but the above mentioned documents are considered when this IEE report was consider for revision.

2.5 Obligations Under International Treaties

Pakistan is a signatory to various international treaties and conventions on the conservation of the environment and wildlife protection. The country is obliged to adhere to the commitments specified in these treaties. The Convention on Biological Diversity was adopted during the Earth Summit of 1992 at Rio de Janeiro. The Convention requires Parties to develop national plans for the conservation and sustainable use of biodiversity and to integrate these plans into national development programs and policies. Parties are also required to identify components of biodiversity that are important for conservation and to develop systems to monitor the use of such components with a view to promoting their sustainable use. The Convention on the Conservation of Migratory Species of Wild Animals, 1979 requires countries to take action to avoid endangering migratory species, where the term 'migratory species' refers to species of wild animals of which significant proportions cyclically and predictably cross one or more national jurisdictional boundaries. The parties are also required to promote or cooperate with research into migratory species. Under the International Plant Protection Convention, 1951, Pakistan is required to take steps to ensure the protection of certain plant species that face the extinction threat.

Exhibit 2.1: Selected NEQS for Waste Effluents

Parameter	Unit	Standards
Temperature	°C	< 3 °C
pH value (acidity/basicity)	pH	6-9
5-day biochemical oxygen demand (BOD) at 20 °C	mg/l	80
Chemical oxygen demand (COD)	mg/l	150
Total suspended solids	mg/l	200
Total dissolved solids	mg/l	3,500
Grease and oil	mg/l	10
Phenolic compounds (as phenol)	mg/l	0.1
Chloride (as Cl)	mg/l	1,000
Fluoride (as F)	mg/l	10
Sulfate (SO ₄)	mg/l	600
Sulfide (S)	mg/l	1.0
Ammonia (NH ₃)	mg/l	40
Cadmium	mg/l	0.1
Chromium (trivalent and hexavalent)	mg/l	1.0
Copper	mg/l	1.0
Lead	mg/l	0.5
Mercury	mg/l	0.01
Selenium	mg/l	0.5
Nickel	mg/l	1.0
Silver	mg/l	1.0
Total toxic metals	mg/l	2.0
Zinc	mg/l	5
Arsenic	mg/l	1.0
Barium	mg/l	1.5
Iron	mg/l	8.0
Manganese	mg/l	1.5
Boron	mg/l	6.0
Chlorine	mg/l	1.0

Source: Government of Pakistan (2000)

Notes:

1. The standard assumes that dilution of 1:10 on discharge is available. That is, for each cubic meter of treated effluent, the recipient water body should have 10 cubic meter of water for dilution of this effluent.

2. Toxic metals include cadmium, chromium, copper, lead, mercury, selenium, nickel and silver. The effluent should meet the individual standards for these metals as well as the standard for total toxic metal concentration.

Exhibit 2.2: Selected NEQS for Gaseous Emissions

	Unit	Standard
Smoke	Ringlemann scale	40% or 2
Particulate matter – boilers and furnaces using oil	mg/Nm ³	300
Hydrogen sulfide	mg/Nm ³	10
Sulfur oxides	mg/Nm ³	1,700
Carbon monoxide	mg/Nm ³	800
Nitrogen oxides	mg/Nm ³	400

Source: Government of Pakistan (2000)

3. Description of the Project

This Chapter provides a description of the project and its salient features, its location, its components and its various phases. Also covered in this Chapter are the inputs (water, fuel, electricity, materials, etc.) and discharges (wastes, emissions, disposals, etc.) associated with different phases of the project.

3.1 General Information

3.1.1 Project Overview

The proposed New Bong Escape Hydropower project, having a capacity of 84-MW proposes to utilize the water currently being discharged from the existing Mangla Powerhouse into the Jhelum River through Bong Canal and New Bong Escape. Part of the water in the Bong Canal is diverted to the Upper Jhelum Canal (UJC) for irrigation purposes; the surplus water is released back in the Hari channel (a channel of Jhelum River). Therefore, the project does not require a new water reservoir, and will not change the existing flow regime of the Jhelum River.

The power plant will produce 540 Gwh per annum hydropower electricity, over the 25-year concession period. The power generated will be sold to National Transmission and Despatch Company (NTDC) through an existing transmission line proximate to the proposed site, under a long term Power Purchase Agreement for the concession period. The PPA provides for a 'take-or-pay' arrangement whereby available energy not purchased by NTDC will be compensated through a minimum energy payment based on historic hydrology.

Four horizontal Kaplan bulb-turbines with a rated capacity of about 21 MW each have been recommended after considering plant efficiency, civil works construction cost, economy and operations & maintenance aspects. Key components of the project include a headrace (inlet water channel), diversion channel, powerhouse, tailrace (outlet water channel), switchyard to provide connectivity to the WAPDA grid diversion channel, drop structure (subsidiary out fall structure), bridge over headrace and a residential colony. **Exhibit 3.1** presents a schematic diagram of the project.

The project is the first-ever hydroelectric Independent Power Producer (IPP⁶) in the country. The project is being developed on the Built-Own-Operate and Transfer (BOOT) arrangement, and the ownership of the powerhouse will be transferred to the Government of Azad Jammu and Kashmir (GoAJK) at the end of the concession period (i.e. 25 years).

⁶ Private power plants connected to the National Grid, and selling power to the Utility.

3.1.2 Existing Structures

Brief descriptions of the existing structures relevant to the proposed hydropower project are provided below. These structures are also shown in **Exhibit 3.2**.

Mangla Hydropower Project

Commissioned in 1967, the Mangla Project was designed as a multipurpose project to conserve water, control floods in the Jhelum River, supply water for irrigation, and generate power. The Mangla powerhouse has 10 units of turbo-generators of 100-MW each. The water from powerhouse is discharged into the Bong Canal. The total design discharge of the 10 units is about 45,000 cusecs (1,278 cumecs).

During construction of the Mangla Project, there was an option of either returning the flow from the Mangla Powerhouse directly to the Jhelum River in the range elevation 875-880 feet (267-268 m) providing a head of about 327 feet (100 m) for Mangla generation or excavation of a new channel leading from the tailrace to Jabbar Nullah. The proposed tailrace channel could be constructed at a flatter gradient than the natural Jhelum River channel and would allow head to be gained at the power station. The concept of the Bong Canal was thus born; resulting in lowering of the Mangla Powerhouse tailrace by more than 30 feet (9 m) and producing 10% more power from the facility.

Mangla Raise Project: WAPDA is currently undertaking a project to raise level of the Mangla Dam. The project will increase the storage capacity of the reservoir by some 2.9 MAF ($3.55 \times 10^9 \text{ m}^3$). The raise is expected to reduce the Mangla spillway discharges, increase the discharges through the Mangla Powerhouse (and Bong Canal) and thus make a larger volume of better-regulated water available to the New Bong Escape hydropower project.

Bong Canal

The Bong Canal was built as part of the Mangla hydropower project as its tailrace, and was designed to convey water released from the Mangla powerhouse (and local inflows along the canal) to the Jabbar Nullah, which continued to the UJC regulator. The end portion of the Bong Canal is enlarged and called Bong Pond. The maximum capacity of the Canal is 49,000 cusecs (1,392 cumecs). The Bong Canal is about 7.5 km in length from the Mangla Powerhouse to the Bong Pond and UJC Regulator.

Upper Jhelum Canal (UJC)

The UJC supplies water to irrigation areas in Punjab. The UJC was built, between 1905 and 1910, to take Jhelum River water to Rasul to meet the Lower Chenab Canal system irrigation requirements. The condition of the Canal has remained problematic throughout the period of its operation. The UJC head regulator controls the canal flows downstream of the Bong Escapes. The head regulator is operated manually to maintain a constant water level in the Bong Pond. Originally (i.e. before the construction of Mangla Project), the UJC drew water directly from the Jhelum River through head-works at Mangla. Three miles (4.8 km) from the head-works, the

Canal discharged into Jabbar Nullah with a fall. This portion of the UJC (called the old UJC) was abandoned after construction of the Bong Canal.

The UJC was originally designed to convey up to 12,500 cusecs (355 cumecs), and had been carrying this flow in the past, before the operation of the Mangla powerhouse started. However, in recent years, the capacity of the UJC has reduced to about 9,000 cusecs (256 cumecs) due to hydraulic and structural problems in the canal downstream from the regulator structure.

Old Bong Escape

The Old Bong Escape structure, consisting of a gated regulator and a channel 2,500 feet (762 m) in length, was constructed in about 1905 as part of the Upper Jhelum Canal and its regulator. Its primary function was to release the surplus water back to the river. Presently, the operation of the Old Bong Escape is limited to silt exclusion and discharging exceptional floods in conjunction with the New Bong Escape. The structure is manually operated and is not generally required or to be used since the construction of New Bong Escape, except the silt ejectors. The maximum capacity of the Old Bong Escape is 21,000 cusecs (597 cumecs). Being a man-made structure, the Old Bong Escape Channel has no significant eco-systems. There are no water users along the channel either.

New Bong Escape

The New Bong Escape, consisting of a gated regulator and a channel of 4,000 feet (1,219 m) in length, was constructed as part of the Mangla Project, and is located on the right bank of Bong Pond, 25,000 feet (7.62 km) downstream of Mangla power station and about 1,400 feet (427 m) upstream of the Old Bong Escape. Nine radial gates can be automatically controlled or manually operated to maintain a constant water level in the Bong Pond. The Escape has a maximum capacity of 41,000 cusecs (1,165 cumecs). It currently releases the surplus water back to the Hari channel. Being a man-made, the New Bong Escape Channel has no significant eco-systems. There are no water users along the channel either.

3.1.3 Hydrological Regime and Water Availability for the Proposed Project

The New Bong Escape hydropower project relies on water released from the Mangla reservoir, through the Mangla Powerhouse, into the Bong Canal together with seasonal flows from the Jabbar Nullah. The water available to the new plant is represented by the total flows less the irrigation requirement of the UJC and is currently reflected by the flows through the New Bong Escape. The Mangla reservoir is fed by the Jhelum, Kanshi and Punch rivers. The total annual inflows into the reservoir have been an average of about 23 MAF ($2.8 \times 10^{10} \text{ m}^3$) over the past 35 years; 2.6 MAF ($3.18 \times 10^9 \text{ m}^3$) has been passing through the spillway annually, 6.6 MAF ($8.07 \times 10^9 \text{ m}^3$) has been the annual requirement of the UJC leaving an average of about 13.6 MAF ($1.66 \times 10^{10} \text{ m}^3$) annually (18,800 cusecs or 534 cumecs) for the New Bong Escape hydropower project.

Records for the River Jhelum have been kept since 1907, but the discharges have been measured only since 1922. Pre-Mangla Dam records show that the average annual river flow at Mangla has been about 23 MAF ($2.8 \times 10^{10} \text{ m}^3$). This shows a fairly stable and reliable average water inflow at Mangla of about 23 MAF ($2.8 \times 10^{10} \text{ m}^3$) annually.

The proposed project will not change the existing water regime of the area. As stated above, the surplus water that is currently released through the New Bong Escape back to the Jhelum River will be utilized for the proposed project. There will not be any impact on the irrigation water being released in the UJC, nor the Jhelum River downstream of the New and Old Bong Escapes.

Jabbar Nullah

Jabbar Nullah is a natural water course draining into the left bank of Bong Canal, between RD 25+000 and 26+100. This Nullah, with a catchment of 12.5 square miles (32 sq. km), brings flash floods during monsoon period (mid-June through mid-September). These floodwaters are allowed to discharge into Hari channel through the New Bong Escape. In the event of exceptionally high floods, flows exceeding the capacity of the New Bong Escape, the Old Bong Escape can cater for the additional flows.

Hari Channel

Hari channel is essentially a channel of the Jhelum River. Jhelum River, much like most of the other rivers in the region, spreads out in multiple braid-like channels after entering the plains. Some of these channels have local names different than the main river. Hari is one of such channels of the Jhelum River.

3.2 Project Site

The proposed hydropower project site is located around 120 km southeast of Islamabad and about 7.5 km from the existing Mangla Dam. Administratively, the project area falls in Mirpur District of Azad Jammu and Kashmir. Most of the land was acquired by WAPDA in 1960s as part of the Mangla Dam project. The land will be leased to the Project for the concession period. WAPDA has also provided its approval for carrying out various project activities, including excavation of the Hari channel.

The site is located at $73^\circ 43' 42'' \text{ E}$ and is $33^\circ 05' 14'' \text{ N}$. The site for headrace, powerhouse, interconnection facility, some portion of tailrace channel and contractor's camp is in a well-defined and limited area measuring about $1,100 \times 3,000$ feet, bounded by the existing road between Mangla and Mirpur at its north, the New Bong Channel on its west, Old Bong Channel on its east, and Jhelum river flowing in east - west direction at its southern boundary. The tailrace channel will further extend up to 7.5km downstreams in the Hari Channel. The Project is accessible from town of Dina via Mangla and from Sarai Alamgir along UJC; both Dina and Sarai Alamgir being on the main railway line and the Grand Trunk road (N5) of the country. **Exhibit 3.3** shows the project location and its surroundings.

3.3 Project Components

Salient information of the key project components is tabulated below, and shown in Exhibits 3.1 and 3.4.

<i>Project Facility</i>	<i>Technical Features</i>	<i>Purpose/Function</i>
Headrace Channel	Capacity: 38,000 cusecs (1,080 cumecs) Length: 574 feet (175 m) Bed width: 246 to 377 feet (75 m to 115 m) Concrete lining	To connect the Bong Pond and the proposed Powerhouse.
Road Bridge	Prestressed reinforced concrete road bridge spanning across the Headrace Channel.	To provide the crossing over the Headrace Channel for the Mangla-Mirpur road.
Tailrace Channel	Capacity: 49,000 cusecs (1,392 cumec) Length: 7.5 Km Bed width: 400 feet (121.9 m) Bed slope: 1:4,000	To connect the proposed Powerhouse and the Hari channel.
Tailrace Embankment	Length: 7.5 Km Height: 20 feet (6 to 8 m) Width at the top: feet (6.1 m) Side slope: 1:1.75 Stone pitching.	To protect Tailrace Channel from floodwater.
Powerhouse	Width: 235 feet (71.7 m) Length: 246 feet (75 m) Operating head: 30.63 - 44.31 feet (9.34 -13.51 m) Design flow: 35733 cusecs(1,012 cumecs)	To house 4 sets of turbo-generators and associated systems, auxiliaries, control room, offices, workshop, etc.
Switchyard	Length: 410 feet (125 m) Width: 236 feet (72 m)	To connect the Powerhouse with the existing 132 kV transmission line.

<i>Project Facility</i>	<i>Technical Features</i>	<i>Purpose/Function</i>
Drop Structure (Subsidiary Outfall)	Width: 39 m Length: 71 m	To reinforce the existing Old Bong Escape Channel
New Bong Escape Channel coffer dams.	Length: 1771 feet (540 m) Width: 200 feet (61 m)	To redirect the flow of the New Bong Escape Channel away from the Tailrace Channel and Powerhouse.
New Bong Escape Diversion Channel	Capacity: 41,000 cusecs Length: 1,190 meter Width: 123 m (400 feet) Bed Slope: 1:1000	To divert the NBE discharge to River Jehlum

Brief and simplified descriptions of the project components are provided below.

3.3.1 Headrace Channel

The Headrace channel will convey water from the Bong Pond to the proposed powerhouse. The Headrace channel inlet is located between the New and Old Bong Escape structures. The water flow currently bypassed through the New Bong Escape will be diverted to the Headrace Channel, without any changes to the flows in the UJC.

During the final design, the optimum alignment and geometry of the Headrace Channel will be determined.

3.3.2 Road Bridge

The existing Mangla-Mirpur road will be crossed by the Headrace Channel. Therefore, a road bridge will be constructed over the Headrace.

The Tailrace Channel will convey water from the powerhouse to the River Jhelum through Hari channel, and will be constructed by excavating the land adjacent to the Powerhouse and the part of the Hari Channel. The design is intended to achieve an additional increase in the gross head available at the powerhouse by about 16.4 - 19.7 feet (5 - 6 m) at full flow, and other requirements such as scouring and deposition.

The mean gradient of the Jhelum River in the reach near the New Bong Hydropower project site is about 1:750. The proposed concept for the New Bong Escape project is to excavate a tailrace channel with a flatter gradient so that head can be gained along the length of the channel. However, the resulting tailrace channel must have a stable regime where scour and deposition will be in balance. The Tailrace Channel will be protected from the flood in the main Jhelum River channel, by a flood embankment running parallel to the Tailrace Channel. In the updated design (84 MW

capacity) the length of the tail race channel has been enhanced to 7.5 Km, with the tail ending at Afzal Pur village.

3.3.3 Flood Protection Dike

During the Jhelum River high flows, which are very infrequent after construction of Mangla Dam, there is likely-hood of channel migration towards the tailrace, which may cause sediment deposition that could affect the tail water level. To guard against the situation and also provide protection to tailrace, all the excavated material will be placed in an embankment along the right-bank of channel.

The layout of the embankment is designed to give it a smooth curve so that the river flood flow passes along smoothly. Total excavation for the tail race channel is estimated at about 5.00 million cubic meters. Some of the excavated material will be used as fill in construction of flood protection dike along the right bank of the tail race channel. The remaining excavated material will be compacted alongside the dike and its surface will be stabilized through plantation. **Exhibit 3.6** Gives the detail of the protection dike.

3.3.4 Powerhouse

The design of the powerhouse is based on the available long-term flow records of Bong Canal and to ensure the operation of the powerhouse on the design capacity. Headwater and tailwater levels were determined from the characteristics of the proposed channels.

The powerhouse will comprise a short inlet section with a bellmouth entry sufficiently long to limit velocity at the trashrack to about 1.2 m/s under rated conditions. The selected turbines will determine the dimensions of the waterway through the powerhouse. Access to the turbine and generator (located in the bulb upstream from the turbine runner) is provided through a hatch in the main powerhouse floors and through the roof of the structure. A bridge crane can be provided for minor maintenance but removal of the main equipment would use a mobile crane operating above the roof level. The exact dimensions and levels of the powerhouse will be determined during the detailed design of the project.

3.3.5 Switchyard

The switchyard can be located at either side of the powerhouse as required to suit take-off of high voltage cables from the powerhouse transformers to the switchyard. The Complex will be connected via an in-out arrangement to the existing 132 kV transmission line from Mangla to Kharian, which is located at the most upstream of the three transmission lines at the site. Overhead lines will be installed to connect the switchyard to the transmission line.

A conventional outdoor, air-insulated switchyard gas insulated design will be used to accommodate the switching equipment. The equipment will be configured in a double bus, breaker and a half arrangement connecting the high voltage windings of the four generator step-up transformers to four overhead line circuits. The circuit breakers will be live-tank SF₆ gas.

A digital control board will be provided containing the line protection (including transfer trip equipment) and metering packages. The relaying and metering packages will be networked into the plant control system to provide status, alarms and diagnostics capability to the operator on the Video Display Terminals (VDT's) of the computer control system.

3.3.6 Drop Structure (Subsidiary Outfall)

The Drop Structure(Subsidiary Outfall) will essentially be a realigned and strengthened Old Bong Escape Channel. This structure is required to ensure smooth water discharge during occasional floods from the Jabbar Nullah into the Hari Channel. The concrete structure will reinforce the old channel against any possible channel erosion caused by the increased drop in the water level in the Hari channel due to its excavation and use as the Tailrace Channel.

3.3.7 NBE Diversion Channel

The new feature in the updated design of the project is inclusion of NBE Diversion Channel. This diversion channel has been included in the design of the project to avoid water turbidity and pooling of water during construction period in the downstream. In the 2004 IEE report it was pointed out that there will be water stagnation as a result of construction activities, resulting in mosquito breeding and to avoid health risks appropriate mitigation options were suggested, such as spraying of oil and pesticides as remedial measures. However, to completely avoid such nuisance, the new design proposes diversion of NBE water to Jehlum River through NBE Diversion Channel, which will have multiple positive effects during construction period of this project.

3.3.8 Mechanical and Electrical Systems

A brief listing of the mechanical and electrical systems is provided below.

- Mechanical Equipment
 - ▶ Turbines
 - ▶ Governing System
 - ▶ Gates and Stop-logs, Trash-racks, Cranes and Hoists
 - ▶ Miscellaneous Mechanical Equipment and Systems
 - Water Supply System
 - Cooling Water System
 - Compressed air system
 - Powerhouse elevators
 - Water level sensing system
 - Water Flow measuring system
 - Maintenance workshop
 - Dewatering and Drainage System

- Ventilating and Air Conditioning Systems.
- Fire Protection System
- Oil Handling and Purification System.
- Electrical Equipment
 - ▶ Generators
 - ▶ Excitation System
 - ▶ Ancillary Electrical Equipment and Systems:
 - Medium Voltage Switchgear
 - Bus Ducts and Cable Connections
 - Station Service Transformers
 - Emergency Station Service Generator
 - Lighting
 - ▶ Protective Relaying
 - ▶ Main Power Transformers
 - ▶ Unit Automation and Controls
 - ▶ Cables and Raceway System
 - ▶ DC and UPS Systems
 - ▶ Grounding System.

3.3.9 Infrastructure Requirements

Site Access

The site access at present is provided by the road connecting new Mirpur Town with Mangla and downward to Dina besides the road from Sarai Alamgir along Upper Jhelum Canal. As mentioned earlier, a road bridge would be required to be built on the headrace channel of the proposed power plant at the site on the Mangla-Sarai Alamgir road along UJC.

Construction Workers Camp

Construction camp will be located on the left side of power house down stream of Old Bong Escape and running alongside the tailrace. The site of construction camp has been changed to the very proximity of the power house. This construction camp could be converted into operation and maintenance staff residential colony, once the project will be commissioned.

Housing for Operation and Maintenance (O&M) Staff

The plant managers, engineers, and supervisory personnel will be provided separate accommodations. There will be 20 housing units, 18 flats, and a mosque for the about 60 O&M workers to be involved for O&M of the plant. Proper solid waste

disposal and sewerage works will be designed for these housing units as per directions of the EPA AJK and financiers guidelines.

3.4 Project Construction

3.4.1 Contracting Arrangements

An 'engineering, procurement and construction' (EPC) contract has been selected for the project implementation. This means that the selected EPC contractor will be responsible for detailed engineering design, construction and commissioning of the project facilities.

3.4.2 Construction Planning and Schedule

Construction planning will broadly cover the following main components.

- ▶ Construction Workers Camp
- ▶ NBE Diversion Channel
- ▶ Headrace inlet, bridge, and lined Headrace Channel
- ▶ Powerhouse .
- ▶ Subsidiary out fall structure
- ▶ Tailrace Channel.
- ▶ Flood Protection Dike
- ▶ Two Cofferdam embankments
- ▶ Switchyard
- ▶ Interconnection and Transmission Facility
- ▶ SCADA and telecommunications
- ▶ Instrumentation
- ▶ Residential colony and permanent offices, etc.

Each of the above components will be independent segments as far as construction interfacing is concerned construction camp will be constructed at first stage and work on other segments will proceed simultaneously on each of them and even by different construction agencies/subcontractors. The planning could be done easily without interference to reduce the total period of construction.

The EPC contractor will be responsible for the details of the construction planning, subject to achieving the overall completion target date and the performance parameters of the Complex. Accordingly, all construction planning aspects described in this section demonstrate that the project will be feasible within the overall proposed time frame and that the project according to conceptual design can be constructed under the existing site conditions.

3.4.3 Construction Methodology

The construction methodology will follow the conventional construction practices for projects of this type.

3.4.4 Staffing

Arrangement of the construction workforce will be the responsibility of the EPC contractor and its sub-contractors. It is assumed that a maximum of 300 to 350 workers will be working at the project site. These will include skilled and unskilled workers for the civil construction, mechanical fabrication and erection, and electrical and control system installation.

3.4.5 Equipment and Vehicles

The following construction equipment and vehicles are expected to be employed at the project site during construction phase:

- ▶ Excavators
- ▶ Well drilling machines (rotary as well as percussion type)
- ▶ Cranes
- ▶ Mixing plant (for concrete)
- ▶ Concrete mixing trucks
- ▶ Concrete laying machines
- ▶ Welding plants
- ▶ Dumpers and loaders
- ▶ Fork lifters
- ▶ Water tankers
- ▶ Air compressors
- ▶ Water pumps
- ▶ Vehicles for personnel movement
- ▶ Rollers
- ▶ Graders
- ▶ Aggregate crushing plant

Exact numbers of the above equipment and vehicles will be determined during the detailed design stage.

3.4.6 Traffic

Transportation of Powerhouse Equipment: This will be a major operation, involving movement of heavy and large loads via a fleet of trucks and trailers from Karachi to site. It is estimated that around 100 truck/trailer loads will be required for

this operation. The route from the GT Road (N5) to the site has been carefully selected with respect to the condition and size of the bridges encountered.

Mobilization (and Demobilization) of the Contractors: Since several sub-contractors will be working at the site, who will be mobilizing at different times, concentrated traffic loads are not expected during this activity. The demobilization is also not likely to cause much of the traffic concentration.

Construction Materials Supplies: since exact quantities of the construction materials are not known at this stage, the corresponding traffic load can not be determined now. During the detailed design stage, this information will be available. However, it is estimated that on average 40-50 truck loads per day will be supplying different types of construction materials to the site.

3.4.7 Construction Materials

The availability of suitable local materials in appreciable quantities in the surroundings of the proposed project to minimize the high cost of haulage was the main consideration. Some testing of suitability of the material will be carried out during the construction stage for different services/locations. In particular, the construction of embankments will make use of well-graded materials that will not be susceptible to piping and will allow control of seepage.

Embankment Fill. Material, consisting of cobbles, gravel, and sand, will be required for construction of embankments for the headrace channel. The required fill will be selected from the excavation of the inlet, the headrace, and the powerhouse. Any remaining material will be processed for use as filter material, processed as concrete aggregate (provided it proves suitable after testing), or diverted to raise the level of the area between escape channels and the power channel from around 822.0 to 829, i.e., the the level of 1992 flood downstream of New Bong Escape.

Concrete. Gravel and cobbles will be processed to meet the coarse aggregate requirement for concrete works. Coarse aggregate deposits are available in the area as natural alluvium terrace deposits along the Jhelum River on the left bank, several miles in length and 50 to 100 feet (15 to 30 m) in thickness. Some suppliers have already installed crushers in the vicinity of the project for local commercial supply of concrete grade aggregate. Material obtained from the excavation of the channel and powerhouse may be processed for the purpose. Crushed coarse aggregates are also supplied from limestone quarries in Taxila near Rawalpindi and quartzite quarries in Kirana hills near Sargodha.

Cement is manufactured in Pakistan and is readily available in local markets. Cement in bulk quantities can be obtained directly from the factories. Such cement factories nearer to the site are located in Taxila, Wah and Hattar Industrial area.

Bricks. Bricks for masonry work are manufactured in almost every part of the country. Many kilns are located in Jhelum district and good quality bricks can be obtained in the required quantity from these sources.

Steel and Reinforcing Steel. Reinforcing steel is also manufactured in Pakistan and is available in local markets. There are several re-rolling mills located in and around Lahore producing high quality grade 60 and grade 40 steel that observe the ASTM standards.

3.4.8 Other Supplies

Water: During the construction period, about 1.0 million gallons of water per day will be required for the construction activities and human consumption. Groundwater wells will be dug at suitable places for this purpose.

Fuels: For the construction equipment and vehicles, diesel and petrol will be required. Diesel and petrol is freely available everywhere from the petrol pumps all over the country, and there are several petrol pumps in Mangla, Dina and Mirpur. It is evident that there would be minimal requirement of on-site storage of fuel, however, if required, adequate storage facility will be maintained on site.

For the residential camp, cooking (and probably heating) fuel will also be required. It is expected that Liquefied Petroleum Gas (LPG) cylinders as easily available in the market will be used for this purpose.

Electricity: Temporary connections will be obtained from WAPDA for the construction activities and camp and for backup diesel generators will be used.

Camp Supplies: Camp supplies can be procured from Mangla, Mirpur, or even Jhelum. These will be transported to the site on delivery vans. Arrangements can be made to outsource this activity.

3.5 Powerhouse Operation

3.5.1 Key Activities

Key O&M activities include powerhouse operation, regular maintenance of the tailrace and routine maintenance of other plant and equipment.

3.5.2 Staffing

Relatively small staff of around 60 personnel will be required during the powerhouse operation. Most of the required staff stationed on the project site will be for technical and management purposes. Staff will also be required to look after the routine operation and maintenance of plant and structures.

3.5.3 Housing

For residential purposes of the Operation and Maintenance staff 20 housing units and 18 flats will be constructed in the 2.5 acres of land in the proximity of the power plant. The housing colony for O&M staff will be constructed as per standard design specifications providing proper sewerage facilities as per EPA AJK guidelines. Provision for solid waste management will be provided along with properly designed

septic tanks and soakage pits with pour flush latrines. Arrangements will be made for safe disposal of solid waste.

3.5.4 Supplies

Supplies for the powerhouse operation would include:

- ▶ Water
- ▶ Electricity
- ▶ Spares for the plant and machinery
- ▶ Lubricating oils, grease and other chemicals
- ▶ Office supplies
- ▶ Supplies for residential colony
- ▶ Fuel for vehicles.

Groundwater wells will be the source of water for the operation and maintenance staff living in the residential colony of this project. Powerhouse will use its own electricity; however, electrical connection will also be obtained from WAPDA to supplement any shortfalls. For most of the remaining items, supply contractors can be employed who would provide the required supplies as per the requirements at that time.

3.5.5 Equipment and Vehicles

A small fleet of vehicles will be required, primarily for the personnel transport, during the powerhouse operation.

3.6 Decommissioning

At the end of the operational life of the powerhouse, a detailed Decommissioning Plan will be prepared to decommission the facility. The key activities during the decommissioning include:

- ▶ Disconnecting the switchyard with the Utility Grid.
- ▶ Removing the Powerhouse and Switchyard electrical systems.
- ▶ Removing the turbines, generators and associated systems.
- ▶ Removing all warehouse equipment and materials.
- ▶ Removing all workshop machinery, equipment and materials.

All of the above equipment can be sold out for reuse or as scrap. The concrete structures can be left in place. Office buildings and residential colony can also be left intact for later use.

Exhibit 3.1: Project Schematic Diagram

(Please see the following page.)

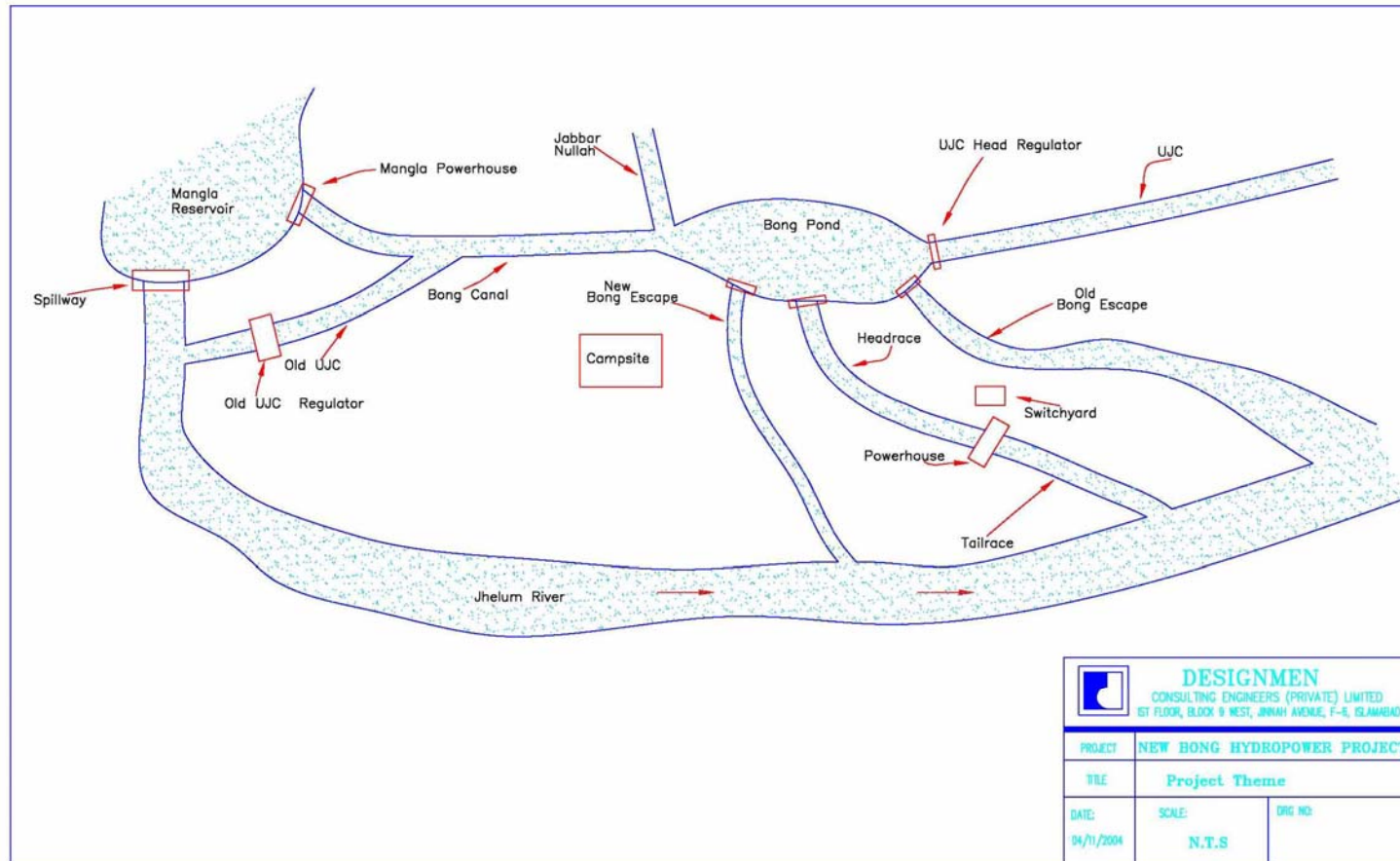


Exhibit 3.2: Existing Hydrological Structures

(Please see the following page.)

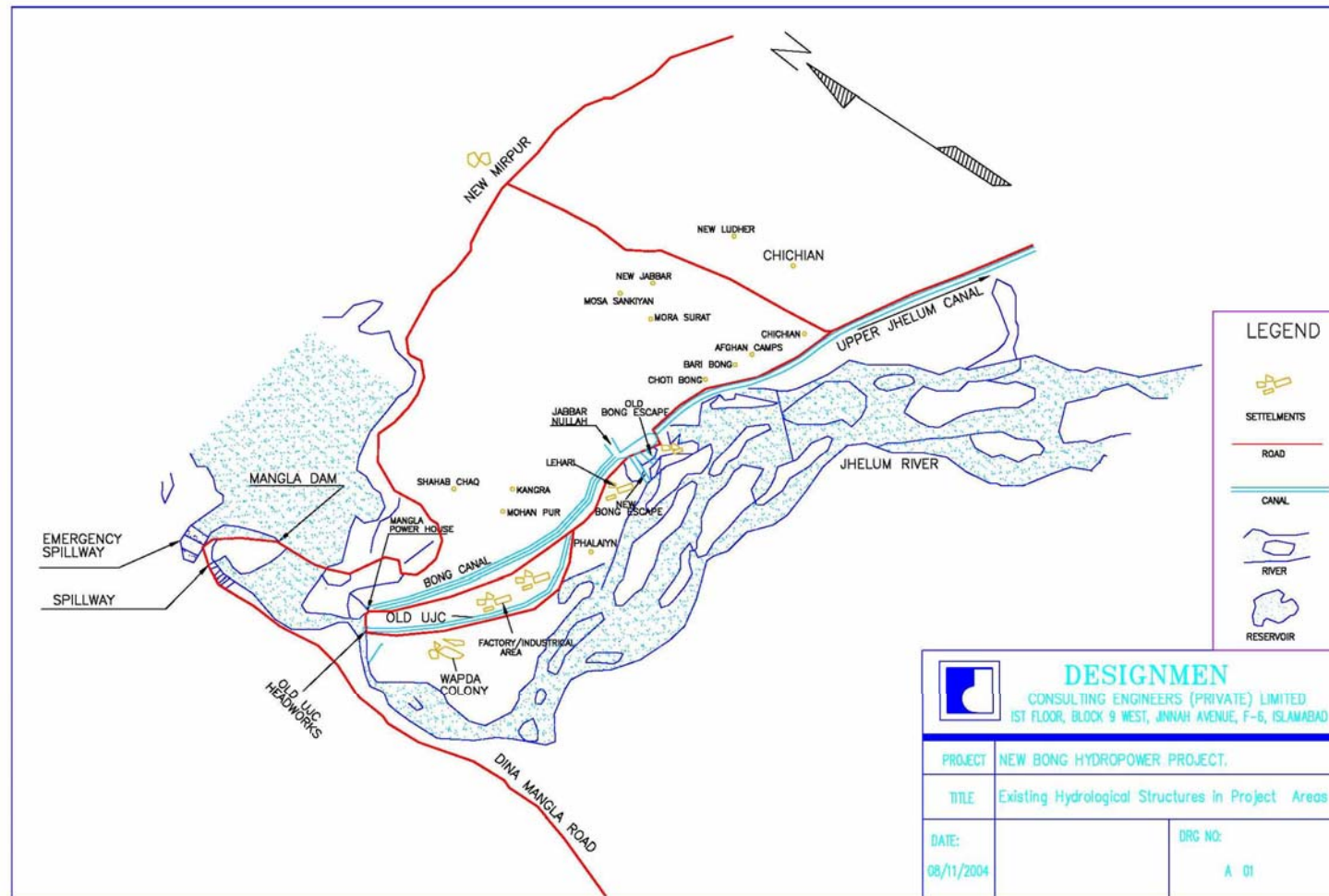


Exhibit 3.3: Project Location and its surroundings

(Please see the following page.)



Exhibit 3.4: Project Components

(Please see the following page.)

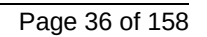


Exhibit 3.5: Project Schedule

(Please see the following page.)

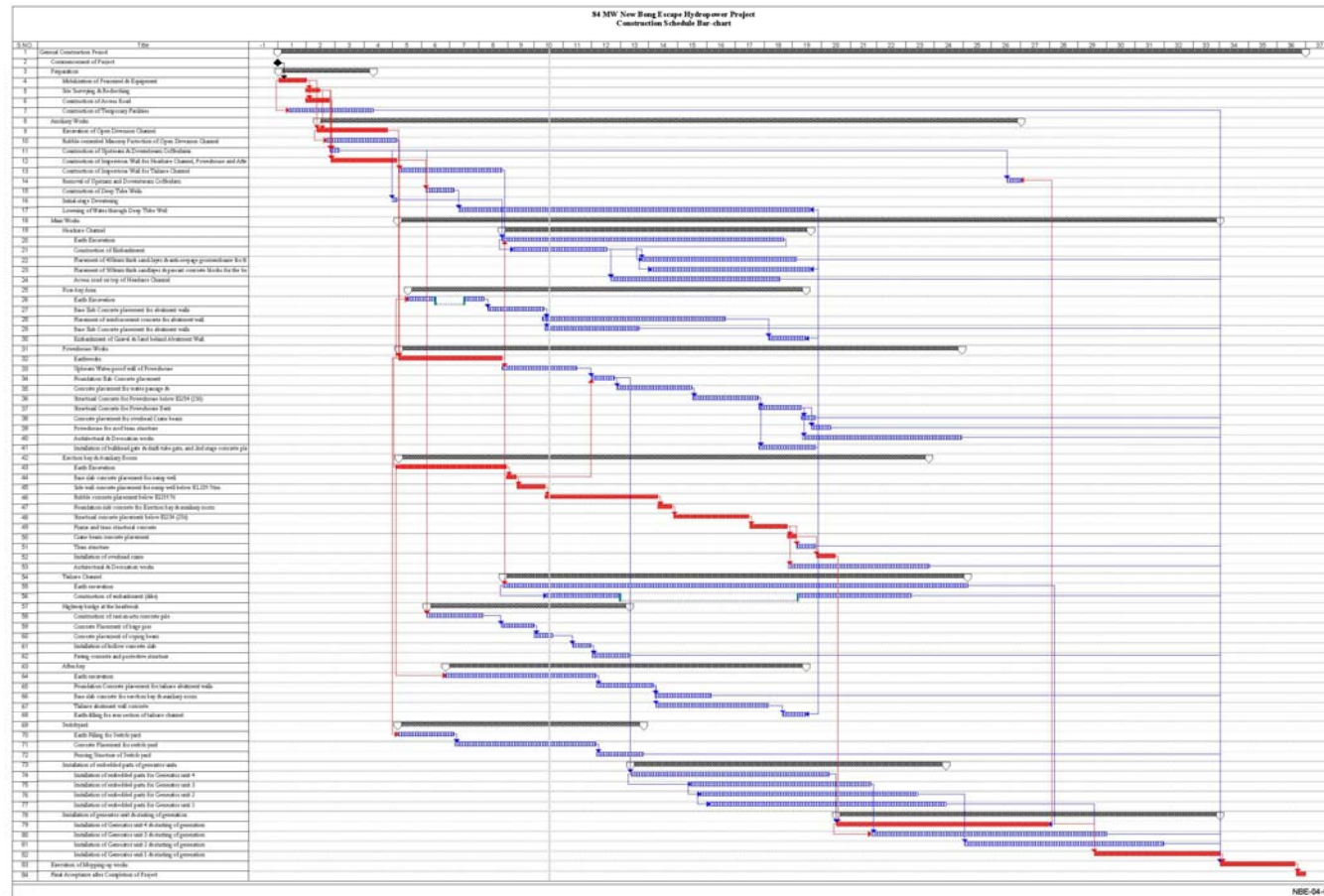
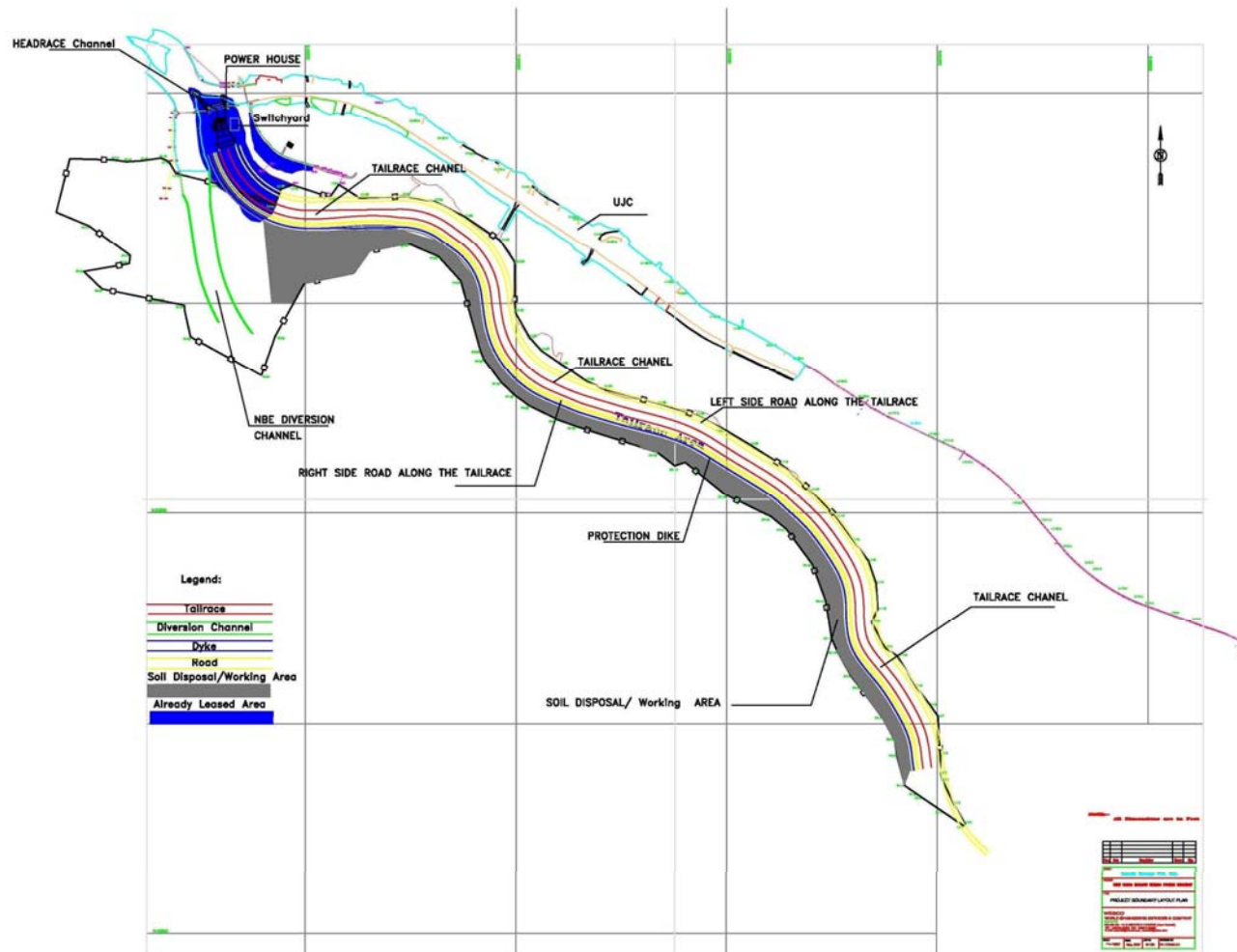


Exhibit 3.6: Details of the flood protection dike

(Please see the following page.)



4. Description of the Environment

This Chapter describes the environmental conditions at the proposed site before the commencement of the project activities. The environmental baseline in this Chapter addresses the physical, biological and social aspects.

4.1 Physical Environment

The physical environment consists of existing land use of the project site, geology and geomorphology, soils, groundwater, surface water, meteorology and climate. The existing condition (i.e. baseline) of each of these components of the physical environment is discussed below. The description in these sections are almost entirely based upon secondary resources, including various studies conducted earlier specifically for the proposed project (e.g. Project Feasibility Study⁷, Subsoil Investigations and Pumping Tests⁸, etc.).

4.1.1 Existing Land Use

The proposed project site is a tract of land between two man-made water channels (New and Old Bong Escapes) not inhabited by people. The land is owned by WAPDA as a result of land acquisition under the Mangla Dam project in 1960s. The land is mostly lying vacant. The strip of land between the Bong Pond and Mangla-Mirpur road has a strand of trees, mostly eucalyptus. This part of the project site is also owned by WAPDA, and is occasionally used for recreational purposes by the local communities. **Exhibit 4.1** shows the land use of the project site and its immediate vicinity. **Appendix C** includes some photographs of the proposed site.

4.1.2 Geology and Geomorphology

Geology of the Region

The prevailing geologic conditions in the region are the results of extensive inundation, depositions, coastal movements, and erosions over a long period of time in the geological ages. Consequently, the region is one of folded mountains with sharp peaks, ridges, and a deeply incised youthful drainage system. The rock types are predominantly sedimentary. The recent geological history in the vicinity of the site has been one of deposition rather than erosion.

The geology of the region is closely related to the formation process of Himalayan ranges resulting in intense deformation with complex folding, high angle strike-slip faults and crust thickening expressed in a series of thrust faults. The important tectonic changes which have had so much influence in the region are feebly displayed in the site

⁷ Feasibility Study for New Bong Escape Hydropower Project. Laraib Energy Limited. July 2004.

⁸ Subsoil Investigation and Pumping Test for New Bong Escape Hydropower Project. Consolidated Engineering Services (Pvt) Ltd. June 2000.

itself, and it is only by considering the geology on a broader regional scale, as well as in site specific detail, that the effects can be appreciated.

The project site is located in the Potwar region of Upper Indus Basin, among low hills composed of beds of the Siwalik system of Plio-Pleistocene age. The Siwaliks are the freshwater sediments deposited in the Indo-Gangetic Basin by the streams rejuvenated by Himalayan uplift initiated in the Miocene age. The latest orogeny, which is considered still in progress, though on a lesser scale, folded and displaced the Siwalik deposits.

The prominent feature of the geological structure in the region is depicted by the change of strike between the two banks of the Jhelum River. On the western bank, the strike is in a northeast direction, whereas on the eastern bank it is northwest, forming a sharp inverted V-shape pattern, with its apex at about 150 km north of the site near Muzaffarabad. The junction of the two arcs is known as Syntexial Bend of the Northwest Himalayas.

Geology of the Project Area

The prevailing geologic conditions, at the proposed project site, are a result of extensive erosion of the hills of the lower Himalayas during Pleistocene to sub-recent period, transportation and deposition of this eroded material in the southward area. Construction records from the Mangla dam and the Bong Canal indicate that the rock exposures nearest to the site are about 4,500 feet (1,372 m) downstream of the Mangla tailrace and about 20,000 feet (6,096 m) northwest from the proposed site. These rocks belong to Siwalik group and consist of alternate beds of sandstone, siltstone, and claystone. These beds form sharp folds indicated by varying steep to gentle dips in upstream and downstream directions. The beds are highly sheared. The shear zones in clay stone reach up to 4 feet (1.22 m) in thickness. The bedrock beyond chainage 44 +500 of Bong Canal is overlain by alluvium, containing cobbles and boulders with sand-filled interstices and only a small portion of intermediate particles, spreading over a vast area. Investigations for the Bong Canal and New Bong Escape structure indicated that the thickness of this alluvium is more than 350 feet (107 m).

Downstream of the Bong Canal, the surface in the north and western part is covered with 8 to 10 feet (2.44 to 3 m) of spoil obtained from the excavation of the Bong Canal and the New Bong Escape structure. The spoil consists of gravel boulders with some fine silty sand. In the southern part, about 2,000 feet (610 m) from the Old Bong Canal, at the site of the proposed powerhouse, the surface is covered with about 10 feet (3 m) of very fine silty sand. The fine sand also extends north and westward underneath the spoil.

At chainage 3+200 feet from the tailrace, there is evidence of the existence of a thrust fault striking east west and dipping about 40 degrees north. This fault has been traced to about eight kilometers in the east. There is also evidence that the fault has been active in fairly recent geological times since there are indications of movement in recent river alluvium gravel.

Geomorphology

The project area is a part of the Jhelum valley located on the left bank of the river Jhelum and situated a short distance downstream from the point where the river leaves the gorge and opens in the plains, and where the Mangla Dam was constructed in late 60s. The area is the flood plain of the Jhelum River, dissected by several man-made drains and natural streams. The natural drains system is characterized by numerous streams forming as a result of torrential rains with the storm-water running down the slopes of the hills in the north. These storm water flows ultimately join the Jhelum River in the south.

The relief of the area is moderate in the southern part. In the north about a kilometer from the Bong Canal it abruptly rises into a hilly range, which forms the rim of the Mangla reservoir.

The terraces are made of alluvium consisting of gravel boulder embedded in sand and silt reaching to a minimum depth of about 120 meters. The top is generally covered with a 1 to 2 meter thick sandy silt layer forming the topsoil, which is very fertile. The terraces are under cultivation and various crops are grown on them. The slopes of the hills are generally covered with grass and a variety of bushes and trees where people graze their cattle.

4.1.3 Seismicity

The site is located in an active seismic area, and in the vicinity of Mangla and Jhelum faults. It is left-lateral strike-slip fault, which runs nearly in N-S direction with steep dip towards the east (Shahid Baig et al). In the Kashmir region the Jhelum fault truncates the MBT, the Poonch Thrust and the Himalayan Frontal thrust. The Jhelum fault is a younger fault and shows a left lateral offset of about 31 km along the western limb of the syntaxis as indicated by quaternary terraces which are uplifted and tilted, as exposed along the Jhelum, the Soan and the Kunhar rivers (Shahid Baig et al). The fault extends from the Soan valley to the Kaghan valley where it joins the shear zone of Bossart (Bossart et al, 1984) and extends towards the Allai-Kohistan. There is a strong possibility that the Jhelum fault cuts the MMT in the Allai-Kohistan towards Choor plains. The Jhelum fault may be one of the surface ruptures of the Indus-Kohistan seismic zone of Seeber and Ambruster (1979). The Jhelum fault with a length of 120 km, can produce an earthquake of $M = 7.5$ when its capability is determined through widely accepted procedures. With $M = 7.5$ and New Bong Escape Hydropower Project site within a distance of 10 km, peak ground accelerations around 0.40g (Maximum Credible Earthquake - MCE) have been estimated at site with recent attenuation relations. The feasibility study recommends that the most important structure, ie, the powerhouse, be designed based on the earthquake return period of 1,000 years.

4.1.4 Meteorology and Climate

Meteorology

The climate of the Project Area is semi-arid characterized by four distinct seasons in a year, that is, winter from Mid-November to February, spring during March and April

summer from May to Mid-September and autumn from Mid-September to Mid-November. Two-climatic/meteorological data collection stations are available near the project site; one in Jhelum City (established by Pakistan Meteorological Department) and the second at Mangla (established by WAPDA). These stations represent the climatic conditions of the project area adequately.

Rainfall

Average annual rainfall at the two stations from the record of more than 30 years is 852.50 mm and 849.50 mm at Jhelum and Mangla, respectively. Maximum rainfall (about 62% of the total annual) occurs during the Monsoon season (summer months of July, August and September), while the period of minimum rainfall or drier period is October and November (autumn season). Maximum rainfall recorded at Jhelum and Mangla is 171.2 mm on 16-7-1988 and 131.38 mm on 5-8-1994, respectively.

Mean monthly rainfall data of these two stations is provided in **Exhibit 4.2**.

Temperatures

The average maximum temperatures at Jhelum and Mangla have been recorded as 39.4 °C and 40.5 °C, respectively. The maximum temperatures recorded so far have been 49.2 °C on 31-5-1988 and 48.37 °C on 17-6-1995, respectively for these two stations. The minimum temperatures of -3 °C on 22-12-1950 and 0.9 °C on 7-2-1994 have been recorded, respectively at Jhelum and Mangla.

Mean monthly maximum and mean monthly minimum temperatures of these two stations are tabulated in **Exhibit 4.3**.

Wind Speed and Direction

Predominant wind direction has been north to northwest from October to May while during Monsoon period (June to September) it is east to southeast. Maximum average daily wind speed for Jhelum is 3.7 km/hr during April and May, and for Mangla is 3.86 km/hr during May. The wind data for these two locations is provided in **Exhibit 4.4**.

Humidity

From the Mangla Climatological Station, maximum value of Relative Humidity (RH) recorded on August 08, 14, 16 and 17, 1977 was 100% while the minimum value was 04% on May 27, 1972. These values for Jhelum Meteorological Station are not available. Average monthly RH values at Jhelum and Mangla record are provided in **Exhibit 4.5**.

Climate

Pakistan's latitudinal and longitudinal extents and its northern rim of lofty mountains are the two factors, which have a great bearing not only on the temperature and rainfall patterns, but also on the general circulation of the atmosphere on the southern Asia.

Climate of Pakistan according to Koppen's classification⁹ falls under the following five types:

Tropical Semi-arid with Dry Winter: This climate type prevails in Karachi, Hyderabad, and southern Khairpur Division. The mean annual temperature is above 18 °C.

Tropical Arid: This is characterized by average annual temperature of about 18 °C with dry winters. This includes southern Kalat and whole of the Indus Plain.

Cold Semi-arid With Dry Summer: This climate type covers central Kashmir, Peshawar, D.I. Khan, Quetta and northern half of Kalat Division.

Snow Forest Climate: This climate type is characterized by average temperature of coldest month below –30 °C. Mean temperature of the warmest month is between 10 and 22 °C. It includes northern mountainous areas and parts of Kashmir.

Extreme Cold: Having average temperature of the warmest months between 10 and 0 °C. It comprises eastern and northern parts of Kashmir, Chitral, Gilgit and Laddakh.

Based upon the above classification, the proposed project area falls on the edge of the Tropical Arid climate zone.

Seasons

Broadly, there are four well-marked season in the country, briefly described below.

Cold Season (December to March): The weather during this period is influenced by the frequent passing of western disturbances originating over the Mediterranean and Western Europe. These cyclones advance eastward over Saudi Arabia, Iran, Afghanistan and then to Pakistan. The mean monthly temperature is below 4.4 °C in the mountainous areas, and varies from about 10 °C in the north of the plains to about 18 °C in south. Rainfall during this period increases northwards and westwards.

Hot Season (April to June): High temperature and aridity are the main features of this season. During this season, the day temperature begins to rise and peaks in June from 40 to 46 °C, while temperature of 50 °C and above is not uncommon. The areas along the Sindh-Makran coast are under the influence of sea breeze which keeps the maximum temperature down to about 35 °C. The relative humidity is low, and rainfall is small, between 27 and 76 mm in plains and increasing along the sub-mountain areas.

Monsoon Season (July to September): The establishment of low pressure over the Indo-Pakistan subcontinent in May and June attracts winds from the Indian Ocean which start blowing over the land about middle of June, as the south-west monsoons. During this season, changes in the structure of the upper air, allows further invasion of moist air from Bay of Bengal in July. This period experiences periods of heavy rains and storms. The monsoon spreads northwards, generally in series of pulses. In

⁹ *Climatic Regions of West Pakistan*, Pakistan Geographical Review. Kazi, S. A., 1952.

Punjab, it reaches by early/mid July. The provinces of Sindh and Baluchistan never come under the regular sway of the moist currents. These areas are affected by occasional monsoon incursions in July and August. The sub Himalayan region receives the highest amount of rainfall. The monsoon currents remain steady in July, remain mostly constant to the middle of August, and begin to recede at the end of August. However, occasionally, it continues to be active even in September when some of the highest floods have been recorded in the Indus basin.

Post-monsoon Season (October and November): This period is essentially transitory. In October, the maximum temperature varies from 34 °C to 37 °C over much of the country, while nights are fairly cool. In November, the maximum and minimum temperature fall by about 6 °C, and the weather becomes pleasant. Due to anti-cyclonic conditions, these months are by far the driest months, and characterized by clear skies, and light and variable winds all over the plains of Pakistan.

Ambient Air Quality

No ambient air quality data is available for the proposed site. However, the area does not have major pollution sources, such as large industries, heavy vehicular traffic, brick kilns, etc., in its immediate vicinity. There exist a few small to medium industrial units in Mangla (between the old UJC and Bong Canal), however these are unlikely to impact the air quality of the proposed area in any significant manner because of the size of these units and their distance (5-7 km) from the proposed site. Therefore, the criteria ambient air quality pollutants (NO_x, SO₂, PM, CO, etc.) in the project area are expected to be well within the acceptable limits.¹⁰

4.1.5 Soils

Basic data available for assessment of project feasibility was based on the strata encountered in boreholes drilled along the Bong Canal and the New Bong Escape, geological mapping done for the foundation of the Escape structure, the logging of test pits excavated for investigation in 1996 and the bore -hole data obtained in 2000.

It was found that at the project site, the topsoil consists of loose, yellowish brown, sandy silt, loose yellowish brown silty fine sand, and trace of gravel and is extending to depths from 5 to 10 feet (1.5 to 3 m). Topsoil is underlain by layers of rounded to sub-rounded gravel, cobbles, and boulders with voids filled with sandy silts and silty sands. This material extends to the maximum investigated depth of 164 feet (50 m). High water and mud losses were observed during drilling between 20 to 30 feet (6 to 9 m) depth suggesting the existence of isolated thin layers of open work gravel. The mapping of excavations for the New Bong Escape confirmed the existence of open work lenses 4 feet (1.2 m) thick and up to 30 feet (9 m) long. A lens of clayey silt was also reported at approximate El.760 extending continuously under the escape structure.

¹⁰ There are no ambient air quality standards in Pakistan. Usually, the relevant WB guidelines and USEPA standards are used to characterize the ambient air quality, if required.

The results of soil investigation carried out by Consolidated Engineering Services (Pvt.) Ltd. are provided in **Exhibit 4.6**.

4.1.6 Groundwater

The groundwater in the area is generally expected to be greatly influenced by the water bodies (both natural and man-made) in the vicinity. Groundwater in such areas is generally shallow with moderate yields. During the geotechnical investigations conducted by Consolidated Engineering Services, the groundwater was encountered at a depth of 0.8 to 2.45 m from the existing ground level (EGL). The groundwater table may therefore be considered at 1 m from EGL.

Aquifer

Based upon the soil investigation results (**Exhibit 4.6**), Layer 1, Layer 3, Layer 5 and Layer 7 are silty clay, hence these layers are impervious, whereas the remaining layers are sandy/gravelly, hence pervious in nature. The presence of silty clay layers indicates possibility of confined aquifer conditions. Flow of groundwater is essentially through the sandy/gravelly layers.

Aquifer Characteristics

Aquifer characteristics include stratification, groundwater table, transmissivity, storativity, permeability and radius of influence. The stratification and groundwater table have been discussed above, the remaining parameters are discussed below.

Transmissivity: Transmissivity is a measure of rate of water flow through a unit width of aquifer under a unit hydraulic gradient. It is correlated to the permeability and saturated thickness of the aquifer.

Storativity (Storage coefficient): Storativity is indicator of the volume of water that an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in the component of head normal to the surface.

Permeability: Permeability of an aquifer defines its ability to transmit groundwater.

Radius of Influence: Radius of Influence is the distance from the pumping well where drawdown is zero and is characteristics of the subsoil materials.

The values of the above parameters were calculated on the basis of the pumping test results. These tests were carried out as part of the geotechnical investigations of the project site. Average values of these parameters thus calculated are:

- ▶ Transmissivity: 320 m² per day
- ▶ Storativity: 0.002
- ▶ Permeability: 1.5×10^{-4} m/sec
- ▶ Radius of Influence: 100 m.

The above values indicate confined aquifer conditions. The presence of sandy/gravelly layers, and the values of permeability and transmissivity indicate availability of moderate quantities of groundwater.

Groundwater Quality

Complete information on groundwater quality of the project area is not available. A limited analysis was carried out during the geotechnical investigations as part of the feasibility study of the project. The values for the parameters analyzed are given below:

- ▶ pH: 7.0
- ▶ Sulfates (SO₄): 0.0043% (43 ppm)
- ▶ Chlorides (Cl): 0.0014% (14 ppm)
- ▶ Total dissolved solids (TDS): 0.0152% (152 ppm).

4.1.7 Surface Water

Jhelum River

Jhelum River (and the Hari channel) is the principal natural water body in the area, having a catchment area of 12,870 sq miles (32,947 sq km). The River is a part of Indus River system, and drains the southwestern parts of Himalayan Mountains. The mean annual flow of the river is 23 MAF (2.8×10^{10} m³). Jhelum River is perennial, however, much like most rivers in the country, there is a great fluctuation in its discharge, with large flows during monsoons.

Jhelum River downstream of Mangla Dam, much like other rivers in the region, has a very broad flood plain, at times several kilometers wide. During low flows, the river branches in several channels over a very broad floodplain. The Jhelum River floodplain adjacent to the project site is more than 6,000 feet (1,830 m) in width. The Hari channel thus represents only a very small portion of the entire floodplain. **Exhibit 4.7** shows the Jhelum River floodplain adjacent to the project site.

Jabbar Nullah

Jabbar Nullah is also a natural drainage channel at the Jhelum River's left bank. The Nullah brings flash floods due to rainstorms. The Nullah has a catchment area of 12.5 sq. miles (32 sq km) in the Pabbi hills north of the project area. The Nullah is non-perennial, and for most of the year, there is no significant run off from its catchment. During monsoons however, flash floods can occur with discharges up to 20,000 cusecs (566 m³/s or cumecs).

Modified Hydrology of the Area

The natural hydrology of the area has been significantly altered, first by diverting a portion of the Jhelum River water into UJC through a headwork at Mangla in 1910, and then by constructing Mangla Dam at the same location in 1967. Now the largest water body in the area is Mangla Reservoir, having a gross storage of 5.88 MAF (7.2×10^9 m³) and a surface area of about 100 sq miles (256 sq km). It has a shoreline of 250

miles (400 km), and extends 40 miles (64 km) into the Jhelum River upstream of Mangla. The Dam capacity is expected to increase by another 3.28 MAF ($4 \times 10^9 \text{ m}^3$) as a result of on-going Mangla Raise project.

As a result of the construction of Mangla Dam, the River stretch from the Dam to the Bong Escapes is almost completely dry, except when it receives water from the spillways during monsoons and heavy rains. The Mangla Raise project once complete will further reduce the spillway operation. At the Bong Escapes (discussed in **Section 3.1.2**), the water over and above the UJC diversion, is released back into the Jhelum River, thus providing nominal water flows throughout the year.

The Upper Jhelum Canal (UJC) and Bong Canal are the key features of the altered hydrology of the area in the immediate vicinity of the proposed project area. These have been discussed in **Section 3.1.2**.

Surface Water Quality

Details of canal water and river water quality are not available. The Bong Canal water was analyzed during the geotechnical investigations; the results are provided below.

- ▶ pH: 6.9
- ▶ Sulfates (SO_4): 0.0163% (163 ppm)
- ▶ Chlorides (Cl): 0.0050% (50 ppm)
- ▶ Total dissolved solids (TDS): 0.0450% (450 ppm).

4.2 Biological Resources

The project site as stated above is located in an area which has been subjected to human intervention for decades. Consequently there are no areas that could be considered as ecologically or biologically sensitive. The description on the ecological setting presented below provides regional perspective.

4.2.1 Ecological Setting

Mangla water and power complex and the Jhelum River, from its sources, down to the delta, are in Oriental Zoogeographical Region of the world. This region spreads over the sub-continent south of Himalaya and also covers southeastern Asia. The Fish of Jhelum River and Mangla reservoir also belong to the same zoogeographical region but is limited to a part of it called Mehran Province. This is spread over the wetlands of Indus basin in Pakistan, eastwards in the sub-continent and the southeastern fresh waters.

The tributary rivers of Indus after their exit from mountainous regions flow through a floral ecozone called Tropical Thorn Forests. However, the flora of riverine tracts is not forest in northern Punjab but is markedly different due to water factor (Ali, Salim and Ripley, S. Dillon. 1968). Champion *et. al.* (1965) describe these habitats and do not consider tributaries of Indus having forests. However, Roberts (1997) names these as 'Riverine plain or Indus basin ecozone having two types of habitats: a). Inundation

zones, seepage zones, Jheels and Swamps and b). Riverine tracts. This includes the river and its immediate vicinity. These habitats have been described as rich in biodiversity (Mirza 1998, Roberts 1997).

The tropical thorn forests ecozone and the riverine habitats are now almost totally modified to agricultural habitats, urban habitats, factories, railways and roads network (Mirza 1998). This modification process is in fast progress day by day. The remnant flora of this zone includes *Tamarix aphylla*, *Saccharum spontaneum*, *Typha angustata*, *Acacia nilotica*, and *Populus euphratica*.

Before the British constructed the canal system for irrigation Jhelum River had its natural off and on changing course after it came out of its gorge in the mountains. Huge flow of water in summer season widened its tract. With the construction of Upper Jhelum canal and old Bong canal in 1910 the river's flow was markedly reduced and agriculture crept in. Further change took place with the construction of Mangla reservoir and the new Bong canal. The riverine tract habitat of Jhelum River, which had already changed to dry area except for one or two minor shallow water channels was now exploited for agriculture and farm huts and houses. The reservoir stored the flood water for constant flow through power channels. However, in 1992 unprecedented flood, reservoir was full to its capacity and the excess water had to be escaped through the gates. Now the riverine tract below the reservoir is mostly agricultural area. Bong Escapes open in the river bed for some flow of water to Rasool Headworks.

4.2.2 Floral Resources

Present floral pattern in the project site and its surrounding area within 10 km is no more the original tropical forest. It has been modified to agricultural habitats, urban areas with exotic and endemic trees, canal and roads with side plantations of *Delbergia* and *Acacia*. The project site has only few strands of trees, mostly eucalyptus. The riverine belt is badly degraded and has no tree population of ecological or economic importance, except some old banyan trees, which should be preserved. The edge vegetation includes mostly grasses, primarily *Typha angustata*, *Saccharum spontaneum*, *saccharum munja*, *Tamarix aphylla*, etc.

4.2.3 Faunal Resources

Because of the degraded habitat conditions described above (**Sections 4.2.1 and 4.2.2**), the project site and its surroundings do not support any faunal resources of ecological or economic significance. The wildlife species reported from the area in general are described below.

The faunal resources reported from the area in general are discussed below. The complete lists are provided in **Appendix D**.

Mammals

The whole pattern of mammalian fauna is markedly changed due to vanishing of tropical thorn forest and great change in riverine tract habitats. The species of small mammals also are not much in natural pattern of occurrence. There is imbalance of species due to modification of habitats. Small mammals of the area include Musk

Shrew, Fruit Bat, Rat-tailed Bat and Yellow Bat. Indian Pangolin, Jackal, Small Indian Mongoose, Jungle Cat, Wild Boar, Five-striped Squirrel, Porcupine and White-footed Fox are also found in the area.

Birds

The predominant avian species seen at the project site and its immediate vicinity are crows and Myna. Other common birds in the area include Indian Kite, Shikra or Indian Sparrow Hawk, Black Partridge, Grey Partridge, Blue Rock Pigeon, Indian Ring Dove, Little Brown Dove, White-cheeked Bulbul and Indian Tree Pie. In the river bed where ever there is some seepage water it is visited in winter by some waders. However nearby Mangla reservoir provides habitat for such species, and is visited by large flocks of wintering water fowl. Agricultural areas also get some Himalayan birds in winter. In summer in addition to local birds there are summer breeders from south, including the monsoon arrivals. In autumn passage migrants stay here for a short time.

4.3 Socioeconomic Environment

During the ESSA study conducted in 1996, IEE 2004 a detailed socioeconomic survey was conducted covering some 21 communities within 5 km radius around the proposed site. Most of those communities will not be directly affected by the project activities, except four communities (Lehri, Ferozabad, Chechian and Afzal Pur) which are adjacent to the project site. While conducting this Revised IEE, these four adjacent communities were consulted and studied in detail. The findings of present study and those of the 1996 ESSA and 2004 IEE are provided below.

4.3.1 Lehri, Ferozabad, Chechian and Afzal Pur

The population in the immediate vicinity of the project area is concentrated in four settlements viz., Lehri Ferozabad, Chechian, and Afzal Pur. Out of these, Lehri Chechian and Afzal Pur are larger villages situated in the proximity of the project site. Village Lehri is located on the right bank of New Bong Escape, while Ferozabad is a small settlement of around twelve houses on the left bank of Old Bong Escape. Village Chechian and Afzal Pur are larger villages located on left side of Tailrace channel.

The human settlement pattern of Lehri comprises of sub-clusters within the village premises. The total population, according to the previous Environmental and Social Soundness Assessment study (PES 1996), comprises of more than 150 households, out of which around a dozen lies around the direct corridor of impact of the project. An overwhelmingly majority of the households subsists on remittances from migrant workers, mostly in the United Kingdom. Local trade and government and private employment is a secondary source of income. Agriculture and livestock are a fringe activity, practiced at a level that is less than even self-subsistence. The general affluence resulting from foreign remittances is apparent from the lavish looks of most of the houses in the village. The educational and social amenities level of the village however, remains low and is visible from almost non-existent social infrastructure such as schools, hospitals or even paved streets.

The people of Ferozabad consist of an extended local family and some small families who have come to the area after being displaced due to war from their native northeastern AJK. The primary source of livelihood for these families is government and private jobs and agriculture is a secondary economic activity. Young men from a couple of families are working abroad and remit money from there. The social infrastructure is poor with an unpaved road and no school or clinic. Most of the agricultural land sown by the inhabitants of Ferozabad is deeper on the left bank of the Old Bong Escape and is not being affected by the project.

Chechian and Afzal Pur are much larger settlements on left side of tailrace, and the village population has similar socio-economic and cultural characteristics as mentioned in village Lehir's case. However, the population of these villages is much larger than Lehir and more agricultural lands are available for cultivation purposes. As compared to village Lehir and Ferozpur, these villages will be least affected by project activities. The project will have positive impacts on these communities as their lands are currently being eroded by the river channel and will be protected from erosion through the construction of stabilized dikes of tailrace channel. It is estimated that approximately 80,000 acres of new land will be reclaimed once trail race channel will be constructed. The 1992 flood changed the direction of the water course which started eroding the lands of these 2 villages. This was a huge economic loss. The communities are now hopeful that the new structure will prevent the land erosion by protecting them from flood water.

4.3.2 Findings of the 1996 Survey

Although the socio-economic survey was carried in 1996, the information would still adequately reflect the prevailing conditions due mainly to slow pace of changes in the area.

Population

The approximate population of the study area is 73,000 spread in twenty-one villages consisting of a total of 4,200 housing units (**Exhibit 4.7**). The land holding per household is small, less than 5 Ha which is the average self-sufficiency holding of a household. As a result, majority of the households depends upon work opportunities outside the villages, particularly abroad. It has been reported that almost 35% of the households of the earmarked survey area have their relatives working or settled abroad.

Twenty-one villages sampled indicated that the occupation of population of the area is largely varied. Farming in agricultural, poultry, dairy and labour in factories and mills are all common in the area, whereas many are interested to work abroad specifically in England. The family size in the project area varies from 3 to 6 (see **Exhibit 4.8**). The land holding being small makes the standard of living barely up to subsistence levels. People go to Jhelum and Mirpur town to get items of daily use. Farming is mostly done mechanically whereas cattle are also a source of tilling of land. Leisure time activities of the people are spent on gossips, attending festivals and playing football, cricket, kabaddi and cards. Other pass time activities of people are cock fight, dog fight and horse riding/racing.

Settlement Patterns

The villages are not well planned. Construction activity is proceeding without any consideration to proper alignment of houses and streets. The accessibility by a vehicle into the villages is very difficult because of very narrow streets and sharp turns. The trend of construction is changing; mud houses are giving way to concrete structures. However, plastering of the walls with mud is still in practice because it keeps the rooms cool in hot season.

Living Conditions and Culture

According to living conditions, the standard of living can be divided into three levels, low, medium and high. Approximately 65% of its population has a low level of living standard followed 30% and 5% for medium and high levels of living of the population. The people of the area are generally conservative. The environment in the area is peaceful, with occasional disputes and few thefts occurring. The village communities take care of each other at the time of need. Some financial assistance is provided by the influential/financially well-off people for the betterment of their community. Government sponsored works are initiated in some villages. However, most of the community activities are confined to self-help.

Overall the people are sensitive to culture and social habits due to more awareness and education. However old socio-cultural habits are being replaced by new ideas and approach to the life. Lack of modern facilities, amenities and absence of job opportunities in or near the villages is promoting trend of migration towards urban areas like Mirpur, Mangla and Jhelum. However, migration abroad is common. Slowly modern farming and irrigation techniques are finding their way into the rural areas. Education facilities are generally available but are inadequate, people are willing to educate their children but due to lack of quality schools and colleges, they are having problems in sending their children to nearby towns.

Cow dung, wood, oil and electricity is the major source of energy for cooking, which create smoke and bad odour, which is hazardous to health. Wheat, maize and millet flour, pulses or vegetables supplemented by chicken, beef or mutton are the main sources of diet of the people.

Drinking Water and its Quality

The water table in the project area is relatively high due to the riverine morphology and water is generally available at shallow depths. Tap water, hand pumps and tubewells are used to exploit it for domestic use. According to the survey, 23% of the population use hand pumps and 17% use tubewells for their domestic water supply needs. The rest of the population uses surface water supplies (Canal, River and tap water) During the survey, it has been reported that water level varies from 3 to 18 m in the area. Several test pits were made within the project site and water table was found to be at 3 m depths.

Public Health

Due to the inadequate health facilities being available, air and water borne disease like Malaria, Cholera, dysentery and tooth diseases are common. Few dispensaries and hospitals are available, however proper facilities like medicine and qualified doctors are not satisfactorily available. The people have to go to Mirpur, Mangla and Jhelum to get better treatment in hospitals.

Education Facilities

The literacy level in the project area is comparatively low due to the inadequacy of schools. Only 22 primary level and 13 middle level schools are available for boys and girls. Such schools do not have the basic facilities like tables, chairs/benches, black boards, in some cases open areas are serving for the purpose of schools. Moreover lack of teachers is another major problem for the existing schools. Apart from one intermediate level college there is an elementary college existing in the surveyed area. Due to inadequate institutional educational facilities families, which can afford, send their children to Mirpur, Mangla and Jhelum.

Refuse Disposal

The garbage/refuse is thrown into the streets or in the fields. As most of the people have cows, buffaloes, goats and sheep, the animal refuse is used as fuel in cooking, so its disposal is not a problem.

There are no proper arrangements for the public sanitation and refuse disposal. Most of the time, the refuse is just dumped in the corners of the streets or into the fields. During the rainy season, the streets with garbage dumping become bad smelling and impassable.

Sanitary facilities particularly wastewater collection and disposal are rare. Septic tanks for toilets and bathrooms are commonly used. The ground water table in the area being shallow, adequate safeguards and appropriate design is used for septic tanks to ensure that the hazard of groundwater pollution is avoided.

Only few villages have paved or brick lined roads and the rest of the villages have katcha pathways.

Present Status of Economic Activities

The key economic issue confronting impact area is its inability to create sufficient employment and economic growth to support its growing population. The major socio-economic activities at the project site are agriculture, fisheries, poultry farming, dairy farming and employment in the nearby small industrial units.

Industrial Units

There are some Industrial units in the vicinity of the project site. These are considered to be important socio-economic activity in the area and include ghee mill, producing ghee and vegetable oil, latex factory producing surgical gloves and a textile mill. They have a good potential for employment for the inhabitants in the area.

Poultry Farming

Poultry farming is done only in few villages and the produce is sent to Mirpur and Mangla, which include birds (chicken) and eggs. The poultry farming is considered as a profitable business. The refuse from the poultry farming is used as fertilizer for the agriculture land

Dairy Farming

Some farmers are involved in dairy farming using cows and buffaloes. The milk is supplied in the villages as well as in the nearby towns.

Social Services

This sector is most neglected in the area, very few services are provided in all walks of social life in this area. Especially education, health and recreation facilities are almost non-existing. If only authorities would take interest there is a lot of land and space available for the provision of facilities.

Recreational Facilities

There are no recreational facilities available within the project area. No playground and parks exist in the area. They youngsters and children just play on open lands and pass time in playing cards or play any street games. .

Women in Project Area

The women have no formal role in the Authority structure of the nearby villages. They are about 48% of the population in these villages; the literacy rate is only about 15-20% (25-30% for males). The area has a primary girls school but there are no facilities for higher education. Traditional attitude of not sending the girls to school is changing now, because the parents understand that the basic education is necessary for each individual without the discrimination of sex. Most of the women stay home and only travel outside the village in case of going to shrines, relatives, and weddings and to hospitals in nearby towns. There is a general trend of marriages with relatives settled abroad.

4.4 Physical Cultural Resources

Archaeological Sites

Several visits were made of the project site but no evidence was found of any archaeological sites. One archeological site in the area is Mangla Fort. The outer boundary wall of Mangla Fort can be easily seen even from very far away due to its elevation, which is considered to be the top most point of the area. The fort is maintained by WAPDA and one can have a panoramic view of the area.

Graveyards

There is no graveyard or graves within the proposed project area however some shrines do exist near the project area. The village Chichian is well known for the

Mazar/Shrine of Hazrat Kari Sharif and Mian Muhammad Bakhsh great poets and Sufis of the region.

Mosques

In almost every village, mosques have been noted; being religiously strong people do participate and contribute in the construction of mosques. The biggest mosque in the area is in village Chichian at the shrine of Hazrat Khari Sharif and Mian Muhammad Bakhsh.

Exhibit 4.1: Land Use in the Project Area

(Please see the following page)

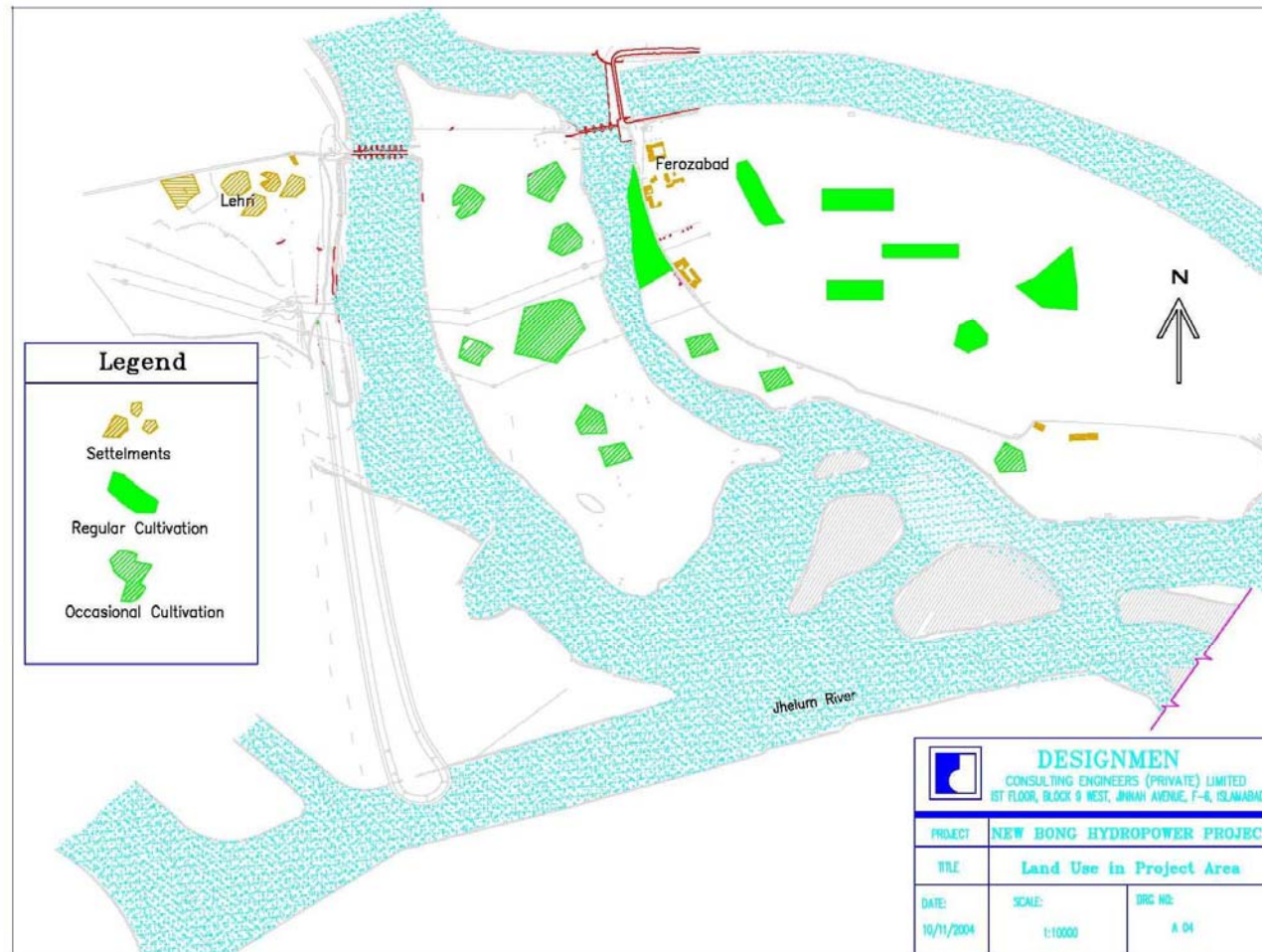


Exhibit 4.2: Rainfall*Mean Monthly Rainfall (mm)*

Month	Jhelum	Mangla
January	33.80	40.50
February	50.00	51.30
March	60.50	68.00
April	36.30	32.00
May	31.80	31.50
June	51.90	45.00
July	237.00	226.00
August	221.00	222.50
September	77.70	76.00
October	12.20	12.70
November	9.90	11.00
December	30.40	33.00
Year	852.50	849.50

Sources: Pakistan Meteorological Department, Jhelum; WAPDA Meteorological Department, Mangla.¹¹

¹¹ Table borrowed from Feasibility Study Report; Laraib Energy Limited, July 2004.

Exhibit 4.3 Temperature*Mean Monthly Temperature (°C)*

Month	Jhelum		Mangla	
	Maximum	Minimum	Maximum	Minimum
January	19.70	5.00	19.10	6.06
February	21.60	7.70	21.22	8.42
March	26.60	12.50	26.02	12.96
April	33.00	17.70	32.67	18.03
May	38.10	22.00	37.20	22.83
June	40.50	25.80	39.53	25.25
July	35.90	25.80	35.00	25.00
August	34.40	25.30	33.24	24.57
September	35.00	23.00	33.62	22.76
October	33.10	16.60	31.24	16.59
November	27.60	9.90	26.70	12.47
December	21.30	5.70	21.20	7.08

Sources: Pakistan Meteorological Department, Jhelum; WAPDA Meteorological Department, Mangla.¹²

¹² Table borrowed from Feasibility Study Report; Laraib Energy Limited, July 2004.

Exhibit 4.4: Wind Speed and Direction

Month	Jhelum			Mangla	
	Wind Direction		Average Daily Wind Speed (km/hr)	Wind Direction	Average Daily Wind Speed (km/hr)
	Morning	Evening			
January	NW	NW	1.75	NA	1.88
February	NW	NW	2.54	NA	2.75
March	NW	W	3.09	NA	3.42
April	NW	VRB	3.70	NA	3.66
May	N	W	3.70	NA	3.86
June	SE	S	3.60	NA	3.26
July	E	SE	3.23	NA	3.31
August	E	S	2.50	NA	1.59
September	E	VRB	2.30	NA	1.40
October	NW	VRB	1.34	NA	1.78
November	NW	W	1.15	NA	1.49
December	N	NW	1.20	NA	1.57

Sources: Pakistan Meteorological Department, Jhelum; WAPDA Meteorological Department, Mangla.¹³

¹³ Table borrowed from Feasibility Study Report; Laraib Energy Limited, July 2004.

Exhibit 4.5: Relative Humidity*Monthly Averages - Relative Humidity (%)*

Month	Jhelum		Mangla	
	Morning (0800 Hrs)	Evening (1700 Hrs)	Morning (0800 Hrs)	Evening (1700 Hrs)
January	84	46	68	51
February	79	42	67	45
March	70	38	63	42
April	54	30	49	32
May	42	24	43	31
June	46	28	50	37
July	72	53	73	59
August	80	61	78	66
September	74	50	70	57
October	69	42	62	48
November	78	47	64	46
December	85	53	68	51

Sources: Pakistan Meteorological Department, Jhelum; WAPDA Meteorological Department, Mangla.¹⁴¹⁴ Table borrowed from Feasibility Study Report; Laraib Energy Limited, July 2004.

Exhibit 4.6 : Soil Stratification

	<i>Depth</i>	<i>Description</i>
Layer 1	Existing ground level to 3-4.5 m depth	Silty clay/clayey silt
Level 2	3-4.5 m to 20 m depth	Sandy gravel/gravelly sand with cobbles and boulders at places
Level 3	20 m to 21.5 m	Silty clay/clayey silt
Level 4	21.5 m to 30 m	Sandy gravel/gravelly sand
Level 5	30 m to 34 m	Silty clay/clayey silt
Level 6	34 m to 39 m	Sandy gravel/gravelly sand with cobbles and boulders at places
Level 7	39 m to 43 m	Silty clay
Level 8	43 m to 50 m	Sandy gravel/gravelly sand with cobbles and boulders at places.

Exhibit 4.7: Jhelum River Floodplain near Project Area

(Please see the following page)

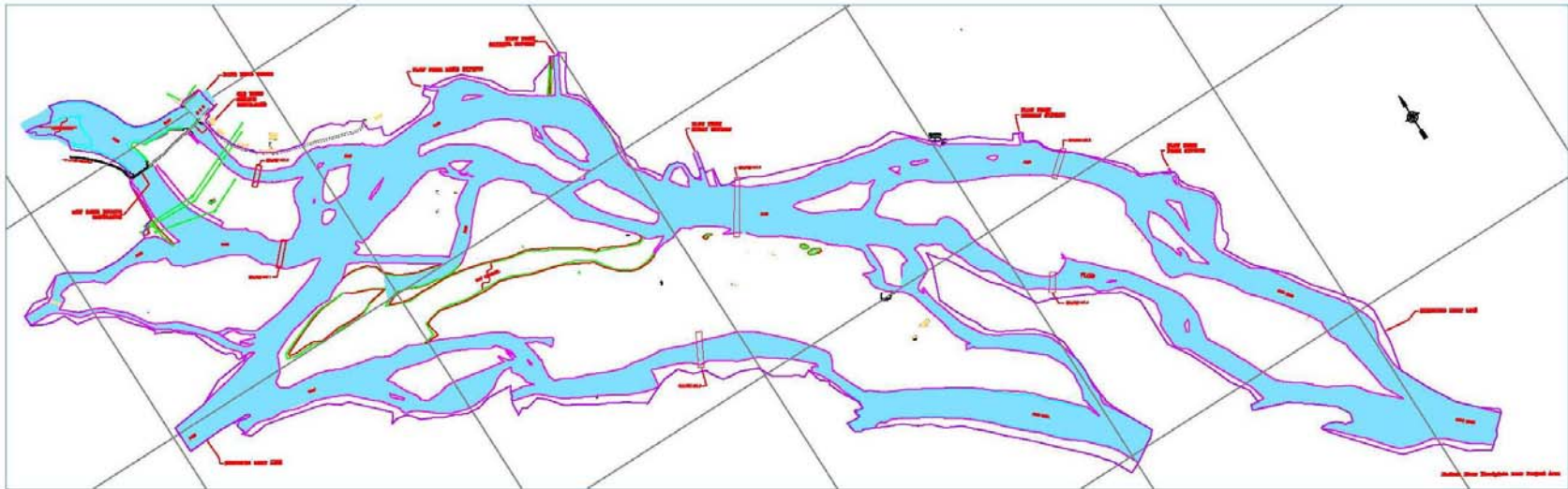


Exhibit 4.8: Population in the Project Area

<i>Villages Surveyed</i>	<i>Number of Households</i>	<i>Population</i>	<i>Distance from Project Site (km)</i>
Lehri	150	2,500	1.0
Mora Malkan	100	1,500	1.5
Naqi	50	3,500	2.0
Phalaiyn	40	3,000	2.5
Taqi Pur	130	2,500	4.5
Sahab Chak	160	3,550	5.0
Mohen Pur	80	1,100	5.0
Mosa Sankiyan	430	2,600	3.5
Kangra	75	1,000	4.0
Mohri	50	300	4.0
Mora Surat	55	560	3.0
Afghan Camp	30	170	3.5
Dhob	16	100	3.0
New Ludher	340	2,650	3.0
Bari Bong	350	3,000	2.5
Choti Bong	220	2,500	3.0
Mora Kikariyan	20	230	4.0
Changarh	25	250	2.0
Ferozabad	18	200	1.0
Mangla Hamlet	1500	10,000	4.0
New Jabbar	450	2,200	4.0
Chechian	1500	8,000	5.5
Afzal Pur	3000	21,500	7.5

Source: Environmental and Social Soundness Assessment. Pakistan Engineering Services. 1996 and community consultations.

5.Screening of the Potential Environmental Impacts and Mitigation Measures

This Chapter discusses the screening of the potential environmental impacts of the proposed project, assesses of the significance of these impacts, and recommends mitigation measures to minimize if not eliminate the potentially adverse impacts of the proposed activities.

5.1 Environmental Screening of the Proposed Project

For the proposed project, an environmental screening matrix was developed as part of the updated and revised IEE study focusing on the potential environmental impacts of the project during construction and operation phases. The matrix examines the interaction of project activities with various components of the environment. The impacts are broadly classified as physical, biological and social, and then each of these broad categories further divided into different aspects. The potential impacts thus predicted are characterized as follows:

- ▶ High negative (adverse) impact,
- ▶ Low negative impact,
- ▶ Insignificant impact,
- ▶ High positive (beneficial) impact,
- ▶ Low positive impact, and
- ▶ No impact.

The matrix is provided in **Exhibit 5.1**.

The negative impacts predicted in this manner are the 'unmitigated' impacts. Appropriate mitigation measures have been recommended as part of the revised IEE report. The occurrence and severity of the potentially adverse impacts identified in **Exhibit 5.1** will be reduced as a consequence of the incorporation of these mitigation measures into the project design/management.

The negative impacts screened through this process are discussed in the following sections.

5.2 Environmental Impact Characterization

During the initial environmental examination process, the predicted impacts (per the **Exhibit 5.1** discussed above) were characterized. Various aspects of the impact characterization include:

- ▶ Nature (direct/indirect)

- ▶ Duration of impact (short term, medium term, long term)
- ▶ Geographical extent (local, regional)
- ▶ Timing (project phase)
- ▶ Reversibility of impact (reversible/irreversible)
- ▶ Likelihood of the impact (certain, likely, unlikely, rare)
- ▶ Impact consequence severity
- ▶ Significance of impact (High, medium, low).

These are explained in **Exhibit 5.2**.

Subsequent to the characterization, appropriate mitigation measures were identified, in order to minimize if not completely eliminate the adverse impact associated with project activities. Finally, residual impacts were also identified.

The impact characterization of the predicted impacts, mitigation measures and residual impacts are discussed below.

5.3 Construction Phase Impacts

Construction phase will be by far the most significant part of the proposed project with respect to environmental considerations, since most of the impacts are likely to take place during this period. Various construction activities might invariably create environmental disturbances, which may have impacts on the nearby communities (see **Exhibit 5.1**). Such impacts include the following:

- ▶ Issues related to unauthorized landuse
- ▶ Changed water regime
- ▶ Water turbidity
- ▶ Soil erosion, degradation
- ▶ Air quality deterioration
- ▶ Surface water contamination
- ▶ Groundwater contamination
- ▶ Loss of/damage to natural vegetation
- ▶ Loss of/damage to wildlife
- ▶ Loss of/damage to aquatic biota
- ▶ Blocked access
- ▶ Noise
- ▶ Safety hazards
- ▶ Public health issues
- ▶ Damage to infrastructure

- ▶ Gender issues
- ▶ Loss of recreational sites
- ▶ Population influx.

These impacts are characterized in **Exhibit 5.3** and can be readily preempted and mitigated. The mitigation measures recommended in this section will be incorporated in the environmental management plan for implementation through environmental requirements and specifications for the detailed design and construction.

These impacts are discussed below.

5.3.1 Issues Related to Unauthorized Landuse

The Land to be acquired for the project has two broad categories in terms of landuse i.e. under water and surface land. The surface land which is 53 acres (21.7 ha) has already been leased to LEL and there are no landuse issues. While the remaining government and all private land is under water and has no significant impacts upon social and economic displacement of people. However, some parts of the surface land were previously been used by the local villagers from the adjacent Lehri and Ferozabad villages for occasional animal grazing, though the locals did not have the animal grazing rights on this land. Since the land was leased out to LEL in 2003, no unauthorized landuse is observed.

Mitigation Measures

There is no un-authorized landuse anymore, if arises in future, the following course of action should be considered in resolving the related issues.

- ▶ Start effective community consultation, awareness and information sharing programme to inform the communities in the proximity of project and those to be effected from this project about the project design, construction details, and construction period and operation and maintenance activities once the project will be commissioned. This community consultation will help the communities to better understand the project, and its exact specifications which will help mitigate negative concerns (if any). During this information sharing the expectations of the communities should be assessed and timely actions should be taken to mitigate negative effects on the project at later stage.
- ▶ During the project design and construction stage, the facilities required to be provided for the communities will be discussed. Such community facilities will be identified and provided to the community addressing their immediate needs as identified by them.
- ▶ A proper community grievance mechanism will be developed to record the community grievances about the project at planning, design, construction and operation stages. The suggested way should be the formation of a grievance committee constituted from the project area communities and comprising notables, elected representatives, social workers, with majority members from the affected households. The project client should hold regular meetings

and/or on need basis to discuss the community perspective and grievances about the project. Forming such a mechanism will bring positive change among the communities about the project and its owners. This committee will also be instrumental to resolve issues among aggrieved households and the project client.

- The land owned by the communities in currently submerged under water and the communities will be paid compensation for the land that the project acquires for the construction activities as per the law of the land and financiers standards and frameworks.

Residual Impacts

It is very important to disseminate the project details to the communities where the project has very low negative impacts on the community land, and land rights. The field visits show that the tail race area communities (Chechian and Afzal Pur) will highly appreciate this project as the project will protect their lands from erosion. Therefore significance of the residual impact is very low, since only small tracts of land owned by GoAJK are involved.

However, during construction period the water of NBC will be diverted towards Jhelum River, this would result in the drying up of the Hari channel. The communities might encroach towards the end of the tail race and reclaim the temporarily dried land for cultivation and grazing purposes. Once the water is released at the operations stage there is a possibility of submerging their temporarily reclaimed lands. This can result in economic loss for the tail end communities.

5.3.2 Changed Water Regime

As mentioned earlier, the proposed project will not result in any alteration in the existing water regime of the area. The project will utilize the surplus water which is currently released back in the Jhelum River. It will therefore be no change in the water availability in the UJC, nor there will be, any water reduction in the Jhelum River downstream of the Bong Escapes.

The only visible impact will be on the New Bong Escape diversion channel, which will receive water only in case of the shutdown of the proposed powerhouse. However this channel will be man-made structure 1,190 m long, and does not have any ecological significance. There are no water users of this channel either. Therefore drying up of this short reach of the man-made channel will not have any significant environmental or social impact.

Mitigation Measures

No mitigation measures are needed for this concern.

Residual Impacts

None.

5.3.3 Water Turbidity

As suggested in IEE 2004, water from NBE Channel will be diverted to into the main channel of Jehlum River through NBE diversion channel before construction starts in the tail race channel. After diversion of water from NBE to main Jehlum River through NBE diversion channel, there will be no issue of water turbidity, pooling, and scouring during the construction stage of tail race channel.

Mitigation Measures

- ▶ During the high monsoons rains excavation works should be properly planned to mitigate increased turbidity in the downstream of Hari channel.

Residual Impacts

No significant residual impacts have been anticipated after adopting above mitigation measures.

5.3.4 Soil Erosion and Degradation

The soil-related issues include soil erosion, slope stability, and soil contamination. These may be caused by the excavation and filling activities, construction activities and maintenance of equipment/vehicles. The quantities of excavation and fill material have been calculated and the construction of project has been planned in such a way that all the excavated material will be utilized in construction of channel embankments, flood protection embankment and filling of low lying areas in a stabilized manner, so that the excavated material may not left dumped and thus eroded by rain water. The channel sides will be properly stabilized and protected against soil erosion. Similarly, embankments will also be protected against possible soil erosion.

There is possibility of soil contamination as a result of oils spillage and leakage, and inappropriate waste (solid as well as liquid) disposal.

Mitigation Measures

The following mitigation measures will minimize the soil erosion and contamination:

- ▶ Excavated slopes will not be left untreated/unattended for long durations. Appropriate slope stabilization measures will be taken per the design (e.g. stone pitching). Temporary measures may also be needed.
- ▶ The embankment filling operation will be carried out in a manner that minimizes chances of soil erosion. This may include construction of embankment in stages, and completing the side slopes of each segment, before moving to the next segment.
- ▶ Temporary soil stockpiles will be placed where there is no risk of soil erosion.
- ▶ Vehicle and construction machinery movement very close to the canal/channel banks will be minimized, as these may cause soil erosion.

- ▶ Good management practices will be employed to minimize leakage and spillage of oils, and fuels to the ground. These includes building containment dikes around fuels/oils storage, storing these in covered areas, constructing a concrete pad for machinery/vehicle maintenance areas, inspecting machinery and vehicles for any leakage, and removing contaminated soils for appropriate disposal.
- ▶ Vehicles and equipment will not be repaired in the field. If unavoidable, impervious sheathing will be used to avoid soil and water contamination.
- ▶ Regular monitoring and maintenance of Tailrace Channel and flood protection embankment will be carried out, in order to detect and forestall any possible soil erosion.
- ▶ For the workers of construction camp sewage, appropriate septic tanks and soakage pits will be constructed having adequate capacity. Temporary latrine facilities should be constructed in the construction area which is at a reasonable distance from the construction camp. Arrangements should be made to safely dispose the sewage waste from these temporary latrines.
- ▶ Appropriate awareness should be given to the workers/labour to avoid open defecation, especially while at work. Strict instructions should be given to the workers to comply with the environmental health and safety standards of the financiers and EPA AJ&K.
- ▶ Trainings on social, environmental and occupational health and safety should be provided to the workforce before starting work on different components.
- ▶ The recyclable waste from warehouse and workshop (such as card board, drums, broken/used parts, etc.) should be handed over to recycling contractors and/or disposed off in a safe manner at specified places designated by the EPA or environmental experts.

Residual Impacts

Appropriate construction practices and management actions as listed above will greatly minimize the soil erosion and contamination. The residual impacts will have minimal and/or no negative impacts.

5.3.5 Air Quality Deterioration

Construction machinery and project vehicles will release exhaust emissions, containing carbon monoxide (CO), sulfur dioxide (SO₂), oxides of nitrogen (NO_x), and particulate matter (PM). These emissions can deteriorate the ambient air quality in the immediate vicinity of the project site. Furthermore, construction activities such as excavation, leveling, filling and vehicular movement on unpaved tracks may also cause fugitive dust emissions. However, the nearest settlements in Lehri and Ferozabad are about 3,000 and 1,000 feet (914 and 305 m) away from most of the construction sites, respectively. Therefore impact of these emissions on the local population will not be very significant.

Mitigation Measures

The following mitigation measures will minimize the emissions and their impacts:

- ▶ Construction machinery and vehicles will be kept in good working condition and properly tuned, in order to minimize the exhaust emissions.
- ▶ Fugitive dust emissions will be minimized by spraying water on soil, where required and appropriate.

Residual Impacts

The above measures will reduce the magnitude of the adverse impact; however these cannot be completely eliminated. There will be some residual adverse impact of the project activities on the ambient air quality of the project area. However, significance of this impact will become 'very low' because of the reversibility of impacts, and impact severity as 'minor'.

5.3.6 Surface Water and Groundwater Contamination

The project activities that can contaminate soil may also contaminate the surface water and groundwater. These include:

- ▶ Solid waste disposal
- ▶ Waste effluents disposal
- ▶ Equipment/vehicle maintenance
- ▶ Spillage/leakage of fuels, oils and chemicals.
- ▶ Open defecation

Mitigation Measures

The mitigation measures recommended to forestall soil contamination will also prevent water surface and groundwater contamination.

Residual Measures

If the recommended mitigation measures are effectively employed, the residual impacts of the project activities on the water resources of the area will be negligible.

5.3.7 Loss of Vegetation

Locating the Headrace intake between the two Bong Escapes will necessitate cutting of trees less than 100, mostly eucalyptus, shisham (*Delbergia Sisso*) and keekar (*Acacia Nilotica*). Eucalyptus is an exotic tree species, with little botanical importance. Since majority of the trees are of this type, their removal will not have serious environmental consequences.

The other project activities that may result into loss of natural vegetation include land clearing for powerhouse complex, construction camp and tailrace channel. However at none of the proposed locations, there is presence of any significant natural

vegetation. The tail race channel will be through the natural water course, and the left side embankment will be along the boundary line of the natural water course, where no loss of vegetation will occur.

Mitigation Measures

The following mitigation measures will further minimize any negative impacts on the floral resource of the area:

- ▶ Cutting of trees and other natural vegetation will be avoided as far as possible
- ▶ If cutting of trees is unavoidable, tree plantation of local species will be undertaken at appropriate location.
- ▶ The number of trees thus planted will be at least five times the ones that are cut. The trees to be planted should be an appropriate mix of fast and slow growing trees.
- ▶ In the entire project area, a comprehensive plantation plan should be developed, with due consideration given to landscaping. The plantation plan should be implemented as early as practicable.
- ▶ The construction crew will be provided with LPG as cooking (and heating, if required) fuel. Use of wood as fuel should not be allowed.

Residual Impact

The proposed tree plantation will take some time to grow and mature, there will therefore be some temporary reduction of trees and natural vegetation in the area. However, once these trees which will be more than five times to the original trees cut down during construction will fully grow; there will not be any significant residual impact of the project on the natural vegetation of the area.

5.3.8 Damage to Wildlife

As stated in **Section 4.2**, there are no significant wildlife species found in the area because of the modification of the natural habitat. The only species now found in the area are those that have adjusted to the environment disturbed by human presence. These species, such as birds, will not be affected by the construction activities. Excavation may cause some impact on small animals, but they are likely to leave the area and move to a safer place. In addition to the above, inappropriate waste disposal can be a potential threat to the scavenging species.

Mitigation Measures

- ▶ The measures to prevent soil and water contamination will forestall any adverse impact on the faunal resources of the area.
- ▶ The measures to restore natural vegetation loss in the area will benefit the area's fauna as well.
- ▶ The project staff will not be allowed to indulge in any hunting or trapping activities.

Residual Impact

The residual impacts on the faunal resources are expected to be quite negligible.

5.3.9 Loss/Damage to Aquatic Biota

The project activities that can potentially harm the aquatic biota include:

- ▶ Excavation and construction of Tailrace Channel
- ▶ Construction of Flood Protection Embankment
- ▶ Excavation and construction of Subsidiary Outfall

There is however no aquatic biota of importance in the project area. There are a few common fish species in the River, and floodplains have some vegetation cover, mostly grasses and reeds such as Dab (*Typha angustata*), Kahi (*Saccharium spontanarum*) and Kana (*saccharum munja*). Fish and other aquatic fauna will move away from the construction zone, and will return once the disturbance ceases, while the grasses will regenerate themselves.

Mitigation Measures

The measures to prevent soil and water contamination will forestall any adverse impact on the aquatic biota as well.

Residual Impact

The residual impact on the aquatic biota is expected to be negligible.

5.3.10 Blocked Access

Since the project is located in an area which is populated (though sparsely), various components of the project can potentially disrupt local communities' access routes. The Headrace Channel will block the road from Mangla to Mirpur town. However, a road bridge is included in the project scope. The powerhouse and switchyard are unlikely to cause any route disruption. The long tailrace however may block the route of some villagers who cross the river downstream of the Bong Escapes. River crossing through boats is done at 4 locations along the proposed tail race channel will be affected. Alternate crossing and/or a foot bridge should be provided at location decided in consultation with the communities¹⁵.

Mitigation Measures

- ▶ The existing routes will not be blocked as far as possible.

¹⁵ This crossing is however not recommended by WAPDA, since it is not very safe to cross the river from these locations. Any sudden operation of the Mangla spillway or Bong Escapes may inundate a larger area of the river bed downstream of the Escapes.

- ▶ If such blocking of the routes is unavoidable, alternate routes should be made available in consultation with the affected communities

Residual Impact

Tailrace Channel may cause some disruption of local route, and this impact may not be totally eliminated. However, significance of this residual impact is low to medium, since only a few villagers use this route, and they can still cross the river a few km downstream of the Tailrace.

5.3.11 Noise

Noise will be generated by the construction machinery and vehicles during the excavation and construction activities. It will be significant at locations which are close to Lehri, Chechian, Afzal Pur and Ferozabad. Most of the project components are quite far away (1,000 feet, about 304 m, or more) from these settlements. Only the Subsidiary Outfall and portions of the Headrace Channel are close to the residential areas.

Mitigation Measures

- ▶ Construction equipment and vehicles will have exhaust mufflers (silencers) to minimize noise generation.
- ▶ Noise will be measured at Lehri and Ferozabad. If found more than 65 dB, appropriate sound reduction mechanism will be put in place.
- ▶ Night time work will be avoided near the communities. Local population will be taken in confidence, if such work is unavoidable.
- ▶ Vehicular traffic through the communities will be avoided as far as possible. Vehicle speeds will be kept low, and horns will not be used while passing through or near the communities.

Residual Impact

With the implementation of above mitigation measures, the residual noise impact will be negligible.

5.3.12 Safety Hazards and Public Health

The project being located close to the communities may pose some safety hazards to the local population. Various project components/activities pose a varying degree of safety hazard to the local population. People may accidentally fall in Headrace and Tailrace channels; there are risks of electrocuting in the Switchyard; and increased vehicular traffic may pose safety hazards along the roads.

The public health issues related to the project location are the possibility of dust emissions during the construction phase.

The public health concerns related to the drinking water contamination will be adequately addressed by incorporating appropriate design for waste effluent disposal and solid waste management systems in the project design.

Mitigation Measures

- ▶ Appropriate signage will be fixed around the construction sites. Unauthorized access within the construction area will not be allowed.
- ▶ The mitigation measures discussed under air quality deterioration, soil and water contamination will address the public health concerns as well.
- ▶ Defensive driving practices will be inculcated in the project drivers through trainings, posters and other similar measures.
- ▶ Vehicle speeds near / within the communities will be kept low, to avoid safety hazard and dust emissions.
- ▶ Road signage will be fixed at appropriate locations along the roadsides
- ▶ Appropriate waste disposal mechanisms will be implemented.
- ▶ Safety hazards and Public Health awareness programme should be initiated to create awareness amongst the project area communities.
- ▶ Proper training to the project workers will be given about safety hazards and public health. The compliance of workers will be regularly monitored.

Residual Impacts

There will be a moderate level of residual impact of safety hazard associated with the vehicular traffic. The safety hazard issues associated with the construction activities will be negligible.

The residual public health issues will also be quite negligible after the effective implementation of the mitigation measures.

5.3.13 Damage to Infrastructure

There is no significant infrastructure in the project area which will be damaged due to project construction activities. Therefore there is low possibility of damage to the infrastructure such as roads and bridges due to the movement of project associated vehicular traffic.

Mitigation Measures

All damaged infrastructure will be restored to original or better condition.

Residual Impact

After the implementation of the above recommended mitigation measure, there will be negligible level of residual impact.

5.3.14 Gender Issues

The construction camp establishment in the proximity of Firozabad, and Lehri village and vehicular traffic may cause some hindrance to women mobility. Construction activities themselves are not likely to cause any such impact. The construction workers movement inside villages after working hours may cause gender issues with the community.

Mitigation Measures

- ▶ Camp location will be decided in consultation with the local population
- ▶ Construction and Operation workers will be strictly directed to avoid entering the villages and settlements.
- ▶ Gender and local culture sensitization trainings will be provided to all construction and operation workers.

Residual Impacts

Despite the implementation of the above mitigation measures, there will be a moderate level of residual impact associated with the gender issues.

5.3.15 Loss of Recreational Site

There is a small tract of land between the two Bong Escapes which is used as a recreational site, which will be utilized for the project site (as part of the Headrace) (Section 4.1.1). As alternate to this and new recreation site north of Lehri village along left side of road will be developed. The size of this recreation site will be larger (3 ha) than the present New Bong's Pond recreation area.

Mitigation Measures

- ▶ Proper development of new recreational site in consultation with the local population will mitigate the loss of recreation site.
- ▶ A properly planned tree plantation should be carried out at newly developed site. The new area identified for recreation should be developed as a small park where people of the area can visit with families as picnic spot.
- ▶ The recreational site should also have 'kids play area' having swings, slides, etc.

Residual Impact

The proposed mitigation measure will adequately mitigate the loss of existing recreational site caused by the project location, though there may be a slight delay till when the new recreational area is fully developed and the trees are reasonably grown. After this gap, there will not be any residual impacts associated with the recreational sites.

5.3.16 Labour and Working Condition

Construction camp for workers will be constructed before construction starts on the project. The space has been identified for this construction camp which is on the left side of power plant. The construction camp will have enough space for housing, washing, bathing kitchen, and other facilities as per national labour laws and international (ILO) guidelines. There will be sound labour-management relationship, and safe and healthy working conditions will be provided. The contact of the workers should be explicit incorporating the employee benefits as per national and international guidelines. There will be grievance mechanism for the labour and no forced/child labour will be used in the construction of the project and it will also be avoided in the value chain.

The security personnel will be hired from professional companies abiding the national and international rules of conduct. However presence and disproportionate use of firearms may be a cause of concern for the project staff and local communities.

Mitigation Measures

- The agreements with LEL, EPC Contractor and EPC Contractor with its sub contractors must have bindings for safety and good working conditions for the workers. These conditions should be compatible with national labour laws and international (ILO) workers guidelines.
- There should be labour policy with LEL, and EPC for hiring the staff, workers, and this policy should abide by the national laws and International Labour Organization guidelines.
- Compliance of workers' rights should be closely monitored through third party.
- No forced/child labor will be used in the project construction and/or its value chain. LEL and EPC should ensure the compliance with this condition with sub contractors.
- Healthy working environment and occupational health and safety trainings will be provided to the workers by the EPC contractor involved in construction and operation of the project
- Hazards and accidents management trainings will be provided to the workers as part of the EPC contract.
- Emergency preparedness and response will be provided to the workers
- Security personnel will be hired from reputable firms with personnel trained as per national and international security personnel laws.
- Close monitoring of the security personnel will be conducted and grievance mechanism will be established for appropriate action of violating the applicable laws.

Residual Impact

There is probability that strict compliance with national laws and international laws will not be followed at all stages of construction and operation of this project. Close monitoring will ensure such compliances to a larger extent.

5.3.17 Population Influx

The proposed project (and the ongoing Mangla Raise project, which is much larger in magnitude) is likely to cause a general uplift of the infrastructure and increased economic activity in the area. This may attract some in-migration from other parts of Pakistan and AJK. However this may not be a serious problem, since there is a general trend of out-migration in the area, to larger towns and cities.

Mitigation Measures

- ▶ During the detailed design, LEL should consult with the local administration to make an advance planning to ensure minimum adverse impacts of any population influx.

Residual Impact

A low level of impact may persist even after implementing the above measure.

5.4 Operation Phase Impacts

The powerhouse operation itself is quite environment-friendly and will not cause any significant environmental degradation. The only visible environmental change will be the drying up of the New Bong Escape channel. However, this channel is man-made and there are no water users downstream. Also, it is not a significant ecological system. Therefore, the drying-up of the channel will not have any significant environmental impact.

To ensure harmony of the project with the environment the project sponsors will implement sound environmental management practices to effectively handle the basic environmental issues.

The operation and maintenance staff will be hired keeping the national labour laws and international laws (ILO) requirements. Occupational health and safety requirements will be provided for staff hired for operation and maintenance of the project. Proper housing facilities will be provided to the project O&M staff. The working conditions will be compatible to the national and international laws. The labour for project O&M will be hired keeping the financiers guidelines, and national laws.

Proper housing facilities will be constructed in 2.5 acres of land. There will be 20 housing units, eighteen flats and a mosque in the O&M staff residential colony. The working and housing conditions will be compatible to the national and international laws for such workforce.

Mitigation measures

- Waste management of the residential complex and offices, particularly sewage by providing appropriate septic tanks and soakage pits with each latrine to maximum required standard.
- Health and hygiene awareness should be provided to the Operation and Maintenance staff; strictly institutionalize the personnel hiring subject to comply with the national and international health and safety standards.
- Waste management of warehouse, workshops and motor pools.
- Operational health and safety (OHS) trainings as per standards of project financiers will be provided to the O&M staff before commissioning of the project. These trainings will be provided periodically and its practice will be monitored during the life time of the project.
- Standard OHS manuals should be developed and staff will be trained to follow the standard manual procedures for the plant operations.
- The operation and maintenance staff should be equipped with proper operational health and safety equipment and the staff should be bound to use these equipments when they are at work sites.
- Proper awareness will be provided to the operation and maintenance staff about the operational health and safety. This awareness should be in compliance with the national and international standards and OHS procedures.
- Proper landscaping will be carried out before commissioning of the project and plantation should be done on a maximum possible area.
- For workers hired for O&M of the project, hiring policy will be compatible with national labour laws and international laws (ILO where reasonable terms of employment will be ensured.
- Reasonable working conditions will be provided, forced/child labour will not used and grievance mechanism for the labour will be formulated.

The above practices and conducts will be institutionalized in the environmental management system of the Company before and after commissioning of the project. LEL and Contractors will ensure compliance with national and international laws in workforce hiring and firing. Reasonable working conditions and terms of employment will be offered for the workforce involved in all stages of this project.

5.5 Impacts during Powerhouse Decommissioning

It is unlikely that the powerhouse will be decommissioned at the end of the concession period of 25 years as hydropower has the long life of 60-80 years. The powerhouse decommissioning will entail very few activities which will interact with the environment. Nature of these activities, and hence the associated environmental impacts, will be similar to those undertaken during the construction phase. The likely impacts of these activities are:

- Air quality deterioration

- ▶ Noise
- ▶ Safety hazards
- ▶ Damage to infrastructure.

All of the above impacts have been discussed in **Section 5.3**, and the mitigation measures recommended in this section will be applicable for the environmental impacts caused by the powerhouse decommissioning activities as well. The environmental mitigation plan can be included in the Decommissioning Plan, mentioned in **Section 3.6**.

Exhibit 5.1: Environmental Screening Matrix (Unmitigated)

	<i>Physical</i>					<i>Biological</i>			<i>Social and Socioeconomic</i>													
	Soil	Air Quality	Surface Water	Groundwater	Water Regime	Natural Vegetation	Terrestrial Wildlife	Aquatic Biota	Access	Noise	Cultivation	Livestock Grazing	Resettlement / Compensation	Safety Hazard	Employment	Infrastructure	Public Health	Cultural Issues	Gender Issues	Recreational Sites	Historical/ Archeological Sites	Population Influx
Construction Phase																						
Site Preparation	N	N	N	N	N	N	N	N	-1	N	-1	-1	-1	N	N	-1	N	N	N	-1	N	N
Transportation of Powerhouse Equipment	0	-1	0	0	N	N	0	N	0	-1	N	0	N	-1	0	-1	0	0	0	N	N	N
Contractor Mobilization	0	-1	0	0	N	N	0	N	0	-1	N	0	N	-1	0	-1	0	0	0	N	N	N
Construction Camp Establishment	-1	-1	-1	0	N	-1	0	N	-1	-1	0	0	N	-1	+1	0	0	0	-1	N	N	0
Construction Camp Operation	0	-1	-1	-1	N	-1	0	0	0	-1	0	0	N	-1	+1	0	-1	0	-1	N	N	0
Excavation and Construction of Headrace Channel	-1	-1	-1	0	N	-1	0	0	-1	-1	0	0	N	-1	+1	-1	0	0	0	0	N	N
Construction of Powerhouse	-1	-1	-1	0	N	0	0	0	0	0	0	0	N	-1	+1	0	0	0	0	N	N	N
Excavation and Construction of Tailrace Channel	-1	-1	-1	0	0	-1	0	-1	-1	0	0	-1	N	0	+1	0	0	0	0	N	N	N

	Physical					Biological			Social and Socioeconomic													
	Soil	Air Quality	Surface Water	Groundwater	Water Regime	Natural Vegetation	Terrestrial Wildlife	Aquatic Biota	Access	Noise	Cultivation	Livestock Grazing	Resettlement / Compensation	Safety Hazard	Employment	Infrastructure	Public Health	Cultural Issues	Gender Issues	Recreational Sites	Historical/ Archeological Sites	Population Influx
Excavation and Construction of NBE Diversion Channel	-1	-1	-1	0	0	-1	0	-1	-1	-1	0	0	0	-1	+1	-1	0	0	-1	N	N	N
Construction of Flood Protection Embankment	-1	-1	-1	0	0	0	0	-1	0	0	0	0	0	0	+1	0	0	0	0	N	N	N
Construction of Workers Camp	-1	-1	-1	0	N	-1	0	0	-1	-1	0	0	0	-1	+1	-1	0	0	0	N	N	0
Construction of Road Bridge	-1	-1	-1	0	N	0	0	0	-1	-1	0	0	0	-1	+1	-1	0	0	0	0	N	N
Construction of Access Road	-1	-1	-1	0	N	0	0	0	-1	-1	0	0	0	-1	+1	-1	0	0	0	N	N	N
Construction Materials Supply	0	-1	0	N	N	0	0	0	0	-1	N	0	N	-1	+1	-1	0	0	0	N	N	N
Other Supplies	0	-1	0	N	N	0	0	0	0	-1	N	0	N	-1	+1	-1	0	0	0	N	N	N
Construction Worker Transportation	0	-1	0	N	N	0	0	0	0	-1	N	0	N	-1	+1	-1	0	0	0	N	N	N
Solid Waste Disposal	-1	-1	-2	-2	N	-1	-1	-1	N	N	0	0	N	0	0	N	-2	0	0	N	N	N
Waste Effluents Disposal	-1	-1	-2	-2	N	-1	-1	-1	N	N	0	0	N	0	0	N	-2	0	0	N	N	N

	<i>Physical</i>					<i>Biological</i>			<i>Social and Socioeconomic</i>													
	<i>Soil</i>	<i>Air Quality</i>	<i>Surface Water</i>	<i>Groundwater</i>	<i>Water Regime</i>	<i>Natural Vegetation</i>	<i>Terrestrial Wildlife</i>	<i>Aquatic Biota</i>	<i>Access</i>	<i>Noise</i>	<i>Cultivation</i>	<i>Livestock Grazing</i>	<i>Resettlement / Compensation</i>	<i>Safety Hazard</i>	<i>Employment</i>	<i>Infrastructure</i>	<i>Public Health</i>	<i>Cultural Issues</i>	<i>Gender Issues</i>	<i>Recreational Sites</i>	<i>Historical/ Archeological Sites</i>	<i>Population Influx</i>
Demobilization of Contractors	0	-1	0	N	N	0	0	0	0	-1	N	0	N	-1	0	-1	0	0	0	N	N	N
Operation Phase																						
Powerhouse Operation	N	0	0	N	0	N	N	0	N	0	N	N	N	0	+1	0	0	0	0	N	N	0
Maintenance	N	0	-1	N	0	N	N	-1	N	0	N	N	N	0	+1	0	0	0	0	N	N	0
Staff Transportation	0	-1	0	N	N	N	0	0	0	-1	N	0	N	-1	+1	-1	0	0	0	N	N	N
Supplies	0	-1	0	N	N	N	0	0	0	-1	N	0	N	-1	+1	-1	0	0	0	N	N	N
Solid Waste Disposal	-1	-1	-2	-2	N	-1	-1	-1	N	N	0	0	N	0	0	N	-2	0	0	N	N	N
Waste Effluents Disposal	-1	-1	-2	-2	N	-1	-1	-1	N	N	0	0	N	0	0	N	-2	0	0	N	N	N

Key: -2: High negative impact; -1: Low negative impact; 0: insignificant/negligible impact; +1: low positive impact; +2: High positive impact, N: no impact.

Exhibit 5.2: Impact Characterization

Categories	Characteristics
Nature	Direct: The environmental parameter is directly changed by the project. Indirect: The environmental parameter changes as a result of change in another parameter
Duration of impact	Short-term: lasting only for the duration of the project such as noise from the construction activities. Medium-term: lasting for a period of few months to a year after the project before naturally reverting to the original condition such as loss of vegetation due to clearing of campsite, contamination of soil or water by fuels or oil. Long-term: lasting for a period much greater than medium term impact before naturally reverting to the original condition such as loss of soil due to soil erosion.
Geographical extent	Local, regional (spatial dimension)
Timing	Construction and Operation
Reversibility of impact	Reversible: when a receptor resumes its pre-project condition Irreversible: when a receptor does not or cannot resume its pre-project condition
Likelihood of the impact	Almost Certain: Impact expected to occur under most circumstances Likely: Impact will probably occur under most circumstances Possibly: Impact may possibly occur at some time Unlikely: Impact could occur at some time Rare: Impact may occur but only under exceptional circumstances
Impact consequence severity	Major: When an activity causes irreversible damage to a unique environmental feature; causes a decline in abundance or change in distribution over more than one generation of an entire population of species of flora or fauna; has long-term effects (period of years) on socioeconomic activities of significance on regional level. Moderate: When an activity causes long-term (period of years), reversible damage to a unique environmental feature; causes reversible damage or change in abundance or distribution over one generation of a population of flora or fauna; has short-term effects (period of months) on socioeconomic activities of significance on regional level. Minor: When an activity causes short-term (period of a few months) reversible damage to an environmental feature; slight reversible damage to a few species of flora or fauna within a population over a short period; has short term (period of months) effects on socioeconomic activities of local significance. Negligible: When no measurable damage to physical, socioeconomic, or biological environment above the existing level of impact occurs.
Significance of	Categorized as High, Medium, or Low

impact	Based on the consequence, likelihood, reversibility, geographical extent, and duration; level of public concern; and conformance with legislative of statutory requirements.
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Exhibit 5.3: Impact Characterization for Project Construction Phase (Unmitigated)

<i>Impact</i>	<i>Nature</i>	<i>Duration</i>	<i>Geo Extent</i>	<i>Timing</i>	<i>Reversibility</i>	<i>Likelihood</i>	<i>Consequence Severity</i>	<i>Impact Significance</i>
Issues related to landuse	Direct	Long term	Local	Construction	Irreversible	Likely	Moderate	Medium
Changed water regime	Direct	Long term	Local	Construction and operation	Irreversible	Likely	Minor	Low
Increased turbidity in Hari channel	Direct	Short term	Local	Construction	Reversible	Likely	Minor	Low
Soil erosion, degradation	Direct	Long term	Local	Construction	Irreversible	Possibly	Moderate	Medium
Air quality deterioration	Direct	Short term	Local	Construction	Reversible	Likely	Minor	Medium
Surface water contamination	Direct	Short term	Local	Construction	Reversible	Likely	Major	High
Groundwater contamination	Indirect	Medium term	Local	Construction	Reversible	Likely	Major	High
Loss of/damage to natural vegetation	Direct	Medium term	Local	Construction	Reversible	Possibly	Minor	Low
Loss of/damage to wildlife	Direct	Medium term	Local	Construction	Reversible	Possibly	Minor	Low
Loss of/damage to aquatic biota	Direct	Medium term	Local	Construction	Reversible	Possibly	Minor	Low

<i>Impact</i>	<i>Nature</i>	<i>Duration</i>	<i>Geo Extent</i>	<i>Timing</i>	<i>Reversibility</i>	<i>Likelihood</i>	<i>Consequence Severity</i>	<i>Impact Significance</i>
Blocked access	Direct	Long term	Local	Construction	Irreversible	Possibly	Moderate	Medium
Noise	Direct	Short term	Local	Construction	Reversible	Likely	Moderate	Medium
Safety hazards	Direct	Short term	Local	Construction	Reversible	Possibly	Moderate	Medium
Public health issues	Indirect	Short term	Local	Construction	Reversible	Possibly	Moderate	Medium
Damage to infrastructure	Indirect	Short term	Local	Construction	Reversible	Likely	Moderate	Medium
Gender issues	Indirect	Short term	Local	Construction	Reversible	Unlikely	Minor	Low
Loss of recreational sites	Direct	Long term	Local	Construction	Irreversible	Certainly	Moderate	Medium

6.Environmental Management Plan

This Chapter outlines the Environmental Management Plan (EMP) and defines the institutional arrangements required for the implementation of the plan. The EMP consolidates the mitigation measures identified during the revised IEE, and reported in **Chapter 5** of this document. The Chapter also presents the environmental monitoring requirements for different phases of the project.

6.1 Purpose and Objectives of EMP

An environmental management plan (EMP) provides a delivery mechanism to address the adverse environmental impact of a project during its execution, to enhance project benefits, and to introduce standards of good practice to be adopted for all project works.

The primary objectives of the EMP are to:

- Facilitate the implementation of the mitigation measures identified in the **Chapter 5** of this document.
- Define the responsibilities of the project proponents, contractors, and environmental monitors/inspectors, and provide a means of effectively communicating environmental issues among them.
- Define a monitoring mechanism and identify monitoring parameters in order to:
 - ▶ Ensure the complete implementation of all mitigation measures.
 - ▶ Ensure the effectiveness of the mitigation measures.
- Provide a mechanism for taking timely action in the face of unanticipated environmental situations.
- Identify training requirements at various levels.

6.2 Components of the EMP

The EMP consists of the following components:

- ▶ Organizational structure; roles and responsibilities.
- ▶ Mitigation plan.
- ▶ Environmental monitoring plan.
- ▶ Communication and documentation.
- ▶ Environmental training.

These are discussed in **Sections 6.3 to 6.7** below.

6.3 Organizational Structure, Roles and Responsibilities

This section provides an organizational structure for environmental management during the construction and operation phase of the proposed project and defines the roles and responsibilities of the various role players for the duration of the project.

6.3.1 Management Approach

Construction Phase

The organizational roles and responsibilities are summarized below:

LEL: The overall responsibility for compliance with the environmental management plan rests with the project proponents (LEL). LEL should create a position for Environmental, Social and Occupational Health and Safety (ESOHS) Manager to address the environmental concerns of the project to the standards of the EPA AJK and the project financiers (IFIs). Expertise of social and environmental training, monitoring and reporting will be required at LEL, for which expertise from a Environmental Consulting Firm should be hired on need basis.. Through its outsourced environmental expertise LEL will monitor, report and devise appropriate measures to comply with the EPA AJK and the Financiers environmental obligations agreed in the Revised IEE and as per agreements with the project financiers. LEL will provide proper occupational health and safety trainings to the project staff involved in O&M.

EPC Contractor: The EPC Contractor will be responsible for the engineering, procurement and construction activities of the project. The EPC Contractor will be responsible for the complete implementation of the EMP and the mitigation measures detailed in the EMP and the Revised IEE of 2009 and ensure the environmental standards of the project financiers. The EPC Contractor will also be subject to certain liabilities under the environmental laws of the country, and project financiers under its contract with LEL. The project EPC contact between LEL and EPC contractor will be subject to written assurance that they will comply with EPA AJK laws, environmental and other obligations of the financiers during construction of the project. Penalties for not observing the national and international project financiers obligations should be the part of the EPC contact agreement between LEL and EPC Contractor. The EPC contractor will ensure internal compliance through a post of Environmental Social and Occupational Health and Safety Officer (ESOHSO) to monitor the environmental obligations of the project at the EPC contractors/sub-contractor level, and assure environmental compliance of the project as per EPA AJK laws and the Financiers guidelines. The environmental officer will ensure that environmental obligations have been complied at all stages of the project and keep a close watch on the environmental compliances during construction stage of the project. This environmental officer will prepare periodical progress report to comply with the requirements of the law and finance documents.

Sub-contractors: The contractors (civil, mechanical, electrical, others) will carry out field activities as part of the project construction. The EPC Contractor shall ensure that his obligations and responsibilities under the EPC Contract shall be adequately passed to the sub-contractors through a sub contract so that such sub contractors shall assume responsibility for implementation of various mitigation actions prescribed in the EMP relevant to the EPC Contractors agreement project financiers and/or with LEL. The sub contractors will ensure compliance of the liabilities under the environmental laws of AJK, and project financiers under their contracts with EPC Contractor and/or with LEL.

Other essential features of the institutional arrangement proposed for the project are:

- ▶ The EMP as well as environmental management requirements and specifications will be included in all contract agreements of LEL with EPC Contractor.
- ▶ EPC Contractor will need to have an ESOHS Officer to supervise and monitor the concerned compliances of its staff and that of its sub-contractors with environmental management requirements and specifications.
- ▶ The ESOHS officer will prepare periodical progress reports of environmental compliance of construction work. He will also mention occurrence and level of non compliances at site by the contractor/sub contractors during various times of reporting period.
- ▶ LEL's Manager ESOHS will arrange random visits of ESOHS experts to the project site and cross check the environmental compliances and non compliance made by sub contractors during various construction stages of the projects. The LEL will also facilitate the regulatory agencies (AJK EPA) and project financiers environmental expert's to visit the project site as and when required.
- ▶ ESOHS compliance meetings will held regularly involving the LEL Manager ESOHS, assigned environmental consultancy firm, EPC Contractor ESOHS Officer and subcontractors of the project, where compliances and non compliances will be reviewed and appropriate measures will be suggested and agreed among three stakeholders.

Operation Phase

During the operation phase of the powerhouse, environmental management becomes a routine function, as an integral part of the powerhouse operation. The operation and maintenance setup for the operation of the power plant after commissioning should include one staff (with expertise in social, environmental and operational health and safety) to supervise and monitor the operation and maintenance staff for optimal performance in the social and environmental aspects of the project as per laws of the land and project financiers guidelines.

The O&M staff will be properly trained to comply with the environmental obligations of the project at its operational stage. Compliance of the staff with social and environmental obligations should be part of the staff contact with LEL and/or O&M

entity responsible for the O&M of the project. Concerned personnel policies will be updated where required to comply with the law of the country and project financier's guidelines. Appropriate social and environmental compliance trainings will be provided and operational health and safety manuals as per the financiers standards should be developed by LEL well before commissioning of the project. The O&M staff should strictly adhered to comply with the developed manuals and procedures at all stages of operation and maintenance of the project.

6.3.2 Organizational Structure and Responsibilities

Construction Phase

The organizational structure for the construction phase of EMP is shown in **Exhibit 6.1**, and its salient features described below.

Primary responsibilities:

- ▶ The primary responsibilities for the environmental performance of the project lies with the project proponents.
- ▶ LEL's Project Manager will be responsible for the company's compliance with the Revised IEE and EMP throughout the project. The ESOHS Manager will report to the LEL's Project Manager about environmental compliances of the project and assist EPC Contractor through hiring of technical expertise to comply with the social and environmental obligations of the project at its construction stage. The ESOHS Manager will ensure that the EPC Contractor is complying with the environmental obligations of EPA AJK and project financiers. The ESOHS Manager will monitor, and report the environmental and social performance of the EPC Contractor and its sub contractors through technical experts.
- ▶ The EPC Contractor's Project Manager will assume the main responsibility for all environmental matters pertaining to EPC scope of work. The EPC ESOHS Officer will ensure compliance of social and environmental and occupational Health and safety obligations on ongoing basis on the project site. ESOHS Officers will report on a daily basis to the EPC's Project Manager.
- ▶ LEL will also coordinate with relevant government departments (AJK EPA) and project financiers through its ESOHS Manager.

Field management and quality control:

- ▶ Carrying out construction activities in an environmentally sound manner during the construction phase will be the responsibility of the site managers of the civil/mechanical/electrical contractors. However EPC Contractors ESOHS Officer will inspect, monitor and give on site instructions to the workforce of sub contractors on the project site for social and environmental compliance of the project as required by different stakeholders.
- ▶ LEL's ESOHS Manager will be responsible for the overall environmental soundness of all construction activities.

- ▶ LEL and EPC Contractor will ensure proper training of the project workforce on social and environmental obligations and compliances as per national (AJK EPA) and international laws and regulations. Training and refresher trainings will be provided to the workforce through experts and its designated environmental consulting Firm will provide technical support and facilitate implementation of the environmental management plan in the field.
- ▶ If any monitoring teams from relevant government departments, NGOs, project financiers visit the project site, LEL's ESOHS Manager will be responsible for coordinating their visits.

The responsibilities of various role players are summarized in **Exhibit 6.2**.

Operation Phase

It is expected that upon commencement of the operation and maintenance phase, LEL's ESOHS Manager will continue to monitor environment, social and operational health and safety aspects to enable continuity and consistency to ensure the aforesaid obligations as per manuals developed for Operation and Maintenance of the Project. Details will be worked out when the organizational structure of the powerhouse O&M will be finalized.

6.4 Mitigation Plan

The mitigation plan is a key component of the EMP. It lists all the potential effects of the project and their associated mitigation measures identified in the Revised IEE. For each impact, the following information is presented in the plan:

- ▶ A comprehensive listing of mitigation measures (actions)
- ▶ The person(s) responsible for ensuring the full implementation of the action
- ▶ The persons responsible for monitoring the action
- ▶ A timescale for the implementation of the action to ensure that the objectives of mitigation are fully met.

The mitigation plan for the construction phase of the New Bong Escape Hydropower project is presented in **Exhibit 6.3**.

It should be emphasized that the mitigation measures will have to be translated into environmental requirements and specifications for the detailed design and construction, with legal binding.

6.5 Monitoring Plan

The objective of environmental monitoring during the various phases of the proposed project will be as follows:

- ▶ Compliance Monitoring: Compliance with the requirements of the EMP will be checked by monitoring the activities of the project contractors on a regular

basis. This will be supplemented by random visits of the ESOHS Manager and technical experts to the project when the work will be in progress.

- ▶ Effects Monitoring: The actual impact of the project activities on physical, biological, and socioeconomic receptors of the project area will be monitored so that any effects either not anticipated in the revised IEE or exceeding the levels anticipated in the revised IEE can be identified and appropriate mitigation measures can be adopted in time.

To achieve these objectives the following monitoring program will be implemented.

6.5.1 Compliance Monitoring

The compliance monitoring of the project activities is principally a tool to ensure that the environmental control measures required in the revised IEE are strictly adhered to during the project activity.

The objectives of the Revised IEE compliance monitoring will be to:

- ▶ Systematically observe the activities undertaken by the civil, mechanical and electrical contractors (and sub-contractors) or any other person associated with the project.
- ▶ Verify that the activities are undertaken in compliance with the Revised IEE and EMP.
- ▶ Document and communicate the observations to the concerned person(s) of EPC Contractor and LEL, so that any corrective measures, if required, can be taken in a timely fashion
- ▶ Maintain a record of all incidents of environmental significance and related actions and corrective measures
- ▶ Prepare periodic reports of the environmental performance of project.

The monitoring plan discussed in **Section 6.4** will be used as a management and monitoring tool for compliance monitoring. Inspection will be done using checklists prepared by the respective contractors, on the basis of the **Exhibit 6.3**, during the construction phase.

Compliance monitoring will be the responsibility of LEL, the EPC Contractor and the sub contractors. It will be carried out by the following:

- ▶ LEL's Environmental and Social Manager(ESOHSM)
- ▶ Environment monitoring and social consultanting firm as and when appointed by LEL.
- ▶ EPC Contractor's Environmental and Social Officer (ESOHSO)

6.5.2 Effects Monitoring

The Revised IEE predicts the impacts of the proposed project on the basis of information available on the environment and the natural processes that link various environmental parameters. Based on this prediction, mitigation measures are

introduced such that the predicted residual effects do not exceed acceptable levels. However, there is always an element of uncertainty in such predictions due to an insufficient grasp of the processes, limitations in prediction techniques, or inadequate data on the environment. This is true for the physical, biological, as well as socioeconomic environment. Consequently, it is possible that even if the mitigation measures are implemented fully, the negative impacts of the project will exceed acceptable limits.

In order to address the above concerns, effects monitoring is undertaken during the project activities, with the overall objective of proper management of environmental risks and uncertainties. Broadly, effects monitoring has four objectives:

- i. To verify that the impacts of the proposed project are within acceptable limits, thus establishing credibility (public assurance)
- ii. To immediately warn the project proponents (and the regulatory agencies, if required) of unanticipated adverse impact or sudden changes in impact trends so that corrective actions can be undertaken, which may include modifications in the proposed activities, or the inclusion of modified or additional mitigation measures
- iii. To provide information to plan and control the timing, location, and level of certain project activities so that the effects are minimized.
- iv. To facilitate research and development by documenting the effects of the proposed project that can be used to validate impact-prediction techniques and provide a basis for more accurate predictions of future impact

The effects monitoring plan is provided in **Exhibit 6.4**. The detailed methodologies will be developed during the detailed design phase of the project, when the specific information on field activities will be known. The effects monitoring will comprise the following:

- ▶ Soil erosion
- ▶ Water quality
- ▶ Air quality
- ▶ Noise
- ▶ Socioeconomic and cultural aspects.

6.6 Communication and Documentation

An effective mechanism for storing and communicating environmental information during the project is an essential requirement of an EMP. The key features of such a mechanism are:

- ▶ Recording and maintenance of all information generated during the monitoring in a predetermined format.

- ▶ Communicating the information to a central location.
- ▶ Storing raw information in a central database.
- ▶ Processing the information to produce periodic reports.

A description of the various components of the communication and documentation system is given below.

6.6.1 Data Recording and Maintenance

All forms to be used for recording information during the environmental monitoring will follow a standard format, which will correspond to the database into which all the information gathered will be placed. All common fields will have identical formats in the database and on the forms. Check boxes will be used as much as possible for ease in filling out the forms and to facilitate data entry.

All forms will be numbered and a tracking system will be developed for each. Whenever a form is released for use in the field, its number will be recorded. The field staff will be required to account for each form after completion. In this manner, it will be ensured that all forms are returned to the office. It will be ensured that check boxes and report formats to be developed keeping in view the requirements of all financiers and regulators in order to avoid multiple reporting.

6.6.2 Meetings

The following environmental meetings will take place during the project:

- ▶ Kick-off meetings (one each for each of the contractors).
- ▶ Fortnightly meetings.¹⁶

The purpose of the kick-off meetings will be to discuss the EMP, and ensure full commitment from concerned parties for its implementation.

A periodic meeting will be held at site during the construction phase. The purpose of the meetings will be to discuss the conduct of the operation, non-compliances noted by the LEL ESOHS Manager, and EPC ESOHS Officer. The remedial measures will also be discussed and agreed during these meetings. The meeting will be recorded in the form of an environmental report (ER) prepared by the EPC ESOHS Officer.

6.6.3 Reports

The EPC ESOHS will produce periodic reports based on the information collected. These will include reports for:

- ▶ Kick-off meetings with each contractor,
- ▶ Fortnightly meetings,

¹⁶ Frequency of meetings may be adjusted per the situation.

- ▶ Non-compliances,
- ▶ Effects monitoring.

At the end of the construction phase, a final report will also be prepared.

6.6.4 Complaints Register

A complaint register will be maintained at the project site to document all complaints, grievances and suggestions received from local communities, affected parties, visitors, monitors and other stakeholders. The register will also contain mitigations measures for the complaints registered by the affected parties.

All complaints received in the complaint register will be sent to the LEL's ESOHS Manager and Project Manager for their information and further action. Availability and maintenance of this register at the project site should be ensured by the LEL. LEL should also ensure that all stakeholders are informed about the "Project Complaint Register" and describe the process of registering complaints.

6.7 Environmental Training

Environmental training will help to ensure that the requirements of the Revised IEE and EMP are clearly understood and followed by LEL and contractor staff and all project personnel throughout the project period. The primary responsibility for providing training to all project personnel will be that of the LEL ESOHS Manager. The environmental and social responsibility training to the LEL staff should be prerequisite of this project. This training should be through hiring the technical experts having knowledge of EPA AJK laws and obligations as well as IFIs social and environmental obligations to comply with in project of such a magnitude.

The environmental training program will be finalized during the detailed design phase. The training will be provided to the LEL staff, the EPC Contractor at first stage. At second stage training and awareness to the construction staff engaged for the project. Training will cover all staff levels, ranging from the management and supervisory to the skilled and unskilled categories. The scope of the training will cover the requirements of the Revised IEE and the EMP, with special emphasis on sensitizing the project staff to the environmental, social and OHS aspects of the project and its surrounding areas.

For operation and maintenance of the project, environmental, social and operational health and safety manuals of project financiers standards will be developed. The O&M staff will be trained well before commissioning of the project. New staff hired for O&M will be trained before taking over the O&M responsibility in the project. The environmental, social and OHS expert should ensure adopting Standard Operating Procedures for the project and its equipment operations. Continuous vigilance of the environment expert on staff during operations should be ensured.

Exhibit 6.1: Organizational Structure for Environmental Management

(Please see the following page)

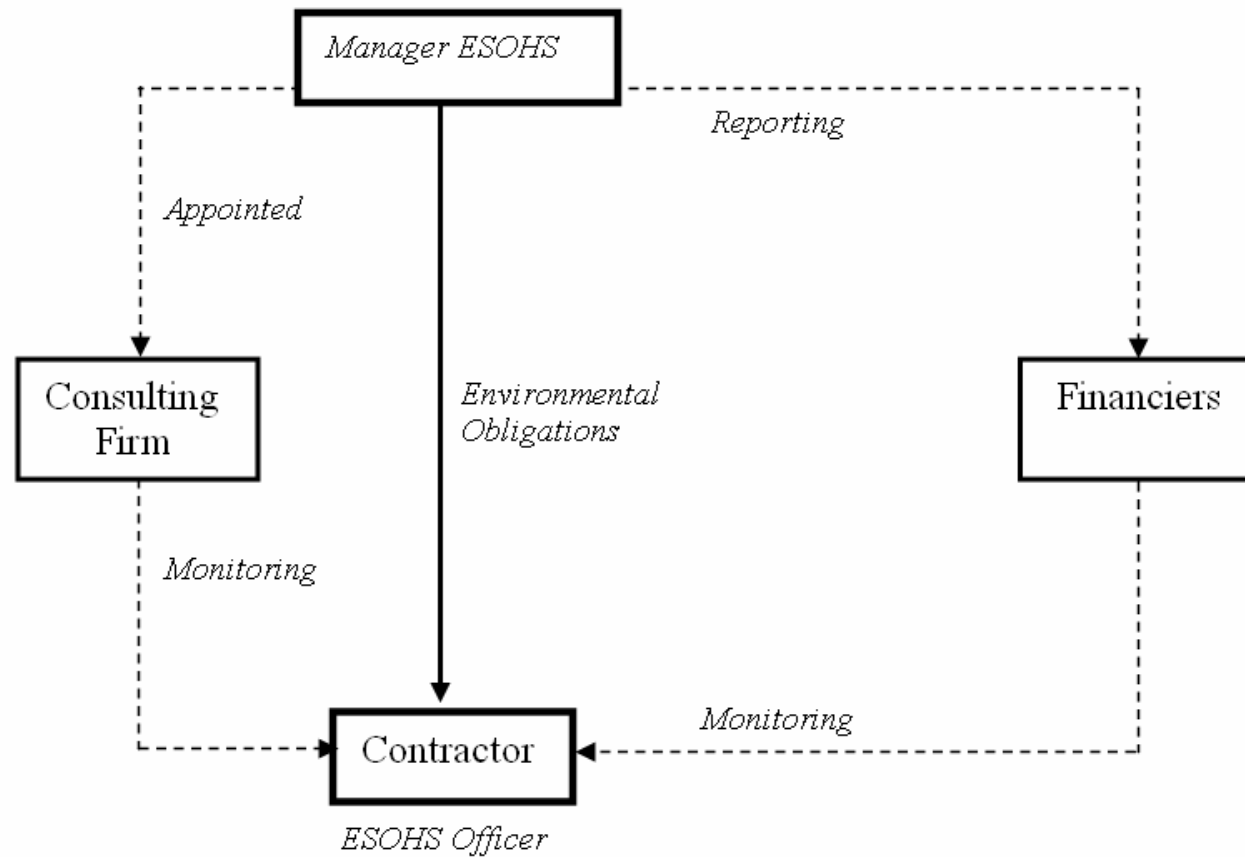


Exhibit 6.2: Responsibilities of LEL, EPC Contractor, and Civil, Mechanical and Electrical Sub Contractors

Organization	Designation	Responsibilities
LEL	Project Manager	Fulfill LEL's obligations as laid out in its contract with various Government authorities (WAPDA, PPIB, NEPRA, etc.). Ensure that the construction is carried out within the agreed timeframe according to satisfactory HSE and technical standards Ensure that LEL project staff should have been trained on the environmental aspects of the project. Ensure that EPC Contractor should have been trained on the environmental obligations of the project.
	Environmental and Social and Occupational Health (ESOHS) Manager	Ensure that the entire project is conducted in an environmentally friendly manner. Ensure compliance with all relevant environmental laws. Assist the LEL's Project Manager in fulfilling LEL's environmental responsibilities and keep him updated on environmental matters relating to the construction. Ensure prior training of the EPC Contractors work force at the project site Review environmental report and ensure implementation of corrective measures, if any. Coordinate with AJK EPA, Financial institutions and other relevant stakeholders vis-à-vis ESOHS issues.
EPC Contractor	Project Manager	Fulfill EPC Contractor's obligations as laid out in its contract with LEL and LEL's contracts with various Government authorities (WAPDA, PPIB, NEPRA, etc.) and project financiers. Ensure that the construction is carried out within the agreed timeframe according to satisfactory HSE and technical standards; Ensure that the project subcontractors and its labor has got proper environmental, social and work related health and safety training before starting work on the project Liaise with LEL's Project Manager. Ensure that ESOHS Officer is properly supervising and implementing the social and environmental obligations of the project on site. Ensure that the ESOHS Officer is preparing daily and weekly environmental obligation

Organization	Designation	Responsibilities
		progress reports.
	Environmental and Social and Occupational Health and Safety (ESOHS) Officer	Ensure that requirements included in the EMP and IEE are fully implemented; Ensure compliance with LEL's HSE requirements and contract agreements with IFC Ensure that the project construction is as per EPA AJK laws and obligations Report on daily and weekly basis to Project Manager on environmental aspects; Liaising with LEL's ESOHS Manager; Liaise with sub contractors' on environmental compliances and non compliances on construction aspects. Liaise and brief the LEL, EPA AJK, IFC missions/visits related to environmental aspects to the projects site
Civil/Mechanical/Electrical Contractors	Site Manager	Manage construction activities, manage construction crew, camp crew and other site personnel, in an environmentally responsible manner; Liaise with EPC Contractor's Project Manager; Liaise with EPC ESOHS Officer and LEL ESOHS Manager

Exhibit 6.3: Mitigation Plan (Construction Phase)

	<i>Project Activities</i>		<i>Impact</i>	<i>Action</i>	<i>Responsibility</i>		<i>Timing</i>
					<i>Execution</i>	<i>Monitoring</i>	
1	Site Preparation	1.1	Blocked Access	Location of construction camp and residential colony to be selected in a manner that minimizes disruption of local routes.	EPCC PM	LEL PM	BC
				Consultation with the communities to be undertaken if necessary for the location of construction camp and residential colony.	LEL/ESOHSM	LEL PM	BC
				Alternate routes will be provided if routes are blocked because of construction activities.	EPCC	LEL PM,	DC
		1.2	Loss of Cultivation	Discussion with the affected households to be initiated as soon as possible to reach agreement on the appropriate mode of compensation.	LEL ESOHSM	LEL PM	BC
				Project employment opportunities, to suit the particular skills or enhanced skills, to be offered to the affectees during the construction and operation phases of the project.	EPCC	LEL PM	DC
		1.3	Recreational Sites	- A recreational site will be developed as part of the proposed project. - A planned tree plantation to be carried out at the proposed recreational site. - The recreational site will also have a 'kids play area'.	EPCC PM	LEL PM	DC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
2	Transportation of Powerhouse Equipment	2.1	Air Quality Deterioration	- Fugitive dust emissions will be minimized by spraying water on soil, where required and appropriate. - Vehicular traffic through the communities will be avoided as far as possible. Vehicle speeds will be kept low.	EPCC	EPC ESOHSO EPC ESOHSO LEL ESOHSM	DC
		2.2	Noise	- Vehicles will have exhaust mufflers (silencers) to minimize noise generation. - Nighttime traffic will be avoided near the communities. Local population will be taken in confidence if such work is unavoidable. - Vehicular traffic through the communities will be avoided as far as possible. Vehicle speeds will be kept low, and horns will not be used while passing through or near the communities.	EPCC EPC ESOHSO	LEL ESOHSM EPC ESOHSO	BC DC
		2.3	Safety Hazards	- Road signage will be fixed at appropriate locations to reduce safety hazard 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 safety hazard and dust emissions.	EPC ESOHSO	LEL ESOHSM	BC DC
		2.4	Damage to Infrastructure	▶ All damaged infrastructure will be restored to original or better condition.	EPCC PM	LEL PM LEL ESOHSM	DC EC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
3	Contractor Mobilization	3.1	Air Quality Deterioration	▶ Vehicles will be kept in good working condition and properly tuned, in order to minimize the exhaust emissions. ▶ Fugitive dust emissions will be minimized by spraying water on soil, where required and appropriate. ▶ Vehicular traffic through the communities will be avoided as far as possible. Vehicle speeds will be kept low.	EPCC ESOHSO	LEL ESOHSM	BC DC
		3.2	Noise	▶ Same as 2.2.	EPC ESOHSO	LEL ESOHSM	BC DC
		3.3	Safety Hazards	▶ Same as 2.3.	EPCC ESOHSO	LEL ESOHSM	BC DC
		3.4	Damage to Infrastructure	▶ Same as 2.4.	EPCC PM	LEL ESOHSM EPCC ESOHSO	DC EC
4	Construction Camp Establishment and Operation	4.1	Soil Erosion / Contamination	▶ Vehicle and construction machinery movement very close to the canal/channel banks will be minimized, as these may cause soil erosion. ▶ Management practices will be employed to minimize leakage and spillage of oils, chemicals and fuels to the ground. These includes building containment dikes around fuels/oils/chemical storage, storing these in covered areas, constructing a	EPCC ESOHSO	LEL ESOHSM LEL ESOHSM	BC DC

Project Activities	Impact	Action	Responsibility		Timing
			Execution	Monitoring	
		concrete pad for machinery/ vehicle maintenance areas, inspecting machinery and vehicles for any leakage, and removing contaminated soils for appropriate disposal.			
	4.2 Air Quality Deterioration	▶ Equipment and vehicles will be kept in good working condition and properly tuned, in order to minimize the exhaust emissions. ▶ Fugitive dust emissions will be minimized by spraying water on soil, where required and appropriate.	EPCC ESOHSO	LEL ESOHSM EPCC ESOHSO	BC DC
	4.3 Surface Water Contamination	▶ Septic tanks and soakage pits will be constructed having adequate capacity. ▶ The recyclable waste will be handedover to recycling contractors or disposed of in a safe manner. ▶ Segregation of solid waste into recyclable and non-recyclable material ▶ Disposing the recyclable material to the recycling contractors ▶ Composting the biodegradable waste ▶ Land filling the remaining waste.	EPCC ESOHSO	LEL ESOHSM EPCC ESOHSO	BC DC EC
	4.4 Loss of Vegetation	▶ Cutting of trees and other natural vegetation will be avoided as far as possible. ▶ The construction crew will be provided with LPG as cooking (and heating, if	EPCC ESOHSO	LEL ESOHSM EPCC ESOHSO	BC DC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				required) fuel. Use of fuel wood will not be allowed.			
		4.5	Blocked Access	► See 1.1.			
		4.6	Noise	► Generators and vehicles will have exhaust mufflers (silencers) to minimize noise generation. ► Noise will be measured at Lehri, Chechian and Ferozabad. If found more than 65 dB, appropriate sound reduction mechanism will be put in place.	EPCC ESOHSO	LEL ESOHSM EPCC ESOHSO	BC DC
		4.7	Safety Hazards	► Protective fencing to be installed around the Camp to avoid any accidents.	EPCC PM EPCC ESOHSO	LEL ESOHSM EPCC ESOHSO	BC DC
		4.8	Gender Issues	► Camp location will be decided in consultation with the local population ► Camp will be minimum 1,500 feet from the nearest community. ► Construction crew will avoid entering the villages and settlements.	LEL EPCC EPCC ESOHSO	LEL ESOHSM EPCC ESOHSO	BC DC
5	Excavation and Construction of Headrace Channel	5.1	Soil Erosion / Contamination	► Excavated slopes will not be left untreated/unattended for long durations. Appropriate slope stabilization measures will be taken per the design (e.g, stone pitching). Temporary measures may also be needed. ► Temporary soil stockpiles will be placed	EPCC PM	LEL ESOHSM EPCC ESOHSO	DC

Project Activities	Impact	Action	Responsibility		Timing
			Execution	Monitoring	
		where there is no risk of soil erosion. ▶ Vehicle and construction machinery movement very close to the canal/channel banks will be minimized, as these may cause soil erosion.			
	5.2 Air Quality Deterioration	▶ Construction machinery and vehicles will be kept in good working condition and properly tuned, in order to minimize the exhaust emissions. ▶ Fugitive dust emissions will be minimized by spraying water on soil, where required and appropriate.	EPCC PM	LEL ESOHSM EPCC ESOHSO	DC
	5.3 Surface Water Contamination	▶ Vehicles and construction machinery movement very close to the canal/channel banks will be minimized, as these may cause water contamination ▶ Management practices will be employed to minimize leakage and spillage of oils, chemicals and fuels to the ground. ▶ Vehicles and equipment will not be repaired in the field. If unavoidable, impervious sheathing will be used to avoid soil and water contamination.	EPCC PM	LEL ESOHSM EPCC ESOHSO	DC
	5.4 Loss of Vegetation	▶ A tree and shrub plantation plan will be developed and implemented at suitable locations within the project site. Local species will be used for this purpose. ▶ The trees thus planted will be at least 5 times the trees cut as part of the	EPCC PM	LEL ESOHSM EPCC ESOHSO	BC DC EC

	<i>Project Activities</i>		<i>Impact</i>	<i>Action</i>	<i>Responsibility</i>		<i>Timing</i>
					<i>Execution</i>	<i>Monitoring</i>	
				construction activities.			
		5.5	Blocked Access	▶ Road bridge will be constructed over the Headrace. ▶ Temporary alternate routes to be provided if required.	EPCC PM	LEL ESOHSM EPCC ESOHSO	DC
		5.6	Noise	▶ Construction machinery and vehicles will have exhaust mufflers (silencers) to minimize noise generation. ▶ Noise will be measured at Lehri, Chechian and Ferozabad. If found more than 65 dB, appropriate sound reduction mechanism will be put in place.	EPCC PM	LEL ESOHSM EPCC ESOHSO	DC
		5.7	Safety Hazards	▶ Protective fencing to be installed around key project components to avoid any accidents.	EPCC PM	LEL ESOHSM EPCC ESOHSO	BC DC
		5.8	Damage to Infrastructure	▶ Same as 2.4.			
6	Excavation and Construction of Powerhouse	6.1	Soil Erosion / Contamination	▶ Same as 5.1.			
		6.2	Air Quality Deterioration	▶ Same as 5.2.			
		6.3	Surface Water Contamination	▶ Same as 5.3.			
		6.4	Safety Hazards	▶ Same as 5.7.			
7	Excavation and	7.1	Soil Erosion /	▶ Excavated slopes will not be left	EPCC PM	LEL ESOHSM	BC

	<i>Project Activities</i>		<i>Impact</i>	<i>Action</i>	<i>Responsibility</i>		<i>Timing</i>
					<i>Execution</i>	<i>Monitoring</i>	
	Construction of Tailrace Channel		Contamination; increased turbidity in Hari channel	untreated/unattended for long durations. Appropriate slope stabilization measures will be taken per the design (eg, stone pitching). Temporary measures may also be needed. ▶ The embankment filling operation will be carried out in a manner that minimizes chances of soil erosion. This may include construction of embankment in stages, and completing the side slopes of each segment, before moving to the next segment. ▶ Temporary soil stockpiles will be placed where there is no risk of soil erosion. ▶ Vehicle and construction machinery movement very close to the canal/channel banks will be minimized, as these may cause soil erosion. ▶ Measures will be adopted to minimize increased turbidity in the Hari channel. These will include minimizing excavation/dredging work in rainy season.		EPCC ESOHSO	DC
		7.2	Air Quality Deterioration	▶ Same as 5.2.			
		7.3	Surface Water Contamination	▶ Same as 5.3			
		7.4	Loss of Vegetation	▶ Same as 5.4.			

	<i>Project Activities</i>		<i>Impact</i>	<i>Action</i>	<i>Responsibility</i>		<i>Timing</i>
					<i>Execution</i>	<i>Monitoring</i>	
		7.5	Loss of Aquatic Biota	▶ Same as 5.3.			
8	Excavation and of Construction Subsidiary Outfall	8.1.	Soil Erosion / Contamination	▶ Same as 5.1.			
		8.2	Air Quality Deterioration	▶ Same as 5.2.			
		8.3	Surface Water Contamination	▶ Same as 5.3.			
		8.4	Loss of Vegetation	▶ Same as 5.4.			
		8.5	Loss of Aquatic Biota	▶ Same as 5.3.			
		8.6	Blocked Access	▶ Temporary alternate routes to be provided if required.	EPCC PM	LEL ESOHSM EPCC ESOHSO	BC DC
		8.7	Noise	▶ Construction equipment and vehicles will have exhaust mufflers (silencers) to minimize noise generation. ▶ Noise will be measured at Lehri, Chichian and Ferozabad. If found more than 65 dB, appropriate sound reduction mechanism will be put in place. ▶ Nighttime work will be avoided near the communities. Local population will be taken in confidence if such work is unavoidable.	EPCC PM	LEL ESOHSM EPCC ESOHSO	DC

	Project Activities		Impact	Action	Responsibility		Timing
					Execution	Monitoring	
				► Vehicular traffic through the communities will be avoided as far as possible. Vehicle speeds will be kept low, and horns will not be used while passing through or near the communities.			
		8.8	Safety Hazards	► Same as 5.7.			
		8.9	Damage to Infrastructure	► Same as 2.4.			
		8.10	Gender Issues	► Construction crew will avoid entering the villages and settlements. 2 Provide gender and cultural sensitization training to the labour force before construction starts	EPCC PM	LEL ESOHSM EPCC ESOHSO	BC DC
9	Construction of Flood Protection Embankment	9.1	Soil Erosion	► Same as 7.1.			
		9.2	Air Quality Deterioration	► Same as 5.2.			
		9.3	Surface Water Contamination	► Same as 5.3.			
		9.4	Loss of Aquatic Biota	► Same as 5.3.			
10	Construction of Residential Colony	10.1	Soil Erosion and Contamination	► Same as 4.1.			
		10.2	Air Quality Deterioration	► Same as 4.2.			

	<i>Project Activities</i>		<i>Impact</i>	<i>Action</i>	<i>Responsibility</i>		<i>Timing</i>
					<i>Execution</i>	<i>Monitoring</i>	
		10.3	Surface Water Contamination	► Same as 4.3.			
		10.4	Loss of Vegetation	► A tree and shrub plantation plan will be developed and implemented at suitable locations within the project site. Local species will be used for this purpose.	LEL EPCC PM	LEL ESOHSM EPC ESOHSO	BC DC EC
		10.4	Blocked Access	► Same as 1.1.			
		10.5	Noise	► Same as 5.6.			
		10.6	Damage to Infrastructure	► Same as 2.4.			
11	Construction of Road Bridge	11.1	Soil Erosion and Contamination	► Same as 5.1.			
		11.2	Air Quality Deterioration	► Same as 5.2.			
		11.3	Surface Water Contamination	► Same as 5.3.			
		11.4	Blocked Access	► Same as 1.1.			
		11.5	Noise	► Same as 5.6.			
		11.6	Damage to Infrastructure	► Same as 2.4.			
		11.7	Safety Hazards	► Same as 5.7.			
12	Construction of Access Road	12.1	Soil Erosion and Contamination	► Same as 5.1.			

	<i>Project Activities</i>		<i>Impact</i>	<i>Action</i>	<i>Responsibility</i>		<i>Timing</i>
					<i>Execution</i>	<i>Monitoring</i>	
		12.2	Air Quality Deterioration	► Same as 5.2.			
		12.3	Surface Water Contamination	► Same as 5.3.			
		12.4	Blocked Access	► Same as 1.1			
		12.5	Noise	► Same as 5.6.			
		12.6	Safety Hazards	► Same as 5.7.			
		12.7	Damage to Infrastructure	► Same as 2.4.			
13	Vehicular Traffic	13.1	Air Quality Deterioration	► Same as 3.1.			
		13.2	Noise	► Same as 2.2.			
		13.3	Safety Hazards	► Same as 2.3.			
		13.4	Damage to Infrastructure	► Same as 2.4.			

Key: LEL Laraib Energy Limited

;

PM: Project Manager;

ESOHSM: Environmental and Social and Occupational Health and Safety Manager

;

EPCC Engineering Procurement Construction Contractor

ESOHSO: Environment and Social Occupational Health and Safety Officer

BC: Before Construction;

DC: During Construction.

EC: End of Construction

Exhibit 6.4: Effects Monitoring Plan for Construction Period

<i>No.</i>	<i>Monitoring Parameter</i>	<i>Monitoring Locations</i>	<i>Frequency¹⁷</i>	<i>Responsibility</i>	<i>Resource Requirement</i>	<i>Documentation</i>
1	Visual observation of soil erosion	Construction site, campsites	During routine monitoring	EPC ESOHSO	-	Record of observations.
2	Groundwater quality	Selected local wells	Fortnightly.	EPC ESOHSO	Sampling bottles	Complete record of sampling and analyses.
3	Surface water quality	Selected locations (Bong Canal, Hari channel downstream of Bong Escapes)	Fortnightly.	EPC ESOHSO	Sampling bottles	Complete record of sampling and analyses.
4	Visual check for exhaust emissions from generators, equipment and vehicles.	Construction sites, camp sites	During routine monitoring	EPC ESOHSO	-	Record of observations.
5	Visual check for dust emissions from generators, equipment and vehicles.	Construction sites, camp sites, project roads	During routine monitoring	EPC ESOHSO	-	Record of observations.
6	Noise	At nearby communities (Lehri and Ferozabad)	Fortnightly or during the construction activities causing noise.	EPC ESOHSO	Noise meter	Complete record of noise measurements, locations, etc.
7	Public Grievances	At nearby communities (Lehri and Ferozabad)	Throughout the field activities.	LEL ESOHSM; EPC ESOHSO	Social Complaint	Complete record to be maintained in the form of

¹⁷ Frequency may be adjusted in the field according to the situation and results of the monitoring.

<i>No.</i>	<i>Monitoring Parameter</i>	<i>Monitoring Locations</i>	<i>Frequency¹⁷</i>	<i>Responsibility</i>	<i>Resource Requirement</i>	<i>Documentation</i>
					Register	the Social Complaint Register.

7. Public Consultation and Information Disclosure

This Chapter provides the objectives, processes and outcomes of the public consultations and disclosure of project information to project stakeholders and community members living in the project area. Based on the feedback obtained during consultations carried out in 2004 and updated and extended consultations carried out in 2009, potential social and environmental impacts have been identified, assessed and appropriate mitigation actions proposed. A comprehensive Resettlement Entitlement Framework (**attached as Appendix E**) has also been prepared for the project, which will guide the process of land acquisition and disbursement of compensation to the affected people for their affected land and assets.

7.1 Objectives

Public consultation and information disclosure is an integral part of the environmental and social assessment aimed at providing a two-way communication channel between the project stakeholders; Project Affected persons (PAPs) and communities, and the project proponent. In line with this aim, the objectives of public consultations were to:

- Develop, enhance and maintain communication links between the project proponents and PAPs and communities in the project area;
- Provide key updated project information to the PAPs, communities and other stakeholders, and to solicit their views on the project and its potential or perceived impacts; and
- Ensure that views and concerns of the PAPs and other stakeholders are incorporated into the project design and mitigation actions implemented with the objectives of reducing or offsetting any negative impacts and enhancing benefits of the project to the PAPs and communities.

7.2 Participation Framework

Public consultation is a continued process, and it should be maintained throughout the project cycle. Consultations carried out to update the 2004 Initial Environmental Examination is essentially an initial step in this continuous consultation process, which will continue during the subsequent project phases as well.

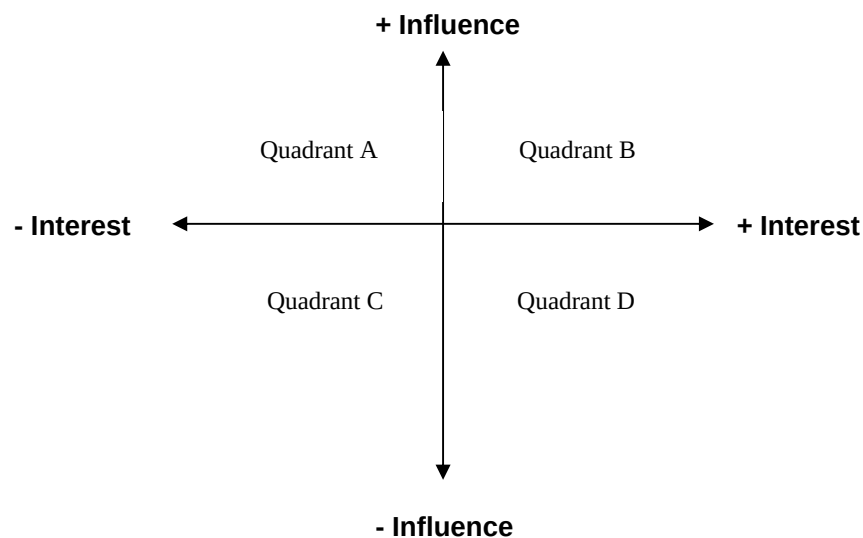
7.2.1 Stakeholders' Analysis

Stakeholders' analysis reveals the nature and magnitude of the stakeholders' interests in and influence on a project. The first step for the analysis is to identify the stakeholders, who are essentially not limited to those affected by the project. They also include those who can affect or influence the project. They can be winners, losers or indifferent. The stakeholder analysis aims to distinguish between the actual

effects of the project on different stakeholders, and those stakeholders' perceptions about the project and its effects.

The second step in the stakeholder analysis is to analyze the interests and influence of the stakeholders, examining their assets and capabilities. The small landowners may have high stakes in a development project such as New Bong Escape Project (NBE), but very little influence. As a contrast, the regulatory agencies may have very high influence but low interest in a project. The third step is to differentiate stakeholders by their attachment to the status quo, or conversely, their desire/willingness to change.

The stakeholders can be best analyzed by comparing their commitment to the status quo against the influence they wield. The diagram given below conceptually presents the interplay of stakeholders' interest and their influence.



The stakeholders' who have considerable influence and are determined to prevent changes (Quadrant A in the above diagram) are the greatest challenges for many projects. The groups that want change, whether or not they have much influence, are the possible counterbalances (Quadrants B and D in the diagram). The project needs to find ways to increase the influence of groups that favor change but lack influence and to mediate between the influential groups that favor change and groups that oppose it.

Stakeholder analysis was carried out to identify relevant stakeholders on the basis of their ability to influence the project or their vulnerability to be negatively impacted from it. This approach ensured that no relevant groups are excluded from the consultation, and appropriate engagement strategies are developed for each stakeholder. Key stakeholders consulted at various levels included:

- People directly affected by the Project (i.e., project affected persons or PAPs mostly having high negative interest and low influence);
- Project beneficiaries (mostly having high positive interest and low influence);

- LEL officials (mostly having high positive interest and high influence);
- Local government (revenue and other departments mostly having low/medium interest and high influence);
- Environment Protection Agency (mostly having medium interest and high influence);
- The broader interested community (mostly having low interest and low influence);
- The NGOs, international organizations and other interest groups (mostly having medium interest and medium to high influence).

7.2.2 Methodology for consultations

The methodology adopted for public consultation included site visits, meetings and discussions with community institutions and other grassroots level stakeholders'.

Following were the key aspects of and sources of information, the consultants used during consultations:

- Desk review of review of literature; existing information, project documents and report;
- Meetings/consultations with project proponent – LEL;
- Meetings with Revenue Department and EPA;
- Site visits;
- Small Focus group discussions;
- Interviews with key informants
- Structured and Semi structured interviews.

Exhibit 7.2 Gives the Framework for participation in the consultation process.

7.2.3 Consultation Process

Consultations with stakeholders were based on a participatory and consultative approach, which was adopted for information gathering and data collection through the consultation process. **Exhibit 7.3** Checklist for data/information gathering.

Meetings were held with key informants i.e. PAPs and community members living in villages in the project area (Details provided in Public Consultation Matrix) as well as relevant government agencies and departments, e.g. District Revenue Office (DRO), AJK Environmental Protection Agency, Health Centers and Education facilities. The focus group discussions with smaller groups of grassroots stakeholders were also held, whereas one-to-one meetings were held with the institutional stakeholders. These discussions were held with project affected people, project beneficiaries and other local communities and villages in project area including Lehri, Afzal Pur, Chechian and Dhab, etc. Meaningfully conceived process of public consultation with affected communities and other stakeholders helped in better understanding local knowledge with respect to the various sets of issues and concerns, and integration of

their feedback into the project design and EMP and REF. **Exhibit 7.1** provides the details of the consultations.

7.3 Major Concerns and Hopes Identified by PAPs

Major concerns of the PAPs, as identified during consultation meetings, are given below:

- People generally talked about some bad experiences of Mangla Dam Project, built in 1960's, but have had no ill feelings about the NBE Project. They were found keen to see the project work getting underway, as they perceived the project will open up many economic opportunities for them;
- People remember the 1992 flood that submerged significant part of their land under the river water, and till to date peoples' land at the right bank side still continues to erode due to increase and change in flow of water. The project design includes construction of a protection dyke, which people take as a positive move as the dyke will regulate flow of water and protect their land from being eroded. They expect that with this dyke and regulated flow of water, it will be possible to reclaim parts of the submerged land.
- Transparency of the Revenue Department process of compensation assessment and timely disbursement to PAPs.
- The PAPs highlighted that their access to the other side of Hari channel, would be cut down during the project construction. They demanded temporary access during construction phase and a permanent bridge to enable movement and communication across the channel.
- There are four boatmen earning livelihood by operating boats across Hari channel commuting people back and forth the Hari channel. The project will provide adequate cash compensation to the affected boatmen and will provide them additional livelihood restoration support.
- PAPs highlighted a concerns related to security, safety and social inconvenience, which they perceived the influx of outside workforce and heavy construction machinery will cause in the area.

These concerns of PAPs have been integrated in the REF and EMP and appropriate actions have been proposed to mitigate and address them. (see Exhibit – for details).

7.4 Conclusions

As is obvious from the above consultations, there is hardly any major social impact the project entailed and or raised by the PAPs with any serious concern. The PAPs hope that the project will not only create economic opportunities but also will result in reclamation of the lost land, which the flood water submerged in 1992. A few social concerns the PAPs highlighted during consultations have been fully made part of the EMP that provides for appropriate mitigation measures/actions, besides the REF also provides for disbursement of fair compensation at market price/replacement cost to the PAPs for their affected land and assets.

The project is likely to generate employment for the local population as workers and material suppliers both during the construction and operation phase. Additionally, the CSR activities of LEL are likely improve the socio-economic conditions of the area and living standards of the community as a whole. This may include recreational facility, education and health facilities to be identified and finalized in consultation with the local community.

Exhibit 7.1: Public Consultations

Date	Location/ village	Venue	Participants	Issues Discussed	Concerns/ Proposed Actions
28 Feb 2009	Lehri Village	Basic Health Unit (BHU)	Javed Mehmood Zafar Iqbal Saeeda Farooq	Participants were informed about the project and were requested to express their feelings about the project. They were consulted for the positive and negative effects, they perceived the project entailed, and their view point was accordingly recorded. They informed that the BHU clients, especially women folks face maternity related problems due to the lack of space, equipment and staff. Maternity operations are carried out at servant quarters (within the BHU) in a much difficult condition. People proposed that a separate building/ward should be constructed along with necessary equipment to better manage the maternity services for local women folks. Given these bottlenecks, people prefer going to Mirpur – a better place located at a distance of 15 km which has a fully functional District Headquarter Hospital. The participants were found keen to see the project work getting underway, as they thought the project would create economic opportunities in the area. They further hoped that the project would support enhancing the capacity of BHU out of the project's welfare/development program for the local communities.	Appropriate CSR strategy will be formulated after carrying out thorough consultation and need assessment survey.
28 Feb 2009	Afzal Pur	House of a Local Resident	M. Farooq Ch. Abid Hussain	Project information was disclosed to the participants. Representative of LEL gave a detailed description of the project design and layout. The team then gave details of the potential environmental and social impacts of the project activities on the surrounding communities. The participants were also informed	The participants proposed that the project should provide temporary access during the construction work, which

			Shaheen Ahmed Tahir Mehmood Nasir Mehmood M. Latif M. Munir	that in order to address any concerns/grievances as a result of the project activities, a complaints/ suggestions register has been placed at the project site office where 2 full time employees (community liaison officers) are present. The community members were asked and encouraged to register their complaints and record their suggestions in the register placed at the site office. The team then sought opinions of the community about the project through semi structured interviews and FGDs. The participants were found to be positive about the project; however, they expressed a concern that the project work will block their access to the land on other side of Hari channel, which they cross through boats. A few people expressed concern that the compensation process may not be transparent if it is left to the government department alone.	should be replaced by providing a permanent foot bridge to link the village with the riverine land on other side of Hari channel. For compensation assessment and disbursement, they proposed that the project officials should keep the process transparent by involving local people and PAPs. Participants were informed that the consultation process with PAPs will continue on regular basis and consultation committees of PAPs will also be formed. Furthermore, a grievance redress mechanism/committee will also continue to function during compensation disbursement and construction activities.
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28 Feb 2009	Pindi Simberwal (Mara)	House of a Local Resident	Amir Sharif Ali Aslam M. Munir Pervaiz Akhtar Bashir Hussain Allah Rakha M. Ramzam Raja Yasir	Project information was disclosed to the participants, and their view point about any positive or negative impacts of the project was sought. The participants expressed similar concerns, which the Afzal Pur people expressed during consultation. Main concern of the people of Pindi Simberwal village was the access to the other side of Hari channel, which they thought the project will interrupt and the transparency and timeliness of compensation disbursement. They also expressed a concern that with the influx of outside workers and construction machinery, safety of local people and their privacy will be affected.	Participants demanded a permanent bridge that should facilitate communication between villages and the land at the other side of the channel. They asked for some working ethics the workers should observe during the project construction work. Participants were informed that their concerns will be properly addressed and appropriate mitigation measures will be implemented as already envisaged in the environmental mitigation/management plan, the implementation of which will be monitored continuously to address construction and safety related concerns of locals.
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28 Feb 2009	Chechian	Farm of Local	Ch. Islam Abdul Shakoor Allah Dita M. Latif	The only concern the participants highlighted was about their access to the other side of channel, which they thought would be cut down during the project works. They said they use the channel for livestock bathing and cleaning, which the project work will obstruct.	Participants demanded that they should be provided a crossing on the channel and a separate pond for cattle bathing.
28 Feb 2009	Dhab	Residence of Abdul Hamed	Abdul Hameed Butt (The only owner of the land on riverside. Rest of the village is quite clear from the project site)	His land is being destroyed due to soil erosions caused by the river. Most of his orchard has already been destroyed. He was found to be very happy about the project as the project infrastructure will save rest of his land from further erosion by river water.	
13 Mar 2009	Mangla	Mangla Resthouse	Ch. Yousaf (Senior Minister, GoAJ&K) Ch. Rukhsar (MLA, AJ&K) Ch. Rashid (Minister HEB, AJ&K) Raja Farooq Niaz (Senior Member, BOR, AJ&K)	Detailed presentation regarding project impacts and benefits to the State and economy was provided to the stakeholders. Response was generally positive and supportive and there was a great desire not to delay the project and to start construction as soon as possible. There was a apparent lack of understanding as to the location of the tailrace channel. The local MLA expressed the desire that after construction of tailrace there would be no erosion of their land holdings and also that some land on the present shore line would be reclaimed. Explanation was provided that the tailrace would start 60-80 feet from the shore line, and this portion of land would be	The tailrace should be designed in a manner that restricts the channel in its given alignment and thus protects any new erosion of the shore line. A foot bridge should be constructed across the tailrace at a location to be mutually agreed amongst the stakeholders.

			Iqbal Ratyal (Secretary Electricity, AJ&K) Ahsan Khalid Kiyani (Commissioner Mirpur, AJ&K) Ch. Muhammad Tayyab (Deputy Commissioner Mirpur, AJ&K)	potentially reclaimed.	
13 Mar 2009	Lehri	Project Site	As above and some local people	Same as above	Same as above
13 Mar 2009	Dhab	Near Police Station	As above and some local people	Same as above	Same as above
13 Mar 2009	Afzal Pur	Residence of Ch. Rukhsar	As above and some local people	The local community expressed the desire that they would get a foot bridge to access the right side of the tailrace channel.	Same as above

Exhibit 7.2: Participation Framework

Project Stage	Proposed Tool	Stakeholders Consulted	Responsibility
Project Design Phase	Meetings with institutional stakeholders (carried out during ESA) Meetings with grass root stakeholders (carried out the communities to be affected during the ESA).	Institutional Stakeholders' Grassroots Stakeholders' including communities to be affected by the project.	IEE/ESA Consultants. LEL.
Project Construction Phase	Sharing/disclosing the Resettlement Action Plan of the project with the affected communities and other stakeholders.	Institutional Stakeholders' Grassroots Stakeholders' including communities to be affected by the project.	IEE/ESA Consultants. LEL. RAP/EMP Monitoring Agencies
	Grievance Redressal Mechanism and Social Complaint Register.	PAPs and communities in project area.	LEL REF Contractors EMP/RAP Monitoring Agency
	Consultations with the communities during Compliance Monitoring and Effects Monitoring	PAPs and communities in project area.	LEL REF Contractors

			EMP/RAP Monitoring Agency
	Monthly meetings at the project sites.	PAPs.	LEL/REF Contractors.
	Consultations with the PAPs/communities during the external monitoring of REF/RAP implementation.	PAPs/communities	LEL REF External Monitoring Agency.
	Consultations with the PAPs/communities during the site visits by IFC Review Missions.	PAPs, LEL Staff REF and Contractors Staff.	IFC Review Missions.
Project Operations Phase	Liaison with the communities living around Power House; Liaison with communities living around Tailrace. Liaison with the communities living around Switch yard.	Communities living around different project components.	LEL/REF AJK/WAPDA

Exhibit 7.3 : Checklist used for Public Consultations

Following Checklist was used for conducting public consultations:

Overview of basic necessities of livelihood available in the area other than the proposed project (e.g. sources of water supply, availability of electricity, sources of fuel wood, means of communication, availability of health and educational facilities, technical and vocational training centers, sources of information);

Overview of socioeconomic milieu of the communities living in the project area;

General socioeconomic profile of the project area, e.g. main professions, sources of livelihoods/income generation, education, health layouts and recreational facilities, land use pattern, and housing and demographic characteristics, etc.

Does the proposed project strengthen the social network already existing in the area or affect it?

Who are the people affected by the project with categories of persons and intensity of impacts?

Are directly affected persons agreeable to allow the project?

What are the social benefits of the proposed project like provision of electricity to majority of the people, if not all, and stability of electricity in the area at large?

What social issues/ losses will be triggered as a result of the project intervention? (e.g. loss of land, loss of livelihood, bifurcation of land, any risks associated with human and animal health, etc).

Any commercial activities affected in the visited area due to this project?

Apprehensions of the visited communities and their suggestions for the improvement of the proposed project.

8. Conclusions and Recommendations

This Revised IEE has been conducted in line with the relevant guidelines of the GoP and IFC/ADB. The IEE also includes public consultation with the project communities focusing on those communities living in proximity of the project site. The objective of the IEE is to identify and assess the potential environmental and social impacts of the proposed 84 MW New Bong Escape Hydroelectric Project.

This Chapter presents the conclusions of the key findings and recommendations for further actions.

8.1 Conclusions

The major conclusions of the Revised IEE are:

- Although the project capacity is significant but due to nature and location of project site, its environmental and social impacts are negligible.
- In run of the river projects, environmental considerations always remain low as there is no damming involved, however minimal environmental and social consequences will be experienced during the construction phase.
- ▶ This has been confirmed that in the operation phase of this project, negligible and insignificant impacts on the social, physical and biological environment of the area will occur.
- ▶ The potential impacts during the construction phase include minimal soil erosion and contamination, vegetation loss, deterioration of ambient air quality caused by exhaust emissions and kicked-up dust, noise pollution, damaged infrastructure, safety hazards and public health concerns for the nearby communities.
- ▶ There will be no significant environmental management issue during the operation phase of this project.
- ▶ All the recommended mitigation measures are contained in the EMP. The EMP together with the environmental requirements and specifications to be developed will need to be part of the EPC contract and sub contract with sub contractors for compliance in construction phase. The EMP provides the organization structure for the environmental management system during the project implementation, and defines roles and responsibilities of various project entities. The EMP includes a mitigation plan, which precisely defines the mitigation actions, executing persons, monitoring persons and timing of these actions. An environmental monitoring plan is also included in the EMP, in addition to communication and documentation requirements, and training needs, in the context of environmental management.

- ▶ Based on the recommended mitigation measures in **Chapter 5**, the impacts identified in **Exhibit 5.1** will be reduced with residual impacts at insignificant levels. **Exhibit 8.1** presents the assessment of the residual impacts.
- ▶ On the basis of overall impact assessment, more specifically, nature and magnitude of the residual environmental impacts identified during the IEE, it is concluded that the proposed New Bong Escape Hydroelectric project is unlikely to cause any significant, lasting impact on the social, physical and biological environment of the area, provided that the proposed activities are carried out as mentioned in this report, and the mitigation measures included in this report are completely and effectively implemented.
- ▶ There are no remaining issues that warrant further investigation. This revised IEE is considered adequate to justify the environmental and social consideration required for national laws (EPA AJK) and project financiers guidelines.

8.2 Recommendations

On the basis of the environmental and social impact assessment discussed in **Chapter 5** and **7**, and the conclusions provided in **Section 8.1** above, it is recommended that:

- ▶ LEL should initiate dialogues with the villagers to understanding them about details of project construction
- ▶ Environmental requirements and specifications should be drafted as soon as possible, to be included in the EPC Contract.
- ▶ An environmental management system (EMS) should be established as soon as possible for the timely and effective implementation of the EMP.
- ▶ As part of the EMS, LEL should formulate an environmental policy to guide environmental management and enhancing corporate image.
 - LEL should devise procedures for compliance of environmental and social obligations as according to this IEE and international financiers guidelines. It is recommended that the EPC sub contractors' staff should be provided awareness of environmental obligations and compliances as per national and international stakeholder's laws and guidelines.

Exhibit 8.1: Impact Matrix – Residual Impacts (Mitigated)

	<i>Physical</i>					<i>Biological</i>			<i>Social and Socioeconomic</i>													
	Soil	Air Quality	Surface Water	Groundwater	Water Regime	Natural Vegetation	Terrestrial Wildlife	Aquatic Biota	Access	Noise	Cultivation	Livestock Grazing	Resettlement / Compensation	Safety Hazard	Employment	Infrastructure	Public Health	Cultural Issues	Gender Issues	Recreational Sites	Historical/ Archeological Sites	Population Influx
Construction Phase																						
Site Preparation	N	N	N	N	N	N	N	N	0	N	0	0	-1	N	N	0	N	N	N	0	N	N
Transportation of Powerhouse Equipment	0	-1	0	0	N	N	0	N	0	-1	N	0	N	0	0	0	0	0	0	N	N	N
Contractor Mobilization	0	-1	0	0	N	N	0	N	0	-1	N	0	N	0	0	0	0	0	0	N	N	N
Construction Camp Establishment	0		0	0	N	0	0	N	0	0	0	0	N	0	+1	0	0	0	-1	N	N	0
Construction Camp Operation	0	0	0	0	N	0	0	0	0	0	0	0	N	0	+1	0	0	0	-1	N	N	0
Excavation and Construction of Headrace Channel	-1	-1	-1	0	N	0	0	0	0	-1	0	0	N	0	+1	0	0	0	0	0	N	N
Construction of Powerhouse	-1	0	-1	0	N	0	0	0	0	0	0	0	N	0	+1	0	0	0	0	N	N	N
Excavation and Construction of Tailrace Channel	-1	0	-1	0	0	-1	0	-1	-1	0	0	0	N	0	+1	0	0	0	0	N	N	N

	<i>Physical</i>					<i>Biological</i>			<i>Social and Socioeconomic</i>													
	<i>Soil</i>	<i>Air Quality</i>	<i>Surface Water</i>	<i>Groundwater</i>	<i>Water Regime</i>	<i>Natural Vegetation</i>	<i>Terrestrial Wildlife</i>	<i>Aquatic Biota</i>	<i>Access</i>	<i>Noise</i>	<i>Cultivation</i>	<i>Livestock Grazing</i>	<i>Resettlement / Compensation</i>	<i>Safety Hazard</i>	<i>Employment</i>	<i>Infrastructure</i>	<i>Public Health</i>	<i>Cultural Issues</i>	<i>Gender Issues</i>	<i>Recreational Sites</i>	<i>Historical/ Archeological Sites</i>	<i>Population Influx</i>
Excavation and Construction for NBE Diversion Channel	-1	-1	-1	0	0	0	0	0	-1	-1	0	0	0	-1	+1	0	0	0	-1	N	N	N
Construction of Flood Protection Embankment	-1	0	-1	0	0	0	0	-1	0	0	0	0	0	0	+1	0	0	0	0	N	N	N
Construction of Residential Colony	0	0	0	0	N	0	0	0	0	0	0	0	0	0	+1	0	0	0	0	N	N	0
Construction of Road Bridge	-1	-1	-1	0	N	0	0	0	-1	-1	0	0	0	0	+1	0	0	0	0	0	N	N
Construction of Access Road	-1	-1	-1	0	N	0	0	0	0	-1	0	0	0	0	+1	0	0	0	0	N	N	N
Construction Materials Supply	0	0	0	N	N	0	0	0	0	0	N	0	N	0	+1	0	0	0	0	N	N	N
Other Supplies	0	0	0	N	N	0	0	0	0	0	N	0	N	0	+1	0	0	0	0	N	N	N
Construction Crew Transportation	0	0	0	N	N	0	0	0	0	0	N	0	N	0	+1	0	0	0	0	N	N	N
Solid Waste Disposal	0	0	0	0	N	0	0	0	N	N	0	0	N	0	0	N	0	0	0	N	N	N
Waste Effluents Disposal	0	0	0	0	N	0	0	0	N	N	0	0	N	0	0	N	0	0	0	N	N	N

	<i>Physical</i>					<i>Biological</i>			<i>Social and Socioeconomic</i>													
	Soil	Air Quality	Surface Water	Groundwater	Water Regime	Natural Vegetation	Terrestrial Wildlife	Aquatic Biota	Access	Noise	Cultivation	Livestock Grazing	Resettlement / Compensation	Safety Hazard	Employment	Infrastructure	Public Health	Cultural Issues	Gender Issues	Recreational Sites	Historical/ Archeological Sites	Population Influx
Demobilization of Contractors	0	-1	0	N	N	0	0	0	0	-1	N	0	N	-1	0	0	0	0	0	N	N	N
Operation Phase																						
Powerhouse Operation	N	0	0	N	0	N	N	0	N	0	N	N	N	0	+1	0	0	0	0	N	N	0
Maintenance	N	0	0	N	0	N	N	0	N	0	N	N	N	0	+1	0	0	0	0	N	N	0
Staff Transportation	0	0	0	N	N	N	0	0	0	0	N	0	N	0	+1	-1	0	0	0	N	N	N
Supplies	0	0	0	N	N	N	0	0	0	0	N	0	N	0	+1	0	0	0	0	N	N	N
Solid Waste Disposal	0	0	0	0	N	0	0	0	N	N	0	0	N	0	0	N	0	0	0	N	N	N
Waste Effluents Disposal	0	0	0	0	N	0	0	0	N	N	0	0	N	0	0	N	0	0	0	N	N	N

Key: -2: High negative impact; -1: Low negative impact; 0: insignificant/negligible impact; +1: low positive impact; +2: High positive impact, N: no impact.

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Appendix A: Study Team

This appendix introduces the team that participated in conducting the IEE study of the proposed New Bong Escape hydropower project. Citation in the Main Report: **Section 1.3.4**

Sher Khan

Sher Khan is M. Sc. in Water & Environmental Engineering from University of Surrey, Guildford United Kingdom with majors in Water Treatment and Supply, Environmental Health, Wastewater Treatment and Sewerage, Water Surveillance, Pollution Control and Waste Management, Groundwater Control, Applied Chemistry and Microbiology and European Water Supply Studies. Mr. Khan is also B.Sc in Civil Engineering from University of Engineering and Technology Lahore with majors in Irrigation Engineering, Environmental Health Engineering, Hydraulic Engineering, Design of Structures, Structural Engineering and Highway Engineering.

Ayaz Asif

Ayaz Asif is a researcher by profession. He has over 12 years of work experience both with National and International organizations in Pakistan and abroad. Currently he is working as an independent consultant and also heading Sustainable Solutions as its CEO.

Previously Mr. Ayaz has been working with LEAD (Leadership for Environment and Development) Pakistan as Program Officer Research and Capacity Building. His responsibilities included; conducting research on environmental issues, writing occasional papers and case studies. He also conducted trainings and developed training modules.

He also worked at the United Nations Headquarters in New York in the Department of Economic and Social Affairs, Environment Statistics Division where his responsibilities were to analyze and compile primary and secondary data on environmental indicators for sustainable development.

Mr. Ayaz holds an MPhil in Biological Sciences from Quaid-i-Azam University, Islamabad and a Masters in Environmental Management from Illinois Institute of Technology, Chicago USA.

Ali Ahmad Jan

Ali Ahmad Jan has done his masters in economics and Mass Communications with graduation in Law. He has attended professional trainings and courses in Japan, USA, Mexico, Thailand, China, Nepal and India. Mr. Jan is a LEAD fellow, graduate of KCI, USA and certified Associate of AtKisson, accelerator sustainability Tools in USA. He has been working with Planning and Development Department Northern Areas, WWF – Pakistan and LEAD Pakistan in various capacities. Mr. Jan has

undertaken a number of case studies, field research and impact assessment studies. During his tenure in Northern Areas Mr. Jan has served as Manager Gilgit Conservation and Information Center situated in Jutial where information on various aspects of Northern Areas is available to various stakeholders. He has also led a team to establish community managed protected area and develop a documentary, website and communication material including brochures on medicinal plants, eco-tourism those are available in Gilgit Conservation and Information center.

Mohammad Omar Khalid

Mr. Khalid has extensive experience of conducting a wide range of environmental studies and assignments, including Environmental Impact Assessments (EIAs), Initial Environmental Examinations (IEE), environmental surveys and audits, base line surveys, developing environmental management plans (EMPs) and environmental management systems (EMS). He has also been involved in conducting trainings in these areas.

Mr. Omar Khalid holds degrees in Electrical Engineering and Business Administration. Mr. Khalid has exposure to a broad range of industrial projects including oil and gas, power generation, petrochemical, chemical, fertilizer and cement, renewable energy resources and has worked with both local and foreign teams, and with owners as well as contractors—resulting in multifaceted and in-depth understanding of the work, issues, problems and constraints.

Mr. Khalid was the team leader for the present assignment. He participated in field visits, public consultation, impact assessment, EMP development and report compilation.

Zahid Beg Mirza

Professor Mirza is one of the leading biologists in the country with more than 40 years of experience. He has been involved in field research, ecological and biological studies, teaching and trainings, apart from supervising PhD students. He has authored over 50 research publications, 19 books and three Country Reports on biodiversity of Pakistan and related topics. Professor Mirza has also participated in numerous environmental impact assessment studies, some of them in ecologically sensitive regions of the country. In addition to the faculty member of the Punjab University, Professor Mirza worked for WWP-Pakistan for several years. He has also been Director of the Pakistan Museum of Natural History, Islamabad, and a visiting professor for a number of universities and colleges.

Professor Mirza participated in the IEE study as the biologist, and helped develop baseline description of the area and impact assessment.

Usman Qazi

Mr. Qazi is a development economist, a social scientist and a community development expert. He has studied engineering from NED University of Engineering and Technology, Karachi, Pakistan and Economics and Management of Rural

Development from Institute for Development Policy and Management, University of Manchester, UK. Mr. Qazi has more than ten years' experience of working in the field of sustainable community development and relief with a special focus on water resource management. He has worked on various projects funded by The World Bank, The Netherlands Government, Department for International Development (UK), The Asian Development Bank and the United Nations.

Mr. Qazi is a fellow of Leadership for Environment and Development (LEAD) International, which is a global forum of future leaders committed to a vision of a more sustainable and equitable world. He is also a member of Registered Engineers for Disaster Relief, an international coalition of professionals working in humanitarian relief.

For the present IEE, Mr. Qazi conducted the public consultation in the project area.

Javed Rashid Choudhry

Mr. J R Choudhry is the General Manager Public Relations (GM-PR) of the New Bong Escape Hydropower Project. He is involved in planning, negotiations, design and public consultation activities of the project. He performed the key role in conducting the project feasibility study. He has also been liaising with all regulatory agencies including WAPDA, NEPRA, PPB, GoAJK and others for the approval and implementation of the project.

Earlier, Mr. Choudhry has been working in oil and gas sector, and with a consulting house involved in electrical power distribution and allied services.

Mr. Choudhry is a graduate electrical engineer, and holds an MBA degree as well.

During the present assignment, Mr. Choudhry provided the project details and key inputs for impact prediction and assessment. He also participated in the Public Consultation conducted during the IEE.

Sultan Ahmed Sheikh

Mr. S A Sheikh is the General Manager Project Development (GM-Project Development) of Laraib Energy Limited, and actively involved in various project activities, including feasibility, negotiations with governmental agencies as well as consultants and contractors. He has also been involved in project's costing, financial planning, budgeting, economical and financial analyses, financial modeling and forecasting.

Earlier, Mr. Sheikh worked in Pakistan Telecommunication Ltd, Islamabad.

During the present IEE, Mr. Sheikh provided the information relating to project activities, schedules, staffing, supplies and housing. Mr. Sheikh also participated in the impact prediction exercise during the IEE.

Appendix B: Construction Methodology

This appendix provides the construction methodology that will be employed during the proposed project. Citation in the Main Report: **Section 3.4.3.**

B.1 Temporary Facilities and Works

A prelude to the construction activities would be establishment of base facilities e.g. site offices, workshops, construction machinery pool and materials area, batching plant, field testing laboratory, ware-houses as well as residential area for staff and labor.

Suitable areas to set up above facilities are available on the right and left side of the New Bong Escape Power Station and quite close to the arterial road. However, it will be necessary to provide an internal road from the New Bong Bridge up to the proposed powerhouse and the temporary facilities. This road will be useful for the construction of the headrace channel (lined) and the powerhouse and will also be required during the operation phase of the Complex.

B.2 Diversion Channel

The river course of New Bong Escape Channel will be used to divert water during construction period and an open channel will be excavated at about 500 m downstream of the New Bong Escape in the island. The course of the New Bong Escape will be changed by constructing a coffer dam in the existing Channel from its left guide bank to the island and the water will be diverted to the excavated channel to allow excavation of the Tailrace in relatively dry conditions. The diversion channel will be about 3,903 feet (1,190m) long, bed width 400feet (123m) and side slopes 1:2. Discharge capacity will be 41,000 cusecs (1,161cumecs).

B.3 Powerhouse Construction

The critical activity in the implementation of the plant is the powerhouse pit excavation. Excavation to a maximum depth of about 95.12 feet (29 m) will be required, of which about 91.8 feet (28 m) will be under the water table, as such, the excavation will require a dewatering arrangement, which will be designed by the Contractor. It will be executed in three stages. In the first stage, excavation will be carried out down to EL. 810. 0 feet (247.0 m). It is anticipated that the total time for this stage of excavation will be 1 month. After the excavation has reached that level, wells will be installed at the periphery of the excavation to depress the water table. These wells will be pumped until the water level has been lowered sufficiently so that excavation can start for the second stage. Well pumping would continue so that second-stage excavation can continue in the dry up-to EL.784 feet (239.0 m). At this level a bentonite slurry trench cutoff may be constructed to reduce the amount of pumping effort to de-water the area down to the powerhouse foundation. It is anticipated that some wells will also be required at the foundation elevation to keep piezometric levels low and help in keeping third stage excavation dry and further reduce the possibility of disturbance to the in-situ foundation material. This

excavation program is based on the assumption that dewatering arrangements remain operational throughout the excavation period. To complete the total excavation and water control measures, a period of about 7 months will be required.

After the excavation has been completed down to the foundation level, blinding concrete will be laid and mass concrete placed in foundations. It is planned to initiate concreting in the 11th month, i.e. 7 months after the start of the excavation and it would take about 8-9 months. During the 1st stage of concreting, pumping of lower level wells will continue.

The structural concrete (second stage) is anticipated to start in the 14th month. It will be taken up in the four bays in succession, to be completed in about 4 months. The rate of placing the second stage concrete will be kept low as this concrete will need placement around embedded parts and will also need proper formwork, which is comparatively a slow and laborious process. The start of second stage concrete is also tied up to the delivery of embedded parts. The total concrete to be poured in three stages is about 71,303 cubic meters (92,694 cubic yards).

The construction of appurtenant structures, e.g. control room, unloading bay, and back-filling in powerhouse, etc., would be completed by the end of month 18th.

B.4 Headrace Inlet

The water level in Bong Canal is maintained at all times around EL. 834.8 feet (254.45 m). Therefore the Inlet for headrace will have to be constructed close to the existing road, thus leaving sufficiently wide dyke or plug between the pond and upstream edge of inlet structure, which will be removed after lining of headrace channel has been completed. The ground level at this point has been measured at around 839 feet (256 m), which would check any spill from the pond.

The construction of inlet and the bridge will need excavation of pit about 600 × 200 feet (183 × 61 m) at the base. The bottom of excavation at the upper end will be EL.816 feet (248.8 m). An open curette will be excavated by a backhoe to drain out the ground water from the pit area to Old Bong Escape Channel where the water level would be around 811.0 feet (247.26 m). Minimum de-watering is therefore anticipated which would be done by open pumping, the ground water level being around 818 feet (249.4 m) at this location.

It is proposed that once the lining of headrace has been completed and powerhouse is ready for operation, the headrace will be filled with pumped water or siphoned from the pond after which the plug at the upstream end will be removed.

B.5 Headrace Channel

The work in headrace channel is proposed to commence almost simultaneously with the start of final stage of excavation for powerhouse. It is proposed that the excavation will start from the powerhouse side as well the Inlet end. It is anticipated that most of the excavation will be in dry and very little dewatering arrangement will be required, the proposed channel bed level being just above ground water level,

which varies between EL.814 feet (248.2 m) & 818 (249.4 m). Dressing and compaction of bed and side slopes for placement of concrete lining of headrace channel will follow the excavation. For lining of the channel, 3 inches thick blinding layer and 6 inches thick reinforced concrete will be provided.

The total excavation in headrace channel will be about 421,415 cubic meters, which will be completed in about 10 month's time. The concrete lining of channel will be initiated about one month after the start of excavation and construction of side embankment. As the concrete lining of channel is a time consuming process, a period of 2 months has been planned for its completion. In order to expedite the work on the channel lining, it is planned to take up this work at a number of locations simultaneously. The length of this channel will be 574 feet (175m) with the bed width of 246 to 377 feet (75m to 115m).

B.6 Road Bridge

The road from Mangla running along Bong Canal crosses the proposed alignment of headrace channel. A road Bridge has, therefore to be built at the same location. Length of the bridge is 394 feet (120 m) and width is 20 feet (6 m).

The structure being all above ground water level, only shallow open pumping may be needed for the foundation blocks under the piers. The construction of the Bridge is expected to be completed within 8 months when the traffic can be diverted over it. Close by on either side of the proposed bridge are the two bridges, one on New Bong Escape regulator and the other on Old Bong Escape Regulator. The top of decks on these bridges is at EL 839feet (255.8m), while the top of deck on headrace channel will be at R.L. 843feet (257.0 m) to accommodate higher free board. The location of the new bridge will be a little downstream of the areas of existing bridges.

The traffic in this stretch of road has to move slowly and therefore easy curves in alignment of the temporary diversion road can be accommodated in the available space.

B.7 Tailrace Channel

Excavation in this area can be started simultaneously with the headrace. Almost more than half of the earthwork will be in wet conditions. This work will take 16 months. The excavation of the tailrace in the river gravel bed, and mostly under water, will be done with the help of dredger, excavator or other special purpose equipment devised for the works. The excavated material from the river bed will be transported by dumpers or slurry pumps (depending on the excavation method selected), a few hundred feet away, for the formation of a flood protection embankment on the right bank of the channel to protect it from flood spills, the embankment will run all along its length from Bong Canal to end of tail race. The length of this channel will be 24,600 feet (7,500 m) with a bed width of 400 feet (121.9 m) and channel bed slope of 1:4000. Total excavation of the proposed tailrace channel based on available X-section is estimate as 5.20 million cubic meters.

The Flood Protection Dyke would be about 20 feet at the top (6.1 m) wide and 20-26.2 feet (6-8 m) high and its right side slope (towards the main river) will be stone-pitched.

B.8 Drop Structure (Subsidiary Out-fall)

One main Drop Structure (Subsidiary Out-fall) on the Old Bong Escape channel and 6 small Drop Structures at the location of left bank drains will be constructed. Drop Structures are completely independent segments and can be handled by different sub-constructors for early and simultaneous completion. The Drop Structure (subsidiary outfall structure) shall measure 128 feet (39 m) wide and 233 feet (71 m) long for the Old Bong Escape Channel.

B.9 Installation of E&M Equipment in the Powerhouse

The manufacturing of each unit of the equipment should take about 14 months, however, the deliveries will start to arrive at site from the 11th month. The manufacturing of the E&M equipment, particularly the turbines and generators, are on the critical path and as such, the supply contract shall have to be awarded at the time of award of civil work. It is also normal for the equipment to be delivered in stages starting with the embedded parts. The erection of embedded parts will start with turbine casing, draft tube liner and generator supports. Installation of these items is expected to start by end of the 13th month.

The installation of the units will be carried out in stages. As soon as curing of the concrete around the embedded parts is complete, the generator and turbine for the 1st and 2nd unit will be installed. It is anticipated that each unit will take about 8th months for installation.

The switchyard would be substantially completed by the 14th month including erection for switchyard equipment, transformers, gantries, isolators and switchgear. The bus bars will be strung and droppers connected. Construction of the powerhouse and switchyard lighting will also be initiated during this period. However, construction will be so planned that part of the switchyard should be ready to match installation first and second unit to come on line timely.

The civil works for the control room will be substantially ready by the 18th month of construction when the work on the installation of panels, instruments, relays and battery will be initiated. The work will include control wiring, and mounting the 400-volt bus bars cables. The installation is expected to be ready by 24th month i.e. before the start of the commissioning of first units.

B.10 Testing and Commissioning

The commissioning of the first unit will be completed by the end of month 27 and the last unit by the end of month 33rd and will include the dehydration of the transformers and testing of switchgear. All relays will be calibrated by secondary injection tests. Primary current injection tests will be applied to all CTs and their ratios verified. Relay wiring will be rechecked and breakers tripped by manual operation of each relay.

The turbines will be given no-load mechanical starts to ensure that no vibration occurs and to check temperature rise of all bearings. Generators will be dried out using established standard procedures. After dry out, voltage will be built up, phase sequence checked and if correct, each machine synchronized with the system.

Load runs will be executed to prove smooth operation and normal temperature rise of all bearings and windings. If possible, response of each unit to stepped changes of load and voltage will be checked. Full load rejection tests will be carried out. The performance on load rejection will be compared with predicted values. If all the above tests and observations give normal results the station is certified as fully commissioned.

B.11 Rehabilitation and Restoration

Once the construction activities are completed, the construction areas which are not part of the powerhouse (such as contractors' camps, equipment yards, staging areas, concrete mixing plant location, material dumps, etc.) will be rehabilitated and restored to the original condition as far as possible. No excess construction material will be left at site. All waste materials will be removed from the site, and the land will be re-contoured to the pre-project condition if necessary.

Appendix C: Photographs

This appendix provides some photographs of the project area and of Public Consultation. Citation in the Main Report: **Section 4.1.1**

Figure C.1: A View of Bong Pond



Figure C.2: Strand of Trees near Bong Pond



Figure C.3: Another View of Strand of Trees near Bong Pond



Figure C.4: Strand of Trees near Bong Pond



Figure C.5: Proposed Powerhouse Site

(Block Plantation near the Bong Pond Visible in the Background)

**Figure C.6: Old Banyan Tree near Tailrace end**

Figure C.7: Public Consultation in the Project Area



Figure C.8: Public Consultation in the Project Area



Figure C.9: Public Consultation in the Project Area



Figure C.10: Public Consultation in the Project Area



Figure C.11: Public Consultation in the Project Area



Figure C.12: A Popular Pastime Activity in the Project Area



Appendix D: Wildlife of the Project Area

This appendix provides lists of the wildlife species reported from the project area and its surroundings. Citation in the Main Report: **Section 4.2.3**

D.1 Local Mammals

- ▶ Long-eared Hedgehog *Hemiechinus collaris*
- ▶ Musk shrew *Suncus murinus*
- ▶ Fruit bats *Pteropus giganteus* & *Rousettus leschenaultia*
- ▶ Rat-tailed Bat *Rhinopoma hardwickii*
- ▶ False Vampire *Megaderma lyra*
- ▶ Pipistrelle *Pipistrellus ceylonicus*, *P. tenuis*
- ▶ Yellow bat *Scotophyllus heathii*
- ▶ Indian Pangolin *Manis crassicaudata*
- ▶ Jackal *Canis aureus*
- ▶ White-footed fox *Vulpes vulpes*
- ▶ Indian Otter *Lutrogale perspicillata*
- ▶ Small Indian Civet *Viverricla indica*
- ▶ Small Indian Mongoose *Herpestes javanicus*
- ▶ Indian grey mongoose
- ▶ Jungle cat *Felis chaus*
- ▶ Wild boar *Sus scrofa*
- ▶ Desert hare
- ▶ Five-striped squirrel *Funambulus pennenti*
- ▶ Porcupine *Hystrix*
- ▶ Soft-furred rat *Millardia meltada*
- ▶ House rat *Rattus rattus*
- ▶ House mouse *Mus musculus*
- ▶ Indian bush rat *Golunda ellioti*
- ▶ Lesser bandicoot *Bandicota bengalensis*
- ▶ Short-tailed mole rat *Nesokia indica*
- ▶ Balochistan gerbil *Gerbillus nanus*
- ▶ Indian gerbil
- ▶ Jird *Meriones hurrianae*

D.2 Local Birds

These breed here and remain throughout the year:

- ▶ Little Grebe *Tachybaptus ruficollis*. (wetlands)
- ▶ Night Heron *Nycticorax nycticorax* (wetlands & trees)
- ▶ Indian pond Heron or Paddy Bird *Ardeola grayii*. (wetlands & trees)
- ▶ Cattle Egret *Bubulcus ibis*. (wetlands & trees)
- ▶ Little Egret *Egretta garzetta*. (wetlands & trees)
- ▶ Purple Heron *Ardea purpurea*. (wetlands)
- ▶ Crested Honey Buzzard *Pernis ptilorhynchus* (Trees)
- ▶ Black-shouldered or Black-winged Kite *Elanus caeruleus* (Agriculture & wetlands)
- ▶ Indian Kite or Pariah Kite *Milvus migrans* (Urban vicinity)
- ▶ Brahminy Kite *Haliastur Indus* (wetlands)
- ▶ Egyptian or Scavenger Vulture *Neophron percnopterus* (Urban vicinity)
- ▶ Oriental White-backed Vulture *Gyps bengalensis* (General area)
- ▶ Short-toed Eagle *Circaetus gallicus* (irregular year round visitor)
- ▶ Shikra or Indian Sparrow Hawk *Accipiter badius* (Agriculture)
- ▶ White-eyed Buzzard *Butastur teesa* (General area)
- ▶ Tawny Eagle *Aquila rapax vindhiana* (General area)
- ▶ Red-headed Merlin or Turumtee *Falco chiquera* (Agriculture)
- ▶ Black Partridge *Francolinus francolinus* (Agriculture & riverain)
- ▶ Grey Partridge *Francolinus pondicerianus* (Dry areas)
- ▶ Moorhen *Gallinula chloropus* (wetlands)
- ▶ Red-wattled Lapwing *Hoplopterus indicus* (wetlands)
- ▶ Blue Rock Pigeon *Columba livia* (urban & Agriculture)
- ▶ Indian Ring Dove *Streptopelia decaocto* (Agriculture)
- ▶ Little Brown Dove *Streptopelia senegalensis* (Agriculture)
- ▶ Common or Yellow-footed Green Pigeon *Treron phoenicoptera* (trees)
- ▶ Alexandrine or Large Indian Parakeet *Psittacula eupatria* (Agriculture)
- ▶ Rose-ringed Parakeet *Psittacula krameri* (Agriculture)
- ▶ Greater Coucal or Common Crow-pheasant *Centropus sinensis* (wetlands)
- ▶ Spotted Owlet *Athene brama* (Agriculture)
- ▶ Little Swift or House Swift *Apus affinis*

- ▶ White-breasted Kingfisher *Halcyon smyrnensis* (wetlands)
- ▶ Eurasian Common Kingfisher *Alcedo atthis* (wetlands)
- ▶ Pied Kingfisher *Ceryle rudis* (wetlands)
- ▶ Little Green Bee-eater *Merops orientalis* (Agriculture)
- ▶ Indian Roller *Coracias benghalensis* (Agriculture)
- ▶ Hoopoe *upupa epops* (Agriculture & Urban)
- ▶ Coppersmith or Crimson-breasted Barbet *Megalaima haemacephala*
- ▶ Golden-backed Woodpecker *Dinopium benghalensis* (Agriculture & Urban)
- ▶ Sindh Pied Woodpecker *Dendrocopos assimilis* (Agriculture & Urban)
- ▶ Indus Sand Lark *Clandrella raytal* (Riverain)
- ▶ Crested Lark *Galerida cristata* (General area)
- ▶ Small Skylark *Alauda gulgula* (General area)
- ▶ Indian Sand Martin *Riparia paludicola*
- ▶ Indian Cliff Swallow *Hirundo fluvicola*
- ▶ Richard's Pipit *Anthus novaeseelandiae*
- ▶ Large Pied Wagtail *Monticilla maderaspatensis*
- ▶ Small Minivet *Pericrocotus cinnamomeus* (Agriculture & Urban)
- ▶ White-cheeked Bulbul *Pycnonotus leucogenys*
- ▶ Red-vented Bulbul *Pycnonotus cafer* (Agriculture & Urban)
- ▶ Indian Magpie Robin *Copsychus saularis* (Agriculture & Urban)
- ▶ Plumbeous Redstart *Rhyacornis fuliginosus*
- ▶ White-tailed Bush-chat *Saxicola leucura*
- ▶ Pied Bush-Chat *Saxicola caprata*
- ▶ Indian Robin *Saxicoloides fulicata* (Agriculture & Urban)
- ▶ Fan-tailed Warbler *Cisticola juncidis* (Agriculture & Urban)
- ▶ Ashy-grey Wren Warbler *Prinia hodgsonii* (Agriculture & Urban)
- ▶ Rufous-fronted Wren Warbler *Prinia buchanani* (Agriculture & Urban)
- ▶ Tawny or Plain-coloured *Prinia inornata* (Agriculture & Urban)
- ▶ Ashy long-tailed Warbler or Ashy wren Warbler *Prinia socialis* (Agriculture & Urban)
- ▶ Yellow-bellied Wren Warbler *Prinia flaviventris* (Agriculture & Urban)
- ▶ Long-tailed Grass Warbler *Prinia burnesii* (Agriculture & Urban)
- ▶ Tailor Bird *Orthotomus sutorius* (Agriculture & Urban)
- ▶ Yellow-rumped Leaf Warbler *Phylloscopus proregulus* (Agriculture & Urban)

- ▶ Brown Flycatcher *Muscicapa latirostris* (Agriculture & Urban)
- ▶ White-throated Fantail Flycatcher *Rhipidura albicollis* (Agriculture & Urban)
- ▶ Yellow-eyed Babbler *Chrysomma sinense*
- ▶ Common Babbler *Turdoides caudatus* (Agriculture & Urban)
- ▶ Jungle Babbler *Turdoides striatus* (Agriculture & Urban)
- ▶ Oriental White-eye *Zosterops palpebrosa* (Agriculture & Urban)
- ▶ Bay-backed Shrike *Lanius vittatus*
- ▶ Rufous-backed Shrike *Lanius schach*
- ▶ Great Grey Shrike *Lanius excubitor*
- ▶ Black Drongo *Dicrurus macrocercus* (Agriculture & Urban)
- ▶ Indian Tree Pie *Dendrocitta vagabunda* (Agriculture & Urban)
- ▶ House Crow *Corvus splendens* (Urban)
- ▶ Common Myana *Acridotheres tristis* (Agriculture & Urban)
- ▶ Bank Myana *Acridotheres ginginianus* (Agriculture & Urban)
- ▶ House Sparrow *Passer domesticus* (Agriculture & Urban)
- ▶ Yellow-throated Sparrow *Petronia xanthocollis*
- ▶ Indian Baya *Ploceus philippinus*
- ▶ Streaked Weaverbird *Ploceus manyar*
- ▶ Silverbill or White-throated Munia *Lonchura malabarica*

D.3 Winter Migrants from Northern Latitudes or Long Distance Winter Visitors

- ▶ Great crested Grebe *Podiceps cristatus* (reservoir)
- ▶ Great or Eurasian Cormorant *Phalacrocorax carbo* (reservoir)
- ▶ Little or Javanese Cormorant *Phalacrocorax niger* (reservoir)
- ▶ Chinese or yellow Bittern *Ixobrychus sinensis* (wetlands)
- ▶ Large Egret *Egretta alba* (wetlands & agriculture)
- ▶ Grey Heron *Ardea cinerea* (wetlands)
- ▶ Common Teal *Anas crecca* (wetlands)
- ▶ Mallard *Anas platyrhynchos* (wetlands)
- ▶ Pintail Duck *Anas acuta* (wetlands)
- ▶ Garganey *Anas querquedula* (wetlands)
- ▶ Shoveler *Anas clypeata* (wetlands)
- ▶ Common Pochard *Aythya ferina* (wetlands)

- ▶ Eurasian Griffon Vulture *Gyps fulvus* (General area)
- ▶ Hen Harrier *Circus cyaneus* (wetlands & Agriculture)
- ▶ Pallid Harrier *Circus macrourus* (wetlands & Agriculture)
- ▶ Marsh Harrier *Circus aeruginosus* (wetlands)
- ▶ Greater Spotted Eagle *Aquila clanga* (General area)
- ▶ Steppe Eagle *Aquila rapex nipalensis* (General area & urban vicinity)
- ▶ Common Quail *Coturnix coturnix* (Agriculture)
- ▶ Water Rail *Rallus aquaticus* (wetlands)
- ▶ Spotted Crake *Porzana porzana* (wetlands)
- ▶ Ballion's Crake *Porzana pusilla* (wetlands)
- ▶ Ruddy Crake *Porzana fusca* (wetlands)
- ▶ Coot *Fulica atra* (wetlands)
- ▶ Little Ringed Plover *Charadrius dubius*(wetlands)
- ▶ Kentish Plover *Charadrius alexandrius*(wetlands)
- ▶ White-tailed Lapwing *Chettusia leucura*(wetlands)
- ▶ Green Plover or Lapwing or Peewit *Vanellus vanellus*(wetlands)
- ▶ Timminck's Stint *Calidris temminckii*(wetlands)
- ▶ Ruff (& Reeve) *Philomachus pugnax*(wetlands)
- ▶ Jack Snipe *Lymnocyrtus minimus*(wetlands)
- ▶ Common Snipe *Gallinago gallinago* (wetlands)
- ▶ Spotted or Dusky Redshank *Tringa erythropus* (wetlands)
- ▶ Greenshank *Tringa nebularia* (wetlands)
- ▶ Green Sandpiper *Tringa ochropus* (wetlands)
- ▶ Wood Sandpiper *Tringa glareola* (wetlands)
- ▶ Common Sandpiper *Actitis hypoleucos* (wetlands)
- ▶ Black-headed Gull *Larus ridibundus* (wetlands)
- ▶ Common Gull *Larus canus* (wetlands)
- ▶ Lesser Black-backed Gull *Larus fuscus* (wetlands)
- ▶ Caspian Tern *Sterna caspica* (wetlands)
- ▶ Indian River Tern *Sterna aurantia* (wetlands)
- ▶ Black-bellied Tern *Sterna acuticauda* (wetlands)
- ▶ Whiskered Tern *Chlidonias hybridus* (wetlands)
- ▶ Indian Skimmer or Scissorbill *Rhynchops albicollis* (wetlands)

- ▶ Eurasian skylark *Alauda arvensis* (General area)
- ▶ Collard Sand Martin *Riparia riparia* (dry areas)
- ▶ Tawny Pipit *Anthus campestris* (wetlands)
- ▶ Rosy Pipit *Anthus roseatus* (wetlands)
- ▶ Water Pipit *Anthus spinoletta* (wetlands)
- ▶ Blue-headed Yellow Wagtail *Motacilla flava bema* (wetlands)
- ▶ Yellow-headed black-collared Wagtail *Motacilla citreola* (wetlands)
- ▶ Grey Wagtail *Motacilla cinerea* (wetlands)
- ▶ Pied Wagtail *Motacilla alba* (wetlands)
- ▶ Rufous-backed Redstart *Phoenicurus erythronotus*
- ▶ Cetti's Warbler *Cettia cetti* (Agriculture)
- ▶ Moustached Sedge Warbler *Acrocephalus melanopogon*(Agriculture)
- ▶ Paddy-field Warbler *Acrocephalus agricola*(Agriculture)
- ▶ Southern Great Reed Warbler *Acrocephalus stentoreus*
- ▶ Booted Warbler *Hippolais caligata*(Agriculture)
- ▶ Dark-throated Thrush *Turdus ruficollis* (Agriculture)
- ▶ Greenish Warbler or Dull Green Leaf Warbler *Phylloscopus torchiloides* (Agriculture)
- ▶ Brown Chiffchaff *Phylloscopus collybita*(Agriculture)
- ▶ Goldcrest *Regulus regulus*(Agriculture) (Agriculture)
- ▶ Slaty-blue Flycatcher *Ficedula tricolor*(Agriculture)
- ▶ Rook *Corvus frugilegus*(Agriculture)
- ▶ Raven *Corvus corax*(Agriculture)
- ▶ Common Starling *Sturnus vulgaris* (Agriculture & Urban) (Agriculture)

D.4 Winter Migrants from Mountains

- ▶ Himalayan Griffon Vulture *Gyps himalayensis* (General area)
- ▶ Long-legged Buzzard *Buteo rufinus* (General area)
- ▶ Booted Eagle *Hieraaetus pennatus* (General area)
- ▶ Oriental Turtle Dove *Streptopelia orientalis* (Agriculture)
- ▶ Spotted Dove or Chinese Dove *Streptopelia chinensis* (Agriculture)
- ▶ Blossom-headed Parakeet *Psittacula cyanocephala* (Agriculture)
- ▶ Short-eared Owl *Asio flammeus*(Agriculture)
- ▶ Wryneck *Jynx torquilla* (Agriculture)

- ▶ Barn or Common Swallow *Hirundo rustica*
- ▶ Long-tailed Minivet *Pericrocotus ethologus*(Agriculture)
- ▶ Black-throated Accentor *Prunella atrogularis*(Agriculture)
- ▶ Blue-throat *Luscinia svecica* (wetlands)
- ▶ Indian Blue Robin *Luscinia brunnea*
- ▶ Orange flanked Bush Robin *Tarsiger cyanurus*. (Agriculture)
- ▶ Blue-headed Redstart *Phoenicurus caeruleocephalus*
- ▶ Black Redstart *Phoenicurus ochruros*
- ▶ White-capped Redstart *Chaimarrornis leucocephalus*
- ▶ Dark-grey Bush-Chat *Saxicola ferrea*(Agriculture)
- ▶ Blue Rock Thrush *Monticola solitarius*(Agriculture)
- ▶ Blue Whistling Thrush *Myiophonus caeruleus*(Agriculture)
- ▶ Grey-winged Blackbird *Turdus boulboul*(Agriculture)
- ▶ Lesser Whitethroat *Sylvia curruca* (Agriculture)
- ▶ Tytler's or Slender billed Leaf Warbler *Phylloscopus tytleri*(Agriculture)
- ▶ Brook's Leaf Warbler *Phylloscopus subviridis*(Agriculture)
- ▶ Yellow-browed Leaf Warbler *Phylloscopus inornatus* (Agriculture)
- ▶ Sulphur-bellied Warbler *Phylloscopus griseolus*(Agriculture)
- ▶ Grey-headed Flycatcher *Culicicapa ceylonensis*(Agriculture)
- ▶ Yellow-bellied Fantail Flycatcher *Rhipidura hypoxantha*(Agriculture)
- ▶ Great Tit *Parus major* (Agriculture)
- ▶ Wall Creeper *Tichodroma muraria*(Agriculture)
- ▶ Bar-tailed or Himalayan Tree-creeper *Certhia himalayana*(Agriculture)
- ▶ Spotted Munia *Lonchura punctulata*(Agriculture)
- ▶ Common Rosefinch or Scarlet Grosbeak *Carpodacus erythrinus* (Agric)
- ▶ Rock Bunting *Emberiza cia* (Agriculture)
- ▶ Reed Bunting *Emberiza schoeniclus* (Agriculture)
- ▶ Red-headed Bunting *Emberiza bruniceps*(Agriculture)

D.5 Winter from Western Mountains

- ▶ Bonelli's Eagle *Hieraaetus fasciatus* (Agriculture)
- ▶ Orphean Warbler *Sylvia hortensis*(Agriculture)
- ▶ Plain Leaf Warbler *Phylloscopus neglectus*
- ▶ Isabelline Shrike *Lanius isabellinus*(Agriculture)

D.6 Summer Migrants from South or East

- ▶ Black-breasted Quail or Rain Quail *Coturnix coromandelica* (Agriculture)
- ▶ Indian Little Button Quail or Little Bustard Quail *Turnix sylvatica* (wetlands)
- ▶ Yellow-legged Button Quail *Turnix tanki* (wetlands)
- ▶ Pheasant-tailed Jacana *Hydrophasianus chirurgus*
- ▶ Black-winged Stilt *Himantopus himantopus* (wetlands)
- ▶ Small Indian Pratincole *Glareola lactea* (wetlands)
- ▶ Red Turtle Dove *Streptopelia tranquebarica* (Agriculture)
- ▶ Pied Crested Cuckoo *Clamator jacobinus* (Agriculture)
- ▶ Common Hawk Cuckoo *Hierococcyx varius* (Agriculture)
- ▶ Indian or Short-winged Cuckoo *Cuculus micropterus* (Agriculture)
- ▶ Koel *Eudynamis scolopacea* (Agriculture)
- ▶ Savanna or Allied Nightjar *Caprimulgus affinis* (grassy areas)
- ▶ Blue-cheeked Bee-eater *Merops superciliosus* (Agriculture)
- ▶ Wire-tailed Swallow *Hirundo smithii* (Urban)
- ▶ Purple Sunbird *Nectarinia asiatica* (Agriculture)
- ▶ Golden Oriole *Oriolus oriolus* (Agriculture)

D.7 Passage Migrants in Autumn

- ▶ Kashmir Roller *Coracias garrulus* (Agriculture)
- ▶ Blue-headed Rock Thrush *Monticola cinclorhyncha* (Agriculture)

D.8 Passage Migrants in Spring

- ▶ Rosy Pastor *Sturnus roseus*

D.9 Double Passage Migrants

- ▶ Black Stork *Ciconia nigra* (wetlands)
- ▶ White Stork *Ciconia ciconia* (wetlands)
- ▶ Bar-headed Goose *Anser indicus* (wetlands)
- ▶ Ruddy Shelduck *Tadorna ferruginea* (wetlands)
- ▶ Common Shelduck *Tadorna tadorna* (wetlands)
- ▶ Wigeon *Anas Penelope* (wetlands)
- ▶ Red-crested Pochard *Netta rufina* (wetlands)
- ▶ White-eyed Pochard or Ferruginous Duck *Aythya nyroca* (wetlands)
- ▶ Tufted duck *Aythya fuligula* (wetlands)

- ▶ Goosander *Mergus merganser* (wetlands)
- ▶ Goshawk *Accipiter gentiles* (Agriculture)
- ▶ Eurasian Sparrow Hawk *Accipiter nisus* (Agriculture)
- ▶ Grey or Black-bellied Plover *Pluvialis squatarola* (wetlands)
- ▶ Little Stint *Calidris minuta* (wetlands)
- ▶ Redshank *Tringa tetanus* (wetlands)
- ▶ Tree Pipit *Anthus trivialis* (wetlands)
- ▶ Stonechat or Collard Indian Bush-Chat *Saxicola torquata*
- ▶ Blyth's Reed Warbler *Acrocephalus dumetorum*
- ▶ Green Warbler *Phylloscopus nitidus*(Agriculture)
- ▶ Red-breasted Flycatcher *Ficedula parva*(Agriculture)
- ▶ Asian Paradise Flycatcher *Terpsiphone paradisi*(Agriculture)

D.10 Reptiles

Snakes: The species are likely to be found in the project area:

- Nonpoisonous snakes
 - ▶ Thread snake Ramphotyphlops braminus
 - ▶ Blind snake Typhlops porrectus
 - ▶ Blind snake Leptotyphlops blanfordi
 - ▶ Blind snake Leptotyphlops macrorhynchus
 - ▶ John's sand Boa Eryx johnei
 - ▶ Royal snake Spalerosophis diadema
 - ▶ Wolf snake Lycodon aulicus
 - ▶ Cat snake Bioga trigonata
 - ▶ Oligodon taeniolatus
 - ▶ Common Kukri snake Oligodon arnensis
 - ▶ Rat snake Ptyas mucosus
 - ▶ Xenochrophis picator
- Poisonous snakes
 - ▶ Krait Bungarus caeruleus
 - ▶ Cobra Naja naja
 - ▶ Saw-scaled viper Echis crinatus

- Lizards

- ▶ Garden Lizard *Calotes versicolor*
- ▶ Mabuya *macularia*
- ▶ Spotted skink *Riopa punctata*
- ▶ Gecko *Gymnodactylus scaber*
- ▶ Brook's Gecko *Hemidactylus brooki*
- ▶ House Gecko *Hemidactylus flaviridis*
- ▶ Monitor Lizard *Varanus bengalensis*

- Turtles

- ▶ Indus mud turtle *Lissemys punctata*
- ▶ Soft-shell turtle *Trionyx gangeticus*

D.11 Fish Fauna of Jhelum River

- ▶ Rahu fish *Labeo rohita*
- ▶ Kalbans Fish *Labeo calbasu*
- ▶ Srereha Fish *Labeo gonius*
- ▶ Thela Fish *Catla catla*
- ▶ Mori or Mirgil Fish *Cirrhinus mirgala*
- ▶ Khurni Fish *Barbodes sarana*
- ▶ Malli Fish *Wallago attu*
- ▶ *Pafta fish* *Ompok bimaculatus*
- ▶ Sol Fish *Channa marulius*
- ▶ Bam fish *Mastacembelus*

D.12 Fauna of the Project Site

- Mammals

- ▶ Musk shrew *Suncus murinus* (Urban)
- ▶ Jackal *Canis aureus* (Urban vicinity)
- ▶ Small Indian Mongoose *Herpestes jawanicus* (Agriculture)
- ▶ Wild boar *Sus scrofa* (Riverain)
- ▶ Jungle cat *Felis chaus* (Riverain)
- ▶ Five-striped squirrel *Funambulus pennenti* (Agriculture)
- ▶ Porcupine *Hystrix indica* (Agriculture)

- ▶ House rat *Rattus rattus* (Urban)
- ▶ House mouse *Mus musculus* (Urban)
- Resident Birds
 - ▶ Little Grebe *Tachybaptus ruficollis* (wetlands)
 - ▶ Night Heron *Nycticorax nycticorax* (wetlands & trees)
 - ▶ Indian Pond Heron or Paddy bird *Ardeola grayii* (wetlands & trees)
 - ▶ Cattle Egret *Bubulcus ibis* (wetlands & trees)
 - ▶ Little Egret *Egretta garzetta* (wetlands & trees)
 - ▶ Greater Coucal or Common Crow-pheasant *Centropus sinensis* (wetlands)
 - ▶ Moorhen *Gallinula chloropus* (wetlands)
 - ▶ Red-wattled Lapwing *Hoplopterus indicus* (wetlands)
 - ▶ Blue Rock Pigeon *Columba livia* (urban & Agriculture)
 - ▶ Indian Ring Dove *Streptopelia decaocto* (Agriculture)
 - ▶ Little Brown Dove *Streptopelia senegalensis* (Agriculture)
 - ▶ Alexandrine or Large Indian Parakeet *Psittacula eupatria* (Agriculture)
 - ▶ Rose-ringed Parakeet *Psittacula krameri* (Agriculture)
 - ▶ Spotted Owlet *Athene brama* (Agriculture)
 - ▶ White-breasted Kingfisher *Halcyon smyrnensis* (wetlands)
 - ▶ Eurasian Common Kingfisher *Alcedo atthis* (wetlands)
 - ▶ Pied Kingfisher *Ceryle rudis* (wetlands)
 - ▶ Little Green Bee-eater *Merops orientalis* (Agriculture)
 - ▶ Red-vented Bulbul *Pycnonotus cafer* (Agriculture)
 - ▶ Pied Bush-Chat *Saxicola caprata* (Agriculture)
 - ▶ Common Babbler *Turdoides caudatus* (Agriculture)
 - ▶ Jungle Babbler *Turdoides striatus* (Agriculture)
 - ▶ Indian Tree Pie *Dendrocitta vagabunda* (Agriculture)
 - ▶ House Crow *Corvus splendens* (Urban)
 - ▶ Common Myana *Acridotheres tristis* (Urban)
 - ▶ Bank Myana *Acridotheres ginginianus* (Agriculture & Urban)
 - ▶ House Sparrow *Passer domesticus* (Urban and Agriculture)

D.13 Migratory Birds

- ▶ Koel *Eudynamys scolopaceus* (Agriculture)

- ▶ Indian River Tern *Sterna aurantia* (wetlands)
- ▶ Asian Paradise Flycatcher *Terpsiphone paradisi*

Appendix E



A subsidiary of The Hub Power Company Limited

84 MW New Bong Escape Hydropower Project

March 2009

Resettlement and Entitlement Framework (REF)

**Prepared by: Sustainable Solutions (Pvt.) Limited
Islamabad**

List of Abbreviations

AJ&K	Azad Jammu & Kashmir
CCR	Community Complaint Register
DPAC	District Price Assessment Committee
DRO	District Revenue Officer
EMP	Environmental management Plan
EPC	Engineer Procure and Construct
ESOHS	Environmental and Social and Occupational Health and Safety
ESSA	Environment and Social Soundness Assessment
GOAJK	Government of Azad Jammu & Kashmir
GRM	Grievance Redressal Mechanism
IFC	International Finance Corporation
IR	Involuntary Resettlement
LAA	Land Acquisition Act
LAC	Land Acquisition Collector
LEL	Laraib Energy Limited
M&E	Monitoring And Evaluation
NBE	New Bong Escape
NRP	National Resettlement Policy
O&M	Operation and Maintenance
PAPs.	Project Affected Persons
PD	Project Director
PM	Project Manager
RAP	Resettlement Action Plan
REF	Resettlement Entitlement Framework
UJC	Upper Jehlum Canal

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1 Key Socioeconomic Features and Resettlement Issues

1.1 General Characteristics

Administratively, the project area falls under the jurisdiction of the Government of Azad Jammu and Kashmir (GOAJK), with its seat of government in Muzafarabad, the capital city of Azad Jammu & Kashmir (AJ&K). The total population of the study area in and around the project site is estimated as 73,000 persons, residing in about 21 villages. The average family size varies from 5 to 7 members. The land holding is generally small and for those relying only on such holdings the standard of living is barely up to subsistence levels. Jhelum and Mirpur town are the closest urban centers for items of daily use and civic facilities. The communities' leisure time activities include horse racing, football, cricket, kabaddi, cards and general gossip. Other pass time activities of people are cock and dog fighting and hunting of birds etc as mentioned in public consultations.

Much like rest of the AJ&K, male members of the family in the project area are the breadwinners, both in rural and urban areas. Of the total AJ&K male population, on an average 47 % are economically active, while the remaining 53 % are inactive. Among them 25 % are under the age of 10; remaining are students, domestic workers, landlords, property owners, retired persons, disabled and unemployed. The larger part of the rural population belongs to middle or lower middle class due to small landholdings and barani (rain-fed) area. The population of the Mirpur district is relatively better off, because many people from these areas are settled in European countries, and support their families through remittances.

On an overall basis, the old socio-cultural habits of the people are being affected by greater awareness and education, and are being replaced by new ideas and approach to the life; however, lack of modern facilities, amenities and absence of job opportunities in or near the villages is promoting trend of migration towards urban areas like Mirpur, Mangla and Jhelum; and quite often to locations outside Pakistan where the community has close family relations. Modern farming and irrigation techniques are slowly permeating into the rural areas and changing age old farming patterns. Education facilities are generally available but are not up to the reasonable standards and are inadequate. People are willing to educate their children but due to lack of adequate schools and colleges, families which can afford send their children to nearby towns.

1.2 Income sources and occupations

The local economy in the project area is based on three sources of income i.e. service sector, foreign remittances and farming followed by small business enterprises, commercial, and industrial activities.

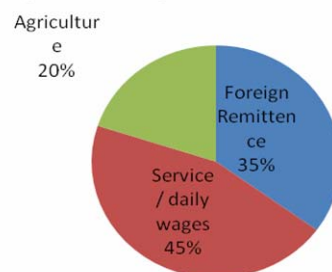
Unlike other rural areas in the country, people do not rely on farming as their major source of earning. Foreign remittances and the service sector contribute significantly to the local economy. The project area is relatively well off as compared to other rural areas of Pakistan and AJ&K. The main source of income is services (45%) followed by Foreign remittance (35%) and dependence on agriculture at some 20% is minimal. It has been observed that in relation to the social standing, there are significant number of well built houses financed by the affluent expatriate communities who are also remitting

cash to supplement local families thus leaving an impression of communities rich in terms of housing and income.

Source of Livelihoods

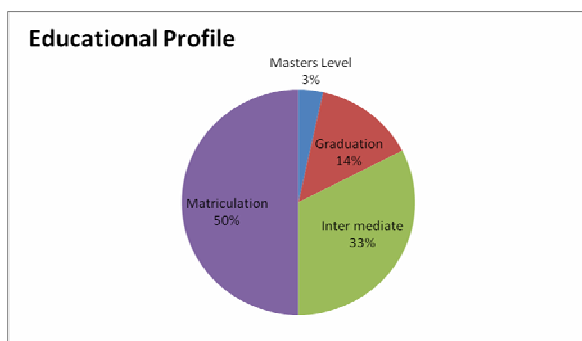
Sector	%age
Foreign Remittance	35
Service / daily wages	45
Agriculture	20

Major Occupations



1.3 Education

Primary and middle schools for boys and girls exist in each major village like Afzalpur, Lehri and Chaian etc. There is one high school and a college each for boys and girls. A college for Elementary Education is also situated in Afzalpur, which is one of the premier institutions in AJK.



Out of the total educated population from matric to masters, the literacy profile (based on the information gathered during public consultations and socioeconomic profiling) indicates that a small percentage (3%) of people have post graduate education up to masters

level, another 14% are graduates, followed by 33% intermediate (equivalent to A levels) and 50% educated up to matriculation levels (equivalent to O levels).

Education by level (in numbers)

Village	Masters Level	Graduation	Inter mediate	Matriculation
Lehri	1	10	20	15
Raja Chack	0	3	10	32
Chechian	1	10	40	60
Seem	0	15	35	60
Afzalpur	12	20	30	40
Total	14	58	135	207

1.4 Women Literacy and Gender Characteristics

The level of education among women is low as the society is generally conservative and women have limited access to education and other economic activities. Mostly women are associated with farming, embroidery and domestic chores. Out of the 207 surveyed people only 26 women reported to be graduates of which only 7 were educated up to masters' level.

Women have no formal role in the authority structure of the villages nearby the project site. They are about 38% of the population in these villages and the literacy rate is only about 15-20% (25-30% for males). There are a number of girls' primary schools but there are no facilities for higher education. Traditional attitudes of keeping girls away from school are slowly changing as in line with generally changing attitudes in mainstream Pakistan and families understand the benefits of basic education regardless of gender discrimination. However, as a general pattern most of the women stay home and only travel outside the village in case of visiting shrines, relatives, weddings or to go to hospitals in nearby towns.

1.5 Health

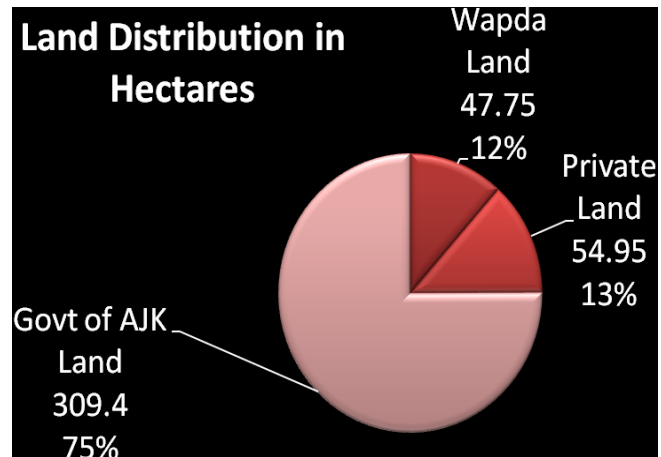
Due to the inadequacy of available health services, air and water borne disease like Malaria, Cholera, dysentery and tooth diseases are common. Few dispensaries and hospitals are available, however proper facilities like medicine and qualified doctors are not satisfactorily available. There is a District Headquarter Hospital in Mirpur for the entire population. People also have access to the military and civil hospitals in Mangla Cantt. There are two Mother and Child Health Centres in the area along with dispensaries and Lady Health workers who provide family planning services.

2 Resettlement and compensation

2.1 Land Acquisition

Apart from already leased 21.7 hectares of land from Government of AJ&K required for powerhouse, headrace and interconnection, an additional land of 412 hectares is required for the project tailrace which consists of both government and private land. Currently the land is under no use as it was submerged in river water after the 1992 flood.

The following two types of additional land to be acquired for the project are as under:



Government Land

A major portion of land is government property and would be leased to LEL, under Land Lease Notification to be issued by Government of AJ&K (President). There would be no land resettlement and action planning required for this land, as the land is owned by government and no squatters or encroachers currently use this land. Some 95% of this land is currently under flowing river water.

Private land

Since the land is under river water and has not economic value, it will not induce any physical or economic displacement of (Project Affected Persons) PAPs. Instead PAPs will receive cash payment for this land at the time of acquisition.

The historical background of the land is as below:

Presently completely under river water, the land once used to be owned and cultivated by local people and Government of AJK till 1992 flood. The 1992 flood changed the water course towards the villages which eroded the existing land and converted it into the river course. Before the flood of 1992, the land, now submerged in river water, had the following major categories according to the Revenue Department record:

1. Mera Awal : Land closed to the village
2. Mera Dom: Land far from village and starts after the category 1 above
3. Nehri: Irrigated through water Canals
4. Ghar Mumkin Darya: Land under water and impossible to be recovered
5. Banjar Qadeem: Barren land currently inside riverbed
6. Ghar Mumkin Bela: Barren land inside flow of river but at higher elevation
7. Ghar Mumkin Rohar: Land recovered after flood
8. Ghar Mumkin Nalah: Land through which flood passes
9. Ghar Mumkin Seem: Land not fit for Agriculture
10. Ghar Mumkin Rasta: Way in the riverbed

Currently the land has been categorized as one category i.e. Ghar Mumkin Daraya (river bed) that is land that cannot be used for any other purposes.

2.2 Boatmen to be affected by the Project

There are a few people (four in numbers) who are running boats at different points on Hari Channel. The boatmen are currently earning a fluctuated income of 100-150 Pakistani Rupees per day from commuters (10-15 nos @ Rs. 10) depending upon the number of commuters crossing the channel. The four boat men will potentially lose a fluctuating monthly income of Pak Rs. 3000-5000 during construction and operations of the project.

The affected boatmen should be compensated in lieu of their income loss as result of diversion of river and construction of dike along with Hari Channel. The following two types of compensations may be offered:

- I. Set up of small business
- II. Employment opportunity in the project

2.3 Access to land on the other side of the Hari Channel

The people in the villages on the left side of Hari channel have some ancestral lands and on the other side of the Hari channel. Their access to the lands will be increased as a result of the diversion of New Bong Escape to the River Jehlum and the economic activities including animal grazing, cultivation and plantation will be increased. The access will be disturbed / blocked after the construction of the power house and re flow of the water in excavated Hari channel.

2.4 Water rights of the communities

All the communities/ farmers along with the Hari Channel have water rights over the Upper Jehlum Canal (UJC) and will not be affected by the project as they do not pump, fetch or take water for irrigation or drinking from the Hari Channel all along its length in the project area.

2.5 Social Affects of temporary Diversion of New Bong Escape (NBE)

The New Bong Escape ("NBE") water flow will temporarily be diverted to Jhelum River during excavation of the existing water course in the Hari Channel. This would not have social implications as the water course will be on marginal land (riverbed) owned by the Government of AJK/Pakistan. This diversion will take place close to the head of the NBE and rejoins the old course at the end of the Hari Channel (end of project area) without any affects on existing human settlements, water rights of dwellers or, land use rights (both statutory and customary) of the local farmers.

2.6 Access to the land through construction of bridge

Access to the lands on other side of the Hari Channel will be ensured through construction of a foot bridge at a suitable site as determined by the local people in a

thorough consultative process. The bridge will be constructed by the end of the construction phase ready for use after commencement of commercial operations of the project.

3 Resettlement and Entitlement Framework

So far, there is no specific policy on resettlement in Pakistan and AJ&K. The Land Acquisition Act (LAA) deals with all aspects of land acquisition, and resettlement issues are addressed on project-by-project basis under special provisions made by the concerned Government, as mentioned above. In the absence of a formal policy to assist PAPs (including the non-titled persons), a project-specific set of resettlement principles has been adopted in this Project.

The basic resettlement principles and guidelines include the following:

- The PAPs are defined as those who stand to lose land, houses, structures, trees, crops, businesses, income, livelihood or access to assets/livelihood as a consequence of the proposed project activities;
- All PAPs are equally eligible for compensation and rehabilitation assistance, irrespective of land ownership status, to ensure that those affected by the project will be at least as well off, if not better off than they would have been without the Project;
- Absence of title will not be a bar for PAPs to receive compensation and rehab assistance except for compensation for land. Compensation for land will require a title;
- The compensation packages will reflect replacement costs for all losses (such as lands, crops, trees, structures, businesses, income, etc.);
- PAPs will be systematically informed and consulted about the project, and RP will be made available to the affected persons and communities;
- For land acquired under the LAA (1894), GoAJ&K has applied section 17(4) the (urgency clause) due to the urgent situation with regard to the project development, as the normal process could result in project delays; however, notwithstanding such measures, in accordance with the law, LEL will adopt transparent and equitable procedures to ensure that the community is not deprived of its rights
- For land purchased, the concept of willing buyer/willing seller at market price and with consensus of both parties will be used;
- For land located under the transmission towers, compensation will be paid for crops and only if the land becomes inaccessible and out of productive use, it will be purchased;
- All assets/infrastructure and livelihood negatively impacted will be compensated at replacement cost (salvage value will not be deducted);
- All community and religious sites affected by the project activities will be compensated or rebuilt;
- All public utilities affected/damaged by the project will be compensated; and
- All trees affected by the project will be compensated and affectees allowed salvaging the trees.

As stated above, damage to the crops (if any) at the time acquisition of land, will be fairly compensated.. However, an entitlement framework has been developed to address other possible resettlement issues. The REF takes care of all project impacts.

3.1 Loss of Agricultural Land

For the legal title holders, customary or usufruct rights holders, cash compensation of affected land would be paid through the Government on the basis of *willing seller-willing buyer* at the mutually agreed market value of the acquired land.

The tenants and sharecroppers (if any) will be compensated for the un-expired duration of the lease.

The vulnerable encroachers or squatters (if any) will be compensated for affected structure at the replacement cost.

3.2 Loss of Residential, Commercial or Institutional Land

The compensation entitlement in case of loss of residential, commercial or institutional land will essentially be similar to the one for the loss of agricultural land, described above.

The PAPs with legal title holders, customary or usufruct rights will be compensated on the basis of *willing seller-willing buyer* at the mutually agreed market value of the acquired land.

The tenants, if any, will be compensated for the un-expired duration of the lease.

The vulnerable encroachers or squatters (if any) will be compensated for affected structure at the replacement cost.

3.3 Loss of Residential, Commercial or Institutional Structure

The owners of any affected structures, with or without legal title, will be entitled to cash compensation at the replacement value (salvage value of the structure will not be deducted). In addition, an allowance will also be paid to the owner for the repairs of the remaining structure, if any.

3.4 Loss of Common Public Utilities/Facilities

In case of loss of any common resources like public utilities/facilities the affected facility or resource will be replaced or restored in consultation with the affected community.

3.5 Loss of standing crops

The affected cultivators will be entitled to cash compensation for the damaged crops calculated on the basis of market prices.

3.6 Loss of Trees

The owners of the affected trees, with or without land title, will be paid cash compensation, on the basis of market value of the trees according to the type, age, size and productivity of trees

3.7 Loss of Public Infrastructure

Cash compensation will be paid to the relevant agency based upon the replacement value of the affected infrastructure. Alternatively, the damaged infrastructure will be replaced or restored to the pre-project condition or better, in consultation with the concerned agency.

3.8 Loss of or Damage to Religious Sites

Cash compensation will be paid for the replacement cost of the religious sites, such as mosques. Alternatively, any affected religious sites will be reconstructed, in consultation with the affected community and cash compensation will be paid for the relocation of graves/shrines.

4 Applicable Policies, Guidelines and IFC Performance Standards

The implementation of the compensation program for this project will follow the requirements of Pakistan's Land Acquisition Act of 1894 and the IFC Performance Standards including the Land Acquisition and Involuntary Resettlement – Performance Standard 5, the IFC's Handbook for Preparing a Resettlement Action Plan and the World Bank Operational Policies (OPs 4.30) and Operational Directives (ODs 4.30) with respect to the resettlement and other social issues associated with the proposed project. The policy framework including Pakistani laws and IFC performance standards is explained below in the following paragraphs.

4.1 Law and Regulations on Land Acquisition and Resettlement

The Land Acquisition Act (LAA) of 1894 with its successive amendments from time to time is the main law and the defacto policy governing/regulating land acquisition for public purpose projects in Pakistan which has been adapted and enforced in AJ&K under the adaptation of Laws Act 1954

The LAA requires that following an impact assessment/valuation effort, land and crops should be compensated in cash at market rates to titled landowners and registered land tenants/users, respectively. Land valuation is to be based on the latest 3-5 years average registered land sale rates; Based on the LAA, only legal owners and tenants registered with the Land Revenue Department or with formal leases are eligible for compensation/livelihood support.

The Law-LAA comprises of 55 sections pertaining to area notifications and surveys of land and structures, acquisition, land awards and compensation and apportionment, and disputes resolution, penalties and exemptions.

The key sections of the LAA are briefly described below.

Section 3

According to this Section, land means land along with any superstructure, fixtures, etc, thereon and benefits accruing there from. For the purposes of the Act, land includes buildings, and also trees and standing crops. Land thus is a sum total of land plus benefits arising out of land plus all objects/things attached to or permanently fastened to anything attached to earth.

Section 4

The Section 4 is the first step in the land acquisition process under the LAA. Under this Section, a preliminary notice is served by the government expressing its desire to "enter upon" broadly identified private lands for surveying and soil-testing for the specified public purpose/s.

Requirements of publication of the notification under Section 4 are mandatory, and the acquisition proceedings would stand invalid if requisites of this section are not fully

satisfied. Notification of Section 4 is a public pronouncement by appropriate government officer, empowered to publish a notification to that effect in official gazette in order to put those who are affected or likely to be affected on due notice. It is an introductory measure and is tentative in its nature, as there is no finality or result in acquisition.

Purpose of Section 4 is to carry out preliminary investigation/land survey with a view to find out after necessary survey whether land was adapted for purposes for which it was sought to be acquired. The Section 4 puts owners of land on alert that land is to be acquired.

Section 5

The initial notification under the Section 4 is followed and confirmed by way of a second notification under Section 5 of the Act. Under this Section, the marking and measurement of the land and assessment of compensation is carried out. The cash compensation is assessed on the basis of five or three years average registered market rate, and is paid to the landowners for their lands being acquired.

Under Section 5, the owners of land or PAPs (interested persons as mentioned in the Act) or those likely to be affected, may raise objections over the intent of land acquisition or survey report to the competent authority within 30 days for the hearing of objections.

Section 6

Once an area in the locality is fixed to be acquired, it is notified by publishing the notification under Section 6 of the Act. The exact purpose of acquisition of land is also mentioned in the notification, and the land may be acquired only for the purpose thus specified. Any proposal for further acquisition in the same locality would have to be followed up by a fresh notification under Section 4.

Section 8

PAPs are made aware of the exact measurement of their respective lands/structures and the value of land under acquisition through issuance of notification under Section 8 of the Act.

Section 9

The government issues notice under Section 9 stating that the land is intended to be possessed and claims for compensation for all interests in the land may be made to the officer concerned and all persons interested/PAPs in the land should appear before him at a given place and time not being earlier than 15 days after the publication of said notice under Section 9.

Sections 10, 11 and 12

The Collector under Sections 11 and 12 based on the proceedings under Section 9 and 10 publicly declares/announces awards. Generally the award is declared at place where PAPs can get together and hear the award. PAPs can either accept the award or reject the award; however, in any case the PAPs have to sign the award mentioning whether they accept the award and the compensation offered therein or reject the award and sign under protest.

Section 17

Under this section, collector is authorized to acquire land on the basis of the situation declared as 'urgency situation' for public good on behalf of the government and can

avoid the formalities to be completed and to avoid any delay in proceedings. In such a situation, the collector under section 17(4) can pass an award without looking into or addressing the objections/complaints of PAPs.

Possession of Land

When the Collector has made an award under section 11/12, he may take possession of the land which shall thereupon vest absolutely in the government or acquiring department free from all encumbrances.

Under this Act-LAA, only legal owners and tenants officially registered with the Land Revenue Department or possessing formal lease agreements are considered 'eligible' for land compensation.

4.2 IFC's Performance Standards

Performance Standard 5 - Land Acquisition and Involuntary Resettlement

The Performance standard defines "Involuntary Resettlement" (IR) as both physical displacement (relocation or loss of shelter) and economic displacement (loss of assets or access to assets that leads to loss of income sources or means of livelihood) as a result of project-related land acquisition. IR is considered involuntary when affected individuals or communities do not have the right to refuse land acquisition those results in displacement. This occurs in cases of: (i) lawful expropriation or restrictions on land use based on eminent domain; 2 and ii) negotiated settlements in which the buyer can resort to expropriation or impose legal restrictions on land use if negotiations with the seller fail.

The standard requires that IR should be avoided or at least minimized. However, where it is unavoidable, appropriate measures to mitigate adverse impacts on displaced persons and host communities should be carefully planned and implemented. Objectives of the Performance Standard for Land Acquisition and Resettlement

- To avoid or at least minimize involuntary resettlement wherever feasible by exploring alternative project designs;
- To mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons' use of land by: (i) providing compensation for loss of assets at replacement cost; and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected;
- To improve or at least restore the livelihoods and standards of living of displaced persons; and
- To improve living conditions among displaced persons through provision of adequate housing with security of tenure at resettlement sites.

LEL will document all transactions to acquire land rights, as well as compensation measures and relocation activities. LEL will also establish procedures to monitor and evaluate the implementation of resettlement plans and take corrective action as necessary.

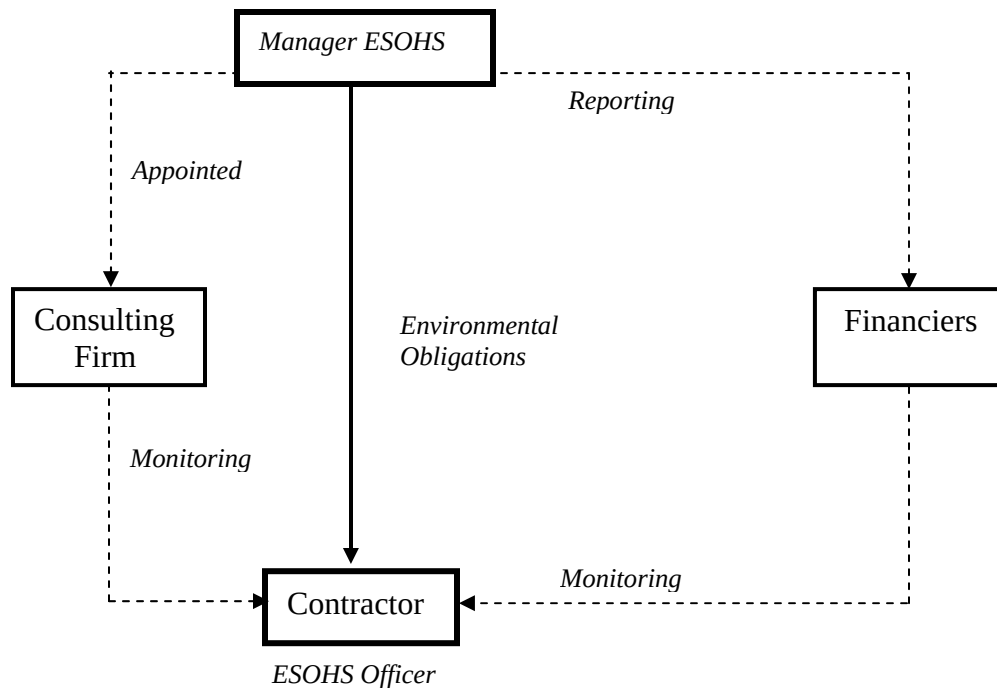
The procedures adopted by LEL in the REF are based on the Performance Standard that establishes the entitlements of affected persons or communities and ensures that these are provided in a transparent, consistent, and equitable manner.

To fully compensate resettlement impacts, LEL will follow the following guidelines of IFC Performance Standards and the Handbook for preparation of a Resettlement Action Plan:

- Promptly compensate economically displaced persons for loss of assets or access to assets at full replacement cost;
- In cases where land acquisition affects commercial structures, compensate the affected business owner for the cost of reestablishing commercial activities elsewhere, for lost net income during the period of transition, and for the costs of the transfer and reinstallation of the plant, machinery or other equipment;
- Provide replacement property (e.g., agricultural or commercial sites) of equal or greater value, or cash compensation at full replacement cost where appropriate, to persons with legal rights or claims to land which are recognized or recognizable under the national laws;
- Compensate economically displaced persons who are without legally recognizable claims to land for lost assets (such as crops, irrigation infrastructure and other improvements made to the land) other than land, at full replacement cost. The client is not required to compensate or assist opportunistic settlers who encroach on the project area after the cut-off date;
- Provide additional targeted assistance (e.g., credit facilities, training, or job opportunities) and opportunities to improve or at least restore their income-earning capacity, production levels, and standards of living to economically displaced persons whose livelihoods or income levels are adversely affected; and
- Provide transitional support to economically displaced persons, as necessary, based on a reasonable estimate of the time required to restore their income earning capacity, production levels, and standards of living.

5 Implementation Arrangements

During construction the site will be administered and controlled by the EPC Contractor and during operations by the O&M Organization. Accordingly, LEL's Environmental and Social and Occupational Health and Safety (ESOHS) obligations would be transferred to the EPC Contractor through contractual terms of the EPC Contract during the construction phase and to the O&M organization during the operational phase. LEL will be responsible to ensure that its environmental and social responsibilities delegated to the contractors are fully performed and satisfied and LEL intends to comply with its monitoring obligations through engaging an environmental consulting firm under contract. The interface at the LEL end will be the Manager ESOHS and at the contractors end will be through an social/environmental administrative structure headed by an ESOHS Officer.



In order to handle the environmental and social/resettlement matters during the proposed project; routine operations of the project, LEL will engage an Environmental and Social and Occupational Health and Safety Expert designated Manager ESOHS) within its own organizational set up for the project. The Manager ESOHS in LEL will coordinate environmental, social and occupational health and safety related requirements and activities. The outsourced ESOHS firm will monitor the obligations of the EMP/REF delegated to the contractors and will provide social and environmental advisory services to the project.

The EPC Contractor, during construction and the O&M organization during O&M will engage an ESOHS officer(s) to manage and implement the ESOHS obligations including implementation. LEL will ensure capacity building training, preparing implementation

manuals and for monitoring of the implementation of EMP/REF and a Resettlement Action Plan for the project through the hired social and environmental consulting firm

5.1 Grievance Redress Mechanism

An attempt has been made during the Environment and Social Soundness Assessment (ESSA) and while developing the Resettlement Entitlement Framework (REF), to identify all potential impacts of the proposed project, to identify all PAPs, to provide mitigation measures to address the potential impacts, and to chart out a mechanism to implement these mitigation measures (including payment of compensation).

However during the project implementation, the stakeholders (mostly the communities in the vicinity of the project sites/transmission line routes) may still have some grievances with respect to the project activities, their impacts, compensation and other mitigation measures. The key reasons of these grievances are listed below:

- PAPs not enlisted,
- Losses (such as damaged crops) not identified correctly,
- Compensation inadequate or inappropriate,
- Dispute about ownership,
- Delay in disbursement of compensation,
- Improper distribution of compensation in case of joint ownership
- Any other issue arising during the project implementation.

In order to address the above eventualities, the Grievance Redressal Mechanism (GRM) has been devised. The main objective of the GRM will be to provide a mechanism to mediate conflict and cut down on lengthy litigation, which often delays the infrastructure projects. It will also facilitate people who might have objections or concerns about their assistance, a public forum to raise their objections and through conflict resolution, address these issues adequately.

The main functions of the GRM will be as follows:

Provide a mechanism to the PAPs on problems arising as a result of project activities,

Record the grievance of the PAPs, categorize and prioritize the grievances that need to be resolved, and report to the aggrieved parties about the developments regarding their grievances and the decision of the project authorities.

Under the GRM, a Community Complaint Register (CCR) will be maintained by LEL at the sites to document all complaints received from the local communities.

The information recorded in the Register will include date of the complaint, particulars of the complainant, description of the grievance, actions to be taken, the person responsible to take the action, follow up requirements and the target date for the implementation of the mitigation measure. The register will also record the actual measures taken to mitigate these concerns.

As soon as a complaint is received, the LEL will discuss it with , the EPC Contractor and determine the remedial action.. Once the remedial action is decided, implementation responsibility as well as schedule will be determined.

The proposed remedial action will be documented in the CCR, with complete details (by whom and by when). The proposed remedial action will be shared with the complainant.

Similarly, the actual action taken will also be documented in the Register and shared with the complainant. The complainant's views on the remedial action taken will also be documented in the Register.

The CCR will be reviewed during the fortnightly meetings at the site during the project, and the action items discussed. The progress on the remedial actions will also be reviewed during the meetings.

The Register will also be shared with the EPC Project Manager and EPC ESOHS Officer on regular basis, for information and further action, if any.

In order to address any unresolved grievances at a higher level of the organization, a Grievance Redressal Committee (GRC) will be constituted. The Committee will be headed by the LEL PM, with ESOHS Manager, EPC Project Manager, ESOHS Officer as its other members along with representation from the affected community, local leaders and Government departments. Any unresolved issue will be sent to the Committee for determining the remedial action.

5.2 Environmental and Social Training

Environmental and social training will help to ensure that the requirements of the Resettlement Entitlement Framework / Environmental Management Plan / Resettlement Action Plan (REF/EMP/RAP) are clearly understood and followed by all project personnel throughout the project period. The primary responsibility for providing training to all project personnel will be that of the EPC Contractor and LEL for their own respective personnel. The environmental and social training program will be finalized during the detailed design phase. Training will cover all staff levels, ranging from the management and supervisory to the skilled and unskilled categories. The scope of the training will cover general environmental awareness and the requirements of the ESSA and the EMP/REF, with special emphasis on sensitizing the project staff to the environmental and social aspects of the area.

5.3 Public Disclosure

LEL will disclose the REF/EMP/RAP to all the stakeholders at the commencement of the proposed project. A Summary of REF/RAP/EMP will be prepared specifically for this purpose and translated into Urdu language, and provided to the affected communities (and also kept at the project sites). This will ensure that the local communities are aware of the project's benefits and provisions available for various types of PAPs, as given in the entitlement framework. In addition, the Summary REF/RAP/EMP will be disclosed through the LEL's official websites.

5.4 Monitoring and Evaluation

Resettlement Monitoring And Evaluation (M&E) system will be put in place in order to ensure that the REF/RAP is effectively implemented. The following aspects of the RP and resettlement process will be monitored during the proposed project:

- Number of PAPs and asset loss,

- Payment of compensation to the PAPs with category of loss;
- Land acquired by type, mode of acquisition and payment of compensation
- Timely disbursement of funds;
- Any outstanding issues and grievance monitoring.

The social monitoring framework and monitoring tools to be employed during the proposed project are discussed below.

Monitoring Plan

The objective of monitoring during the various phases of the proposed project will be as follows:

- Ensuring that the REF/RAP implementation procedure is fully complied with.
- Ensuring the effectiveness of the REF/RAP in minimizing the project's impacts related to involuntary resettlement.

To achieve these objectives, a comprehensive compliance monitoring plan will be in place. The compliance monitoring of the project activities will be carried out within the Contractors environmental management structure principally as a tool to ensure that the REF/RAP implementation procedure is strictly adhered to during the project execution.

Various aspects of the REF/RAP compliance monitoring will be an internal function of the EPC Contractor and will be designed to:

- Document and communicate the observations to the concerned person(s) of the SE Department, and contractors, so that any corrective measures, if required, can be taken in a timely fashion;
- Maintain a record of all incidents of social significance, related actions and corrective measures';
- Maintain contact with the communities, solicit their views and concerns, and discuss them during the fortnightly meetings;
- Prepare periodic reports of the RP implementation during the project;
- Compliance monitoring will be the responsibility of all organizations involved in the field activities.

In addition to the compliance monitoring discussed above, LEL will engage an independent consultant through ESOSH Firm to carry out the monitoring of REF/RAP (and EMP) implementation on periodical basis.

The objective of this monitoring is to validate the internal monitoring results, and specifically ensure that:

- REF/RAP (and EMP) is being adequately implemented,
- Mitigation measures are being implemented,
- Compliance and effects monitoring are being conducted,
- Environmental and social trainings are being conducted as planned, and
- Complete documentation is being maintained.

The LEL will periodically visit the sites (grid stations as well as the transmission line routes), examine the documentation maintained at the site, interview key site staff, make spot checks, take photographs where necessary, interview the PAPs, and meet with the communities. After each monitoring visits, the LEL will prepare a monitoring report. The report will include the observations made during the visits, highlight non-compliances observed, if any, salient information obtained from PAPs/communities, and make recommendations.

Monitoring Indicators

An indicative list of monitors is provided below, which will be used during monitoring in order to evaluate various aspects of the REF/RAP implementation.

- Total number of PAPs, broken down in gender groups and intensity of impacts;
- Number/area/type of affected assets;
- Amount of compensation estimated for land, crops, trees and other assets;
- Amount of compensation disbursed, broken down in by PAPs, assets;
- Number of persons compensated by types of losses;
- Number of persons not compensated as planned (with reason for the gap);
- Total numbers of grievances recorded;
- Total number of grievances addressed;
- Amount of land required;
- Amount of land purchased/state land acquired/acquired under LAA;
- Total number of transmission line towers in cultivated area;
- Total number of transmission line towers in cultivated area, with access available for the cultivators to the land under the tower;
- Total number of transmission line towers in cultivated area, with no access available for the cultivators to the land under the tower;
- Total number of non-compliances recorded (derived from the Compliance Monitoring Reports);
- Actions taken to address non-compliances;
- Total number of non-compliances recorded;
- Actions decided to address non-compliances identified;
- Actions taken to address non-compliances identified;
- Number of training sessions planned and undertaken by target groups and types of trainings.

Exhibit 1.1: Resettlement Entitlement Framework

Types of Loss	Entitled Persons	Compensation Entitlement	Other Options/Actions Proposed	Responsibilities
1. Loss of privately owned agricultural land	Legal owners with valid ownership title, customary, traditional or usufruct rights, as verified/updated by Revenue Record.	These persons (PAPs) will be entitled to: Cash compensation @ market value, as assessed by District Price Assessment Committee (DPAC) following the normal land acquisition process of Land Acquisition Act (LAA) of 1894 keeping in view the land type, productivity, location and value of past land transactions in the area. An extra amount equal to 15% of the total compensation amount will be paid to the PAPs, as LAA provides for compulsory acquisition of land and charges so payable to PAPs.	Project Proponent may also consider acquiring land and providing cash compensation to PAPs on the basis of a mutually agreed market value following the "willing buyer willing seller" principle. If LAA is used, land will not be acquired through urgency procedures, i.e. use of section 17/4 & 6 will not be applied in this project.	Land Acquisition Collector (LAC) LEL
	Tenants, sharecroppers or leaseholders.	PAPs will be entitled to: Reimbursement for remaining lease period. Compensation to tenants based on tenancy agreement with land owners. Compensation to sharecropper based on the agreement with land owner.	Cash compensation equal to market value of lost harvest to be shared with landowner based on the sharecropping contract. Consider providing cash compensation to leaseholders/tenants equivalent to market value of gross yield of affected land for the remaining lease period (minimum one year).	LAC & concerned Revenue Officials LEL
	PAPs without valid titles (encroachers and squatters).	PAPs will be entitled to: Cash compensation for the affected structures @ replacement value.	Consider providing 1 rehabilitation allowance equal to net market value of 1 harvest in addition to standard crop compensation for land use loss.	Revenue Officials. LEL/
2. Loss of residential, commercial, industrial or institutional land.	Legal owners/users with valid title, customary or usufruct rights.	<i>PAPs will be entitled to: Cash compensation @ market value to be assessed by DPAC and land acquisition process done by Land Acquisition Collector (LAC) through normal course of acquisition. An extra amount equal to 15% of the total compensation amount will be paid</i>	In case of dispute over the price, Project Proponent may also consider directly negotiated mutually acceptable price with PAPs following the "willing buyer and willing seller" principle.	LAC, LEL

		<i>to the PAPs, as LAA provides for compulsory acquisition of land and charges so payable to PAPs.</i>		
	<i>Squatters.</i>	<i>Cash compensation at replacement value for affected structures.</i>	Accommodation in a government resettlement area or self-relocation allowance: a) provision of a plot property in public resettlement area; b) provision of a plot leased in a public resettlement area; and c. provision of a self relocation allowance covering 1 year of livelihood. Specify relocation allowance?	LEL/
	Renter/Leaseholder.		Payment of the remaining lease period and three months rent allowance to cover transitional loss of income.	LEL/
3. Structures; residential, commercial, industrial or institutional	Owners of structures with or without legal title, customary, traditional or usufruct rights.	PAPs will be entitled to: Cash compensation for the affected structures or part of the affected structures at replacement value. Allowance to repair the remaining structure.	All such structures will be assessed by B&CD based on replacement cost and if the unaffected portion of the structure is economically not viable for use, compensation will be provided for full structure.	LAC/DPAC/B&CD LEL.
4. Loss of common resources and facilities	Households and communities in project area.	Replacement of common property resources/facilities in consultation with PAPs. Access to equivalent resources/facilities.	Compensation assessment, disbursement or replacement of resources/facilities will be done in consultation with PAPs District Revenue Office (DRO)	DRO B&CD LEL/
5. Loss of standing crops.	Households who cultivate the land.	PAPs will be entitled to: Cash compensation equivalent to the market value of damaged crops.	Crops will be assessed by Agriculture Department (AD).	DPAC AD LARAID/REF
6. Loss of trees.	Owners of affected trees irrespective of the title of land.	PAPs will be entitled to: Cash compensation equivalent to the market value of trees on the basis of type, age, and productivity.	Forest or wood trees will be assessed by Forest Department (FD) and fruit trees will be assessed by Horticulture Department (HD). Assessment will be based on the formula: type, age and the no. of years' productivity is obtained. However compensation will be at par with the market value of produce and wood.	FD/HD/DPAC LEL
7. Loss of public infrastructure/structures and services.	Relevant Departments/Agencies	Compensation in cash at replacement cost to respective agencies, or Restoration/repair of the damaged	Cost assessment will done by relevant department who own the structures, infrastructure and services, e.g.	Relevant Govt Concerned Departments,

		infrastructure in a similar or better condition as before.	telephone and electric poles, under ground fiber cable, bus stops and recreational places.	EPC Contractor LEL
8. Loss or damage to the community structures.	Communities and affected households in project area.	Replacement cost, shifting or construction of structures at appropriate places. E.g. mosques, graveyards, etc.	Costs and shifting locations will be finalized in consultation with communities and affected households.	LEL/ EPC Contractors.
9. Business/ Employment	PAPs losing income and small business enterprises (SMEs).	Business owner: If the loss is temporary cash compensation equal to 3 months income will be provided. In case of permanent loss of income, cash compensation for the business interruption period up to 6 months will be provided.	Job opportunity in the project will be offered to the owners of SBEs on preferential basis.	LEL/ EPC Contractors.
10. Relocation	PAPs whose structures are affected and need relocation.	Transport/transition livelihood costs	Provision of a relocation allowance of (Rs.17, 000) covering transport costs (Rs. 2,000) and a livelihood allowance of Rs. 5,000 covering livelihood costs for 3 months.	LEL EPC Contractors.
11. Vulnerability	Vulnerable households, e.g. women headed households, aged and minors and PAPs below party line.	One special allowance of Rs. 5,000/HH at par with income based on per capita per month, not less than official per capita income/month and or official poverty line.	Wherever possible, employment priority in project-related jobs.	LEL EPC Contractors

Exhibit 1.2: Glossary of Terms (Alphabetical order)

The table given below contains the resettlement terminology used in this Resettlement Entitlement Framework (REF). A number of resettlement terms used in the REF have been adopted from the *IFC's Handbook for Preparing a Resettlement Action Plan*. The terms used in the REF present respective working definitions and the conditions to which they apply.

S. #	Terms	Definitions and Conditions
1	Associated facility	Facilities that are essential to the construction or operation of an IFC-financed project but are not themselves financed by IFC. The IFC policy on involuntary resettlement may apply to resettlement induced by such facilities.
2	Compensation	Payment in cash or in kind for an asset or a resource that is acquired or affected by a project at the time the asset needs to be replaced.
3	Cut-off date	Date of completion of the census and assets inventory of persons affected by the project. Persons occupying the project area after the cutoff date are not eligible for compensation and/or resettlement assistance. Similarly, fixed assets (such as built structures, crops, fruit trees, and woodlots) established after the date of completion of the assets inventory, or an alternative mutually agreed on date, will not be compensated.
	Economic displacement	Loss of income streams/means of livelihood resulting from land acquisition or obstructed access to resources (land, water, or forest) resulting from the construction or operation of a project or its associated facilities.
4	Host population	People living in or around areas to which people physically displaced by a project will be resettled who, in turn, may be affected by the resettlement.
5	Involuntary resettlement	Resettlement is involuntary when it occurs without the informed consent of the displaced persons or if they give their consent without having the power to refuse resettlement.
6	Land expropriation	Process whereby a public authority, usually in return for compensation, requires a person, household, or community to relinquish rights to land that it occupies or otherwise uses
7	OD 4.30	OD 4.30 Refers to the World Bank Group Operational Directive on Involuntary Resettlement. OD 4.30 embodies the basic principles and procedures that underlie IFC's approach to involuntary resettlement associated with its investment projects.
8	Project-Affected Household (PAH)	All members of a household, whether related or not, operating as a single economic unit, who are affected by a project.
	Project-Affected Person (PAP)	Any person who, as a result of the implementation of a project, loses the right to own, use, or otherwise benefit from a built structure, land (residential, agricultural, or pasture), annual or perennial crops and trees, or any other fixed or moveable asset, either in full or in part, permanently or temporarily.
9	Project sponsor	A corporate entity seeking IFC financing for a project either directly or through a financial intermediary supported by IFC.
10	Physical displacement	Loss of shelter and assets resulting from the acquisition of land associated with a project that requires the affected person(s) to move to another location.

11	Replacement cost	The rate of compensation for lost assets must be calculated at full replacement cost, that is, the market value of the assets plus transaction costs. With regard to land and structures, IFC defines “replacement costs” as follows: • agricultural land—the market value of land of equal productive use or potential located in the vicinity of the affected land, plus the cost of preparation to levels similar to or better than those of the affected land, plus the cost of any registration and transfer taxes; • land in urban areas—the market value of land of equal size and use, with similar or improved public infrastructure facilities and services preferably located in the vicinity of the affected land, plus the cost of any registration and transfer taxes; • household and public structures—the cost of purchasing or building a new structure, with an area and quality similar to or better than those of the affected structure, or of repairing a partially affected structure, including labor and contractors’ fees and any registration and transfer taxes. In determining the replacement cost, depreciation of the asset and the value of salvage materials are not taken into account, nor is the value of benefits to be derived from the project deducted from the valuation of an affected asset.
12	Resettlement Action Plan (RAP)	The document in which a project sponsor or other responsible entity specifies the procedures that it will follow and the actions that it will take to mitigate adverse effects, compensate losses, and provide development benefits to persons and communities affected by an investment project.
13	Resettlement assistance	Support provided to people who are physically displaced by a project. Assistance may include transportation, food, shelter, and social services that are provided to affected people during their relocation. Assistance may also include cash allowances that compensate affected people for the inconvenience associated with resettlement and defray the expenses of a transition to a new locale, such as moving expenses and lost work days.
14	Resettlement policy framework	A resettlement policy framework is required for projects with subprojects or multiple components that cannot be identified before project approval. This instrument may also be appropriate where there are valid reasons for delaying the implementation of the resettlement, provided that the implementing party provides an appropriate and concrete commitment for its future implementation. The policy framework should be consistent with the principles and objectives of OD 4.30.
15	Stakeholders	Any and all individuals, groups, organizations, and institutions interested in and potentially affected by a project or having the ability to influence a project.
16	Vulnerable groups	People who by virtue of gender, ethnicity, age, physical or mental disability, economic disadvantage, or social status may be more adversely affected by resettlement than others and who may be limited in their ability to claim or take advantage of resettlement assistance and related development benefits.