Government of the Khyber Pakhtunkhwa, Pakistan

Khyber Pakhtunkhwa Hydropower and Renewable Energy Development Program

Gabral Kalam Hydropower Project

Environmental and Social Impact Assessment

Pakhtunkhwa Energy Development Organization (PEDO)

December 2019

The photograph on the cover page shows the proposed weir location and its upstream

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List of Acronyms

AD	Assistant Director
AIDS	Acquired Immunodeficiency Syndrome
AOI	Area of Influence
AP	Affected Person
BHU	Basic Health Unit
BOQs	Bills of Quantities
BP	Bank Policy
CASA	Central Asia-South Asia
CCGT	Combined Cycle Gas Turbines
CEDAW	Convention on The Elimination Of All Forms Of Discrimination Against Women
CEO	Chief Executive Officer
C-ESMP	Contractor's Environment and Social Management Plan
CIA	Cumulative Impact Assessment
COC	Code of Conduct
CSC	Construction Supervision Consultant
CV	Curriculum Vita
dBA	Decibel
DD	Deputy Director
EA	Environmental Assessment
ECPs	Environmental Codes of Practices
EHSGs	Environmental Health & Safety Guidelines
EMF	Electric and Magnetic Field
EN	Endangered
EPA	Environmental Protection Agency
EQS	Environmental Quality Standard
ESHS	Environmental, Social, And Health & Safety
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
ESU	Environmental and Social Unit
EU-CSC	Environmental Unit -Construction Supervision Consultant
FI	Financial Intermediary
FM	Frequency Modulation
LAA	Land Acquisition Act
LS	Lump-Sum
m	Meter
m/s	Meter Per Second
m^3/s	Meter Cube Per Second
masl	Meters Above Sea Level
MCM	Million Cubic Meter
MDF	Maximum Design Flood
mg/L	Milligram Per Liter
MSC	Management Support Consultants
MSDS	Material Safety Data Sheets
MSIP	Management Strategies and Implementation Plans
MW	Mega Watt
MWh	Megawatt Hour
NCL	Normal Conservation Level
NE	North East
NEQS	National Environmental Quality Standard
NGOs	Nongovernmental Organizations
NIC	National Identity Card
NOC	No Objection Certificate
NTDC	National Transmission & Dispatch Company
NTFPs	Non-Timber Forest Products
NW	North West
NWFP	North-West Frontier Province
O&M	Operation and Maintenance
O_2	Oxygen
OBE	Operating Basis Earthquake
^oC	Degree Celsius
OHC	Occupational Health Center
OHS	Occupational Health and Safety
OP	Operational Policy
PD	Project Director
PEDO	Pakhtunkhwa Energy Development Organization

FS	Feasibility Stage
g	Gram
GAP	Gender Action Plan
GBV	Gender Biased Violence
GCISC	Global Change Impact Studies Centre
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GKH	Gabral Kalam Hydropower Project
GoKP	Government of Khyber Pakhtunkhwa
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
GTZ	Gesellschaft Für Technische Zusammenarbeit
Gwh	Gigawatt Hour
ha	Hectare
HHs	Households
HIV	Human Immunodeficiency Virus
HPP	Hydropower Project
IBAT	Integrated Biodiversity Assessment Tool
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEE	Initial Environmental Examination
IFC	International Finance Corporation
ILO	International Labor Organization
IPCC	International Panel On Climate Change
IUCN	International Union For Conservation Of Nature
km	Kilometer
km^2	Kilometer Square
KP	Khyber Pakhtunkhwa
KPHREDP	Pakhtunkhwa Hydropower And Renewable Energy Development Program'
KV	Kilovolt
kV/m	Kilovolt Per Meter
LAC	Land Acquisition Collector
LPG	Liquified Petroleum Ga
PEPA	Pakistan Environmental Protection Agency
PGA	Peak Ground Acceleration
PIC	Project Implementation Consultant
PM	Particulate Matter
PMC	Project Management
PMO	Project Management Office
PPEs	Personal Protective Equipment
PV	Photovoltaic
PVC	Polyvinyl Chloride
RAP	Resettlement Action Plan
RHC	Rural Health Centre
RPF	Resettlement Policy Framework
SDP	Social Development Plan
SEA	Sexual Exploitation and Abuse
SEE	Safety Evaluation Earthquake
STD	Sexually Transmitted Diseases
STI	Sexually Transmitted Infections
TB	Tuberculosis
TL	Transmission Line
TOR	Term Of Refence
TPMA	Third-Party Monitoring Agency
UN	Union Council
UN	United Nations
US	United State
USD	United State Dollar
VECs	Valued Environmental Components
VU	Vulnerable
WAPDA	Water And Power Development Authority
WBG	World Bank Group
WHO	World Health Organization
$\mu g/m^3$	Microgram Per Meter Cube
µT	Microtesla

EXECUTIVE SUMMARY

The Government of Khyber Pakhtunkhwa (GoKP) through the Pakhtunkhwa Energy Development Organization (PEDO) is planning to implement the **Gabral Kalam Hydropower Project** (the Project or GKH), with financial assistance from the World Bank, under the 'Pakhtunkhwa Hydropower and Renewable Energy Development Program' (the Program). The Project will develop an 88 megawatt (MW) run-of-river hydropower project on the River Gabral (a tributary of the Swat River) to generate about 339-gigawatt hours (GWh) of electricity annually. The Project is located near the Kalam town in the Swat district of Khyber Pakhtunkhwa (KP) province. To address the environmental and social impacts of the Project, PEDO has prepared this Environmental and Social Impact Assessment (ESIA) in compliance with the national/provincial regulatory requirements and the World Bank's safeguard policies. A Resettlement Action Plan (RAP) for the Project has also been prepared and presented under a separate cover.

Project Description

The proposed project facilities include:

- 21 m high (above the riverbed) and 100 m wide weir with spillways, under sluices, fish ladder, outlet structures, and sand trap
- 4.7 km long underground tunnel from the weir site to the powerhouse
- Powerhouse (with two units of 37.5 MW and one unit of 13 MW) and a switchyard
- 2.7 km long 220 kV transmission line
- 6.6 km long roads, which includes the relocation of the existing road near the weir site and access road to the powerhouse site
- Project colony with a necessary water supply and sanitation facilities for 50 operations and maintenance (O&M) staff, including a primary school, a dispensary, and shops

In addition, the Project will develop the following temporary facilities:

- River diversion by building two cofferdams on both upstream and downstream of the weir site, and an open channel for diversion of water above the upstream cofferdam to below the downstream cofferdam
- Spoil (muck disposal sites) for storage of 0.8 to 1 million cubic meters of excess excavated material
- Quarrying and crushing activities to produce about 0.59 million cubic meters of aggregates
- A construction camp for about 200 workers along with water supply and sanitation facilities

Policy and Regulatory Framework

The Khyber Pakhtunkhwa (KP) Environmental Protection Act of 2014 is the primary legislative framework related to environmental protection in the Province. In accordance with this Act, the development of hydropower infrastructure will need to be approved by the KP Environmental Protection Agency (KP EPA) following the procedures given in the Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations, 2010. These regulations classify the projects into two categories (Schedule I and Schedule II) for environmental clearances. The development of hydropower projects of more than 50 MW capacity will fall under Schedule II (which requires EIA), and less than 50 MW capacity will fall under Schedule I (which requires IEE). The Project falls under Schedule II, and this ESIA will be submitted to KP EPA for obtaining the Environmental Approval for the Project.

According to World Bank Operational Policy (OP) 4.01 (Environmental Assessment), the Project is classified as Category A. Other relevant World Bank policies applicable to the Project include Natural

Habitats (OP 4.04), Physical Cultural Resources (OP 4.11), Involuntary Resettlement (OP/BP 4.12), Forests (OP/BP 4.36), Safety of Dams (OP/BP 4.37) and Projects on International Waterways (OP/BP 7.50). The present ESIA has been prepared in compliance with these policies.

Environmental and Social Baseline

Study Area. The Project influence area (or the project area) comprises of about 11 km-long valley of the Gabral River and its mountain slopes, from Kanai village (one km upstream of the weir site to cover the reservoir area) to Kalam town (10 km downstream of the weir site, where it joins the Ushu River to form the Swat River). The influence area covers all those areas that will likely to be directly or indirectly affected by the Project construction and operational activities.

Baseline Surveys. Detailed environmental, ecological, and socio-economic surveys were carried out in the project area through a review of secondary literature, field investigations for primary data collection, sampling and analysis of water, air and noise quality, questionnaire surveys, and community and stakeholder consultations.

Physical Environment

Physical Setting and Land use: The physiography in the project area is dominated by mountainous terrain, narrow valleys of the Gabral river and its tributaries, eroded riverbanks, and agricultural lands along the riverbanks and forests on the hill slopes. The project area is located in a rural setting, and the major settlements in the project area are Kalam (a major tourist town with a population of about 12,300 people and 1351 households). The nearest settlement close to the primary construction site is Kanai village (which is located 0.9 km away from the weir site, on the upstream). A gravel road is located along the right bank of the river, which connects the project villages to the Kalam. Another important feature of the area is severe erosion on the left bank of the river by the 2010 flood, which engulfed the previously existing agricultural lands and filled them with the river sediments and huge boulders and made them not suitable for any cultivation.

Climate. The winters in the project area are freezing with minimum temperatures ranging from -0.4 ^{o}C to – 8.4 ^{o}C from November to March. The temperatures in spring (April and May) and in Autumn (September and October) are usually warm in the daytime (17 to 20 ^{o}C) and cold on the night time (3 to 10 ^{o}C). The average annual precipitation is about 1076 mm, with nearly 58 percent of precipitation falls as snowfall during winter.

Hydrology. The catchment of the Gabral River lies in the upper region of the Hindu Kush mountains of the Swat River basin. The mean 10-daily flows of the Gabral river at the weir site vary from 6.8 m^3/s to 127 m^3/s. The river flows are usually higher during the months of May to August due to the melting of snow and glaciers. During these months, the river carries higher flows than the 65 m^3/s (peak design discharge of the project). The river flows start to decrease from September, and the river flows are low (6.8 to 9.8 m^3/s) from December to March. Bhan Khwar is the perennial tributary of the Gabral River, located 4 km downstream of the proposed weir site (in the dewatered section, between weir and tailrace). The winter flows from the Bhan Khwar (1.5 to 3 m^3/s) contributes to additional environmental flows from the weir to be released from the Project.

Groundwater. The groundwater levels within the river bed are shallow, with depths ranging from 0.8 to 4.5m, due to the presence of overburden riverine deposits. Whilst, the groundwater was not encountered in any of the boreholes that were drilled away from the river due to the lack of fractures in the underground phyllite and schist formations. There is no extraction of groundwater in the project area for the drinking and irrigation uses. There are several springs located in the mountains on both

sides of the river, which are being extensively used for drinking and irrigation purposes by the local communities.

Floods. The peak instantaneous discharges of the Gabral River during the floods vary from 77 m^3/s (in 2001) to about 1400 m^3/s (in 2013). The flood in 2010 (a flood of 300-year return period) is one of the worst in the region and caused severe damages to the infrastructure and the agricultural land in the valleys. A 1000-year (return period) flood of 1791 m^3/s is considered for the design of weir.

Seismicity. The project area is located in a tectonically active region affected by the continuing northward drifting of the Indian Plate and its subduction below the southern flank of the Eurasian Plate. A detailed seismic assessment has been carried out for the project, and a peak ground acceleration of 0.49 g, which is associated with ground motion having a return period of 3,000 years, is used for the design of the weir.

Water Quality. Water quality of the Gabral River, Bhan Khwar River, and spring at Kanai village is measured during January 2019, and the results suggest water quality is generally good, with total dissolved solids ranging from 58 to 67 mg/L.

Air and Noise Quality. Air and noise quality are measured at three villages in the project area during August 2019. The ambient air and noise quality in the project area are generally good and well below the national environmental quality standards as the area has less exposure to vehicular traffic and industrial pollution. The particulate matter concentrations (PM_{10}) in the Kalam area varies from 30 to 35 $\mu g/m^3$ (the national standard is 150 $\mu g/m^3$). The average daytime noise levels in the Kalam area varies from 40 to 50 dBA (the national standard is 65 dBA).

Biological Environment

Biodiversity. The overall biodiversity within the 50 km of the project area includes 245 species of plants, 20 species of fish, six species of amphibians, 18 species of reptiles, 283 species of birds and 70 species of mammals. The list of threatened species that can be found within region include four threatened mammalian species (Himalayan musk deer, Common Leopard, Snow leopard, and Black Bear), five endangered birds (Pallas's fish-eagle, Egyptian vulture, Greater spotted eagle, White-headed duck and Indian skimmer), and one endangered fish species (golden mahseer). The important biodiversity areas near the project area are Bhan Khwar Valley Community Game Reserve, which is located on the Bhan Khwar catchment area (250 km^2), which is a tributary of the Gabral River. The alpine and subalpine habitats of the Bhan Khwar catchment area provide a rich habitat of 21 mammals, including threatened species of snow leopard, and black bear.

Terrestrial Ecology. The project area and its surrounding areas can be classified into three ecological regions based on their altitudes (i) dry temperate ecoregion which covers the elevations up to 2700 masl, (ii) sub-alpine ecoregion, which covers elevations between 2700 to 3200 masl and (iii) alpine pasture ecoregion, which covers elevations between 3200 to 4700 masl.

Dry Temperate Ecoregion. All project facilities are located within this ecoregion, which mainly consists of coniferous forests that play a vital role in the economy of the area as a source of supply of timber, fuelwood, non-timber forest products, forage, and grazing. During field surveys, a total of 72 plant species are recorded in the project area. The forest vegetation mainly consists of Deodar, Blue pine, Chilgoza pine, and Spruce with pure and mixed occurrence. A total of 12 species of mammals, 14 species of herps (three amphibians and 11 reptiles) are recorded from the project area. Among these species, only Asiatic Black Bear (IUCN Status: Vulnerable) is a threatened species. Koklass, a wild pheasant (IUCN Category: Least Concern), is reported to occur near the project site.

Sub-alpine Ecoregion. The sub-alpine ecoregion represents a very fragile but ecologically significant ecosystem found at the elevations between 2700 to 3200 masl. This region also linked to forest resources. Key fauna associated with this habitat is; Musk Deer (*Moschus chrysogaster*), Snow Leopard (*Panthera uncia*), Markhor (*Capra falconeri*), Monal Pheasant (*Lophophorus impejanus*), Himalayan Snowcock (*Tetraogallus himalayensis*) and Snow Partridge (*Lerwa lerwa*). These species are reported in the high mountains of Bhan Valley Community Game Reserve.

Alpine Pastures Ecoregion. The alpine pastures are located on the higher peaks of the mountains of northern areas of Pakistan between the elevations 3200 to 4700 masl. Alpine plants are adapted to harsh conditions, which include low temperature, dryness, ultraviolet radiation, and a short growing season. The area is rich with a wide diversity of flora and fauna. Wildlife species reported in this habitat included Snow leopard, Brown bear, Black bear, Markhor, Ibex, Musk deer, Monal pheasant, Himalayan Snowcock, and Snow partridge. These species are reported in the Bhan Valley Game Reserve. The mammalian species in the game reserve exists in the upper regions of alpines during summer and in the lower regions of alpine during winter.

Aquatic Ecology. The Gabral River and its tributaries are characterized by relatively steep gradients and substrate sizes, fast-flowing, and turbulent waters with high flows and more sediments during summer and low flows and low sediments during winter. Two fish species are recorded from the project area, snow carp (Schizothorax plagiostomus), an indigenous fish species of the Himalayan region, and exotic brown trout, which was introduced in the 1990s. None of these species are listed in IUCN Red List. Snow carps are short-distance migrants and mainly migrate within the tributaries. From April to September (spring and summer, high flows), they prefer upstream headwaters habitat at higher elevations. During September to April (low flows and winter), they prefer lower elevations. The triggers for migrations are high flows and low temperatures. During spring, when flows started increasing in the rivers due to the melting of snow, the fish migrate upstream from April and May (within tributaries) due to high flows and temperature at lower elevations. During autumn, when the temperatures start to drop at higher elevations, the fish migrate downstream from September and October.

Socioeconomic Environment

Demography. A socioeconomic survey of 169 randomly selected households was carried out in the project area. The total population of the surveyed households is 1365, in which males are 717 and females are 648.

Education. The educational facilities in the project area very limited and hence, literacy levels are also very low. There are six primary schools, one middle school for boys (in Ashuran village) and one higher secondary school (separately for boys and girls in Kalam). The level of illiteracy was to the extent of 42.5% for males and 84.8% for females.

Livelihood. The major source of livelihood for the project population is agriculture. The livelihood sources are agriculture (31.5%), 'daily wage labour (12.5%), business (1.5%), service with both the government and private sector (3.6%), and working abroad (3.5%). The remaining 47.4% were unemployed and students. Men in the project area are also engaged in seasonal employment in hotels at Kalam during summer.

Agriculture. Although agriculture is the main livelihood source for the majority of the households, the availability of the agricultural land is limited to the valleys along the riverbanks. The cropping season is between April to October, and there will be no agriculture during winter due to severe cold conditions and snowfall. Generally, two crops are grown, one is from April to July, and the second one is from July to October. Major crops grown are vegetables (tomatoes and potatoes), maize, pulses, and millets.

Household Income. The average household income was computed to be Rs. 68,998 per month. A major proportion (45.5%) of the surveyed households fall in the income category of Rs. 20,000 to Rs. 50,000, while 14.4% and 40.1% come under the income bracket of less than Rs. 20,000 and above Rs. 50,000 per month, respectively. The average per capita income was computed to be Rs. 98,333 per annum and Rs. 8,194 per month. In accordance with the poverty line (Rs. 25,475 per month per household), the level of poverty of the surveyed households is 14.4 percent.

Health. The health facilities in the project area are very limited. There is only one Basic Health Unit (BHU) in Kalam, which has five medical doctors, three nurses and lady health workers, and ten medical technicians. The nearest Rural Health Centre, which has beds and in-patient treatment facilities, is located in Mingora, about 80 km from Kalam.

Migration. Due to extremely cold weather and limited livelihood opportunities in winter, a number of locals migrate to plain areas, mainly the central districts of KP and Punjab provinces. People start to migrate in the month of November before the snow begins to fall and return in February/March. Schools also remained closed in winter and opened in spring. The migrated people work in cities and towns as agriculture labor, household helpers, and drivers and as shop keepers.

Cultural Sites. There are no archeological sites, historical sites, and sites of significant religious value located in the project area. There are six mosques and eight graveyards in the project villages. None of these mosques and graveyards will be affected by the proposed project activities.

Tourism. The landscape in the region is famous for tourism in summer due to its forest cover, mountains, mountain streams, springs, and pleasant weather. There are about 350 hotels in the Kalam town, and about 400,000 tourists visit the Kalam annually.

Analysis of Alternatives

Without Project Scenario. Presently, the electricity deficit between demand-supply is the range of 4,000 to 6,000 MW. Lack of access to electricity and power shortages result in long hours of load shedding, impacting households, industrial and commercial activities. About 64 percent of the total installed power capacity in the country originated from fossil power plants. The greater reliance on thermal sources also resulted in increasing dependency on imported fuel (oil, gas, and coal). The imports result in the high cost of power production and these high imports require USD 4 billion in foreign currency annually in fuel payment for power generation. The “without project” alternative is not realistic, because Pakistan will build additional hydropower plants to minimize power generation from imported fuels and to eliminate power shortages.

Alternatives in Project Planning. During the project conception and development stages, a number of alternatives were considered while taking into account the technical, social and environmental aspects at the fore. The proposed locations of the weir and powerhouse are finally selected to avoid submergence of upstream Kanai and Utror villages, and to release the water back into the river (from tailrace) before the Kalam town, to prevent any impacts on its tourism.

Environmental and Social Considerations in Project Design. Environmental and social aspects have been considered in the planning and design of the Project facilities. These include:

- The weir height and potential power generation from the project are optimized to avoid the inundation of upstream Kanai and Utror villages.
- Construction of embankment (flood protection wall) on the left bank at the weir site has reduced the land acquisition by 17 acres (that could be submerged under reservoir).

- Muck disposal sites are selected in the areas that were eroded in 2010 flood (before the flood, they were under agricultural use) and these sites will be reclaimed and can be used for agricultural purposes
- A fish ladder is designed based on the needs of snow carps and included in the weir
- The project will be operated as a 'true run-of-river' for baseload power generation without any peaking operation
- Tourist-attraction facilities are in-built in the project design (hiking ways, deflected spillway, and parks)

Potential Environmental Impacts and Risks

The Project will be a true run-of-river project (operated as a baseload plant) with a limited reservoir area (50 acres). The most direct and significant negative impacts of the project will be on aquatic ecology caused by the construction of a weir and diversion of the river flows, and land acquisition. The adverse impacts associated with the construction are temporary in nature and will mainly include waste generation, dust pollution, occupational health and safety risk, and community exposure to work hazards. The overall positive impact of the project, which is the generation of 339 GWh of renewable electricity with minimal carbon emission, will be experienced countrywide through the provision of enough energy to power the equivalent of about 116,000 homes per year in the country. The project's potential impacts are given in the following table, along with the key mitigation measures.

Table 1. Potential Impacts of the Project and Key Mitigation Measures

The impact of various Project activities	**Key Mitigation and Enhancement Measures**
Environmental impacts due to Project siting	
1. Generation of low carbon and environmentally friendly power generation. Supply of additional 88 MW (339 GWh) of electric power to the national grid of Pakistan	Implementation of the ESMP and RAP to mitigate impacts associated with the construction of the project
2. Loss of forest vegetation (48 trees owned by the community and 636 forest trees) due to the land clearing under project footprints	Compensation for the provincial forest department for replantation of trees and afforestation of degraded forest lands. Plantation of trees in the colony and around the reservoir area Supporting the provincial wildlife department for wildlife conservation in the project area and the Bhan game reserve. Detailed monitoring of impacts on flora and fauna during construction
3. Inundation of 500 m existing road on the left bank and submergence of a footbridge and PVC water pipes	Realignment and construction of a 1.4 km new road at a higher elevation and relocation of a footbridge and the utilities Provision of water supply to the communities through tankers during the relocation of PVC water pipes
4. Greenhouse gases emissions from the proposed land clearing, construction, material life cycle, and power generation and transmission (0.24 million tons of emissions over the lifetime of the project)	Net greenhouse gases emissions are minus 7.12 million tons when compared to other feasible options for power generation and transmission

The impact of various Project activities	Key Mitigation and Enhancement Measures
Social impacts due to Project siting	
5. Acquisition of 157.44 acres (1259 kanals) of land permanently from 87 households	Adequate compensation for affected households as per the entitlement matrix in the RAP. Implementation of income and livelihood restoration plan Implementation of a social development plan.
6. Impact on 11 acres of land due to construction for 2.75 km long transmission line (12 towers)	Adequate compensation for affected households as per the entitlement matrix in the RAP One-time compensation for the land under towers
7. Loss of livelihood due to the acquisition of 26 acres of agricultural land from 44 households	Adequate compensation as per RAP Implementation of income and livelihood restoration plan. Implementation of social development plan.
8. Relocation of 8 households	Adequate compensation for affected households as per the entitlement matrix in the RAP
Environmental impacts and risks during construction	
9. Generation of about 0.8 to 1 million cubic meters of spoils/muck (excess excavation) and their disposal	Transport and disposal of spoils and designated muck disposal sites identified and approved for land reclamation Proper dumping and adequate compaction to avoid dust and release back to the river Handing over the reclaimed sites to the landowners Landscaping of the areas after completion of works
10. Generation of construction waste including hazardous waste	Containers of adequate size and numbers in place for collection of various types of wastes (metal, rubbers, used fuels, batteries, etc.) Procurement of services of a waste management contractor for transport and treatment of recyclable and hazardous waste
11. Generation of solid waste from campsites and offices (about 100 kg per day).	Implementation of the waste management plan Segregation of solid waste into kitchen waste (organics), paper and plastic (recyclable), and garbage (non-recyclable). Placement of containers with adequate size and numbers. Organic waste will be treated through in-vessel composters Recyclable waste will be compressed through bailers and use services of the waste management contractor Disposal of the garbage at the designated disposal site
12. Wastewater discharges from the construction camps, sites, and batching plants	Construction of wastewater treatment facilities at the campsite (e.g., septic tank and soak pit) and at the worksites (sedimentation tanks for batching plants and discharges from tunnels; and site drainage) Monitoring of wastewater quality to ensure compliance with NEQS
13. The potential risk of soil and water pollution by construction works	Storage of fuels and chemical in contained facilities Availability of spill kits and trained personnel for immediate cleanup of any oil spills

The impact of various Project activities	Key Mitigation and Enhancement Measures
14. Air and noise pollution from construction and traffic	Air and noise pollution control measures at the worksites and regular monitoring of ambient and noise quality to ensure compliance with NEQS Compliance with NEQS on vehicle and machinery emissions
15. Sourcing of aggregates (about 0.5 million cubic meters) for concrete works	Reuse of excavated material to the extent feasible Use of licensed quarry sites Source the material from the boulders from the eroded riverbanks in the proposed reservoir area (which are found to be suitable for aggregates).
16. Impact on river habitat due to construction activities and drying of river section (about 590 m) between two cofferdams (for two years)	Control of wastewater and sediment releases to the river Monitoring and relocation of trapped fish into the downstream waters
17. Impacts from increased human activities on flora and fauna, including Bhan Community Game Reserve	Limit the siting of any temporary facilities within the boundaries of the worksites. Use of non-wood fuel for cooking and heating Code of conduct for workers and employee's protection of flora and fauna and a ban on tree cutting and hunting. Any violation of the code of conduct leads to strict punishment including termination of employment Awareness-raising to workers on the Bhan game reserve
Occupational Health and Safety Risks	
18. Occupational health and safety risks on workers due to hazards associated with the construction activities (instream, underground tunnels, mountain slopes, blasting and drilling, working on heights and trenches, cold weather, etc.)	Development and implement occupational health and safety plan in compliance with WB EHSGs. Regular site inspections and safety audits Regular training program for workers on occupational health safety (monthly training and daily toolbox talks) Incident investigation and reporting Conduct a 'job hazard analysis' at the new construction site to identify potential hazards and implement necessary control measures. Use of relevant personal protection equipment at all times Availability of firefighting fully equipped ambulance, first-aid and rescue facilities at the site Adequate water supply and mobile toilets at the worksites
19. Potential health risks due to inadequate facilities in the campsites (about 200 non-locals, including about 60 foreign workers live in construction camps)	A construction camp will be built with all adequate facilities (safe drinking water and sanitation, kitchen, rest areas, recreation) for labor. Cleaning of the campsite on a daily basis. A medical clinic, with a medical doctor and attendants and preliminary staff, will be established at the camp The Contractor shall establish a mechanism to collect the complaints from the workers and address those complaints by the approved GRM plan
20. Employment generation for the	The hiring of the local community during construction works (about

The impact of various Project activities	Key Mitigation and Enhancement Measures
local community	300 workers on average regularly and 500 during peak construction daily for four years) Implement a labor management plan Formal contracts to be signed with labor
21. Risk of child labor	No hiring of workers less than 18 years of age
Social Impacts and risks during construction	
22. Safety hazards due to increased traffic on local roads especially for children and elderly people	Implement a traffic management plan (e.g., avoiding school hours, following sped limits, hiring licensed drivers, etc.) including awareness-raising and safety measures
23. Community exposure to work hazards	Barricade the work areas with hard fencing to prevent the entry of community in the construction areas. Placing adequate signboards and flagmen to divert the community away from the construction works. Community awareness programs on construction-related hazards, including awareness programs in schools
24. Dust from vehicular movement (20 to 30 trucks per day) on local roads and construction equipment	Frequent sprinkling of water as per weather requirements on the local roads and worksites to control dust emissions Dust control measures at the worksites
25. Risk of damage to houses by blasting activities (through fly rock and vibration)	Use of controlled blasting and placement of sandbags on the drill holes to prevent fly rock Adequate compensation for any affected structures
26. Impacts from labor influx and potential cultural conflicts between communities and workers	The contractor's code of conduct shall cover a program to promote awareness to the construction workers on respecting the local community. Construction camps will be built in the designated areas, located away from the local settlements The Contractor's monthly training program will cover topics related to respectful attitude while interacting with the local community Inclusion of code of conduct obligations and the applicable legislation in the contracts of all employees and workers with the provision of sanctions and penalties in case of violations
27. Risk of gender-based violence, sexual exploitation and abuse, and sexual harassment	The contractor's code of conduct shall cover a program to promote awareness to the construction workers on avoiding gender-based violence, and the risk of spreading sexually transmitted diseases. The Contractor's monthly training program will cover topics related to Code of Conduct such as sexual harassment particularly towards women and children, violence, including sexual and/or gender-based violence Measures to protect the privacy of women and girls by the contractor, sub-contractors and service providers
Environmental and Social impacts	

The impact of various Project activities	Key Mitigation and Enhancement Measures
during Operational stage	
1. Barrier effect on fish migration	A fish ladder has already built into the design of the weir Sensors and underwater video cameras will be placed on the ladder and monitored to count the fish and to assess the effectiveness of the ladder
2. Reduced water flow between weir and tailrace during low flow season	Environmental flow requirements are assessed based on the requirements of snow carps. During extreme low flow season (December to February), when fish don't migrate and live in pools, an environmental flow of 2 m^3/s will be released. During the fish migration season (March/April and September/October) and other seasons, the environmental flow of 2.5 to 3.5 m^3/s will be released. Downstream monitoring and adjustment of flows if required
3. Risk of bird electrocution from the transmission line	Insulation of exposed parts of the tower structure
4.Reduction of sediment load in the downstream water flows from the reservoir	Release of environmental flows and excess flows through sluices to release the sediments in the high flow season Regular flushing of sand traps during high flow season
5. Workers health and safety during routine operation and maintenance	Implementation of OHS plan
6. Waste generation from the plant and staff colony	Implement a waste management plan
7. Community health and safety	Complied with World Bank recognized standards on EMF through design considerations. Review of dam designs by an independent panel of experts
8 Improved livelihood opportunities from the development of tourist attractions and waste generation at tourist sites.	PEDO will provide preference to affected persons in establishing small businesses in designated tourist areas established at the project sites to improve their livelihood. PEDO establish and maintain waste and toilet facilities at the tourist sites near the project facilities

Cumulative Impacts

Valued Environmental Components. The potential cumulative impact of all existing and planned hydropower projects in the Swat River basin, in the context of the Gabral Kalam hydropower project, has been studied. The hydropower development in the basin for the next 20 years include 24 projects with a potential of 2072 MW. Of these four are existing (160 MW), two are under construction (884 MW), and 18 are proposed (1028 MW). All these projects are runoff river projects except Mohmand (Munda) Dam (the most downstream project in the Swat River), which involves storage (1600 million cubic meters) for power generation and irrigation. Four valued environmental components (VECs) have been studied, (i) river flows, (ii) terrestrial ecology, (iii) aquatic ecology, and (iv) socio-economic environment.

Cumulative impacts and contribution of the Project to the Cumulative Impacts. The development of hydropower projects in the Swat River basin will not have any cumulative impacts on the downstream

irrigation schemes if all of them operate for baseload power generation, but if they are operated for peaking power generation (18 hours of storage and six hours of release), there will be a reduction of 34 to 57% of irrigation releases to the Upper Swat Canal. The potential cumulative impacts of hydropower development on terrestrial ecology include forest clearance, degradation of forest habitats, soil erosion and sedimentation, and impact on wildlife habitats. Cumulative impacts on the aquatic ecosystem include habitat degradation in both feeding and breeding grounds, barrier effect on snow carp's migration and fish entrapment. On socioeconomic environment, the potential cumulative impacts from the hydropower construction and associated infrastructure development (including community-led infrastructure to be built by PEDO at each project site) will be employment generation in rural areas, where most of the projects are located and significant improvement of socioeconomic conditions in the project areas due to improved access to towns and markets, electricity, and health and education facilities.

Actions to Address Cumulative Impacts. PEDO is planning to take several actions to address the cumulative impacts through implementation of various mitigation, compensation and enhancement measures, which include (i) detailed ecological studies as part of the ESIA studies of respective projects to develop adequate mitigation plans, (ii) construction of fish ladders to allow fish movement and migration both upstream and downstream of the weir, (iii) release of environmental flows, (iv) design and optimization of project facilities with minimum environmental impact, (v) tree plantation and promotion of wildlife conservation in each project area, (vi) implementing a social development plan for building community-led infrastructure projects in the project areas, (vii) operating all plants for baseload power generation, (viii) working closely with the fisheries department to augment their hatcheries for breeding of snow carps and releasing them on both and upstream of the weirs, (ix) implementing a comprehensive monitoring and adaptive management plan, and (x) carryout a detailed cumulative impact assessment of the Swat Basin under Component B of the parent Program.

Environmental and Social Management Plan

Institutional Arrangements. PEDO will establish a Project Management Organization (PMO) for the implementation of the Program. The Environmental and Social Unit of PMO will include a number of environmental and social specialists (two directors, three deputy directors, and six assistant directors). The staff of PMO will be responsible for the overall supervision of the implementation of the Program, including ESMP. The Construction Supervision Consultant (CSC) will be responsible for supervising the contractors for the implementation of ESMP. For this purpose, the CSC will appoint dedicated environmental, social, health and safety (ESHS) staff to ensure the implementation of environmental and social management plans during the project implementation. CSC staff will include an Environmental specialist, an Occupational Health and Safety Specialist, an Ecologist, Social Specialists, and ESHS site Inspectors. Contractors ESHS staff include an ESHS Manager, an Environmental Officer, an OHS Officer, a Social Officer, and ESHS Site Supervisors (one supervisor at each site).

Environmental Conditions in the Bidding Documents. In order to make the Contractors fully aware of the implications of the ESMP and responsible for ensuring compliance, technical specifications in the tender documents will include compliance with mitigation measures proposed in ESIA as well as World Bank Group EHSGs. The Contractor will be made accountable through contract documents for the obligations of implementing the ESMP.

Mitigation and Monitoring Measures. A mitigation and monitoring plan is developed and presented in the ESIA. An Environmental Code of Practices (ECPs) has been prepared **(Annex 1)** to address generic impacts associated with hydropower construction. Prior to construction, the Contractor will prepare the Contractor's ESMP with site-specific management plans. The contractor will prepare and implement a code of conduct for his workers. Regular trainings will be conducted to contractor's workers on various

ESHS aspects, including occupational health and safety, environmental protection, and awareness to the construction workers on avoiding gender-based violence.

Grievance Redress Mechanism. A project-specific grievance redress mechanism (GRM) will be established to receive, evaluate, and facilitate the resolution of affected parties' concerns, complaints, and grievances about the environmental and social performance. A three-tier GRM has been designed to provide a time-bound, early, transparent and fair resolution for affected people. PEDO will follow the GRM to address any dissatisfaction and complaints by affected people and other stakeholder grievances. In addition, communities and individuals who believe that they are adversely affected by a World Bank-supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service . A GRM specific to deal with the workers' related grievances will also be established.

Budget. The total cost of the ESMP implementation is estimated to be USD 3.94 million. It covers the implementation of measures proposed for waste management, dust management, workers training, health and safety, health facilities at the campsite, wastewater treatment facilities, environmental monitoring, tree plantation and promotion of wildlife conservation, further studies and monitoring during construction, and capacity building of PMO staff.

Consultation and Disclosure

Extensive consultation and information dissemination (including with women) were carried out during ESIA preparation and disclosure. A total of 58 consultation meetings, with 439 participants (373 male and 66 female), were conducted. These include 48 local village meetings, one provincial-level workshop at Peshawar on October 21, 2019, one disclosure workshop at Kalam on November 7, 2019, to share the draft ESIA and RAP, in which the local communities, including affected communities, district-level government agencies (including representatives forest and wildlife departments, union councilors, and district administration). Feedback from the consultations was overall supportive of the Project by all stakeholders, but a request was made to enhance the benefits of the project to the local population through the provision of social services. The general concerns of the local community (also including women) are minimization of impacts on private land, payment of compensation based on the market rates, forms of payment, employment in the construction activities, and adequate mechanism for grievance redress.

The ESIA and Executive Summary of ESIA in Urdu will be disclosed on the PEDO website and will be sent to the World Bank for disclosure on its external website. Hard copies of these documents will be made available at local union council offices for public access.

1 Introduction

The Government of Khyber Pakhtunkhwa (GoKP), through the Pakhtunkhwa Energy Development Organization (PEDO), is planning to implement the Gabral-Kalam Hydropower Project (hereinafter referred to as '**the Project**' or **GKH**). The Project will construct an 88 megawatt (MW) run-of-river hydropower project on the Gabral River to generate about 339-gigawatt hours (GWh) of electricity annually. The Project is located near the Kalam town in the Swat district of Khyber Pakhtunkhwa (KP) province. Major interventions proposed in the Project are (a) construction of river diversion, weir, tunnel, powerhouse, access roads, project colony, offices, houses, and other ancillary infrastructure; and (b) installation of turbines, generators and electro-mechanical equipment, and transmission line. PEDO is the implementing agency of the Project and has prepared a comprehensive Environmental and Social Impact Assessment (ESIA) and Resettlement Action Plan (RAP) for the Project. The ESIA is presented in this report, and the RAP is presented under a separate cover.

The GoKP has requested funding for this Project from World Bank through the proposed 'Pakhtunkhwa Hydropower and Renewable Energy Development Program' (hereinafter referred to as '**the Program'** or **KPHREDP**). The Program will support the GoKP for (i) development of three to four run-of-river hydropower projects in the Swat Basin (including the proposed GKH) and installation of solar panels on the hydropower assets in KP and (ii) strengthening of PEDO, the implementing agency of the Program. PEDO has also prepared an Environmental and Social Management Framework (ESMF) and Resettlement Policy Framework (RPF) for the overall Program and presented under separate covers.

1.1 Background

Pakistan is suffering from an acute power and energy crisis, which is primarily caused by the increasing gap between the supply and the demand for electricity. The current (2017) generating capability of Pakistan is 19,020 MW in summer and 14,833 MW in winter, whereas the current demand is about 25,117 MW. Thus, the current shortfall is 6097 MW and 10,224 MW in the summer and winter seasons, respectively. Pakistan's power needs are increasing with a growth rate of 7 to 8 % (according to Pakistan Electric Power Company), the expected demand will be 96,000 MW by 2029-2030; whereas the generation additions are too slow to accompany the same pace, and there will be insufficient generation to meet the future demand in the coming years.

Per Capita Energy Generation and Consumption in Pakistan is among the lowest in the Word. The per capita energy generation of Pakistan in 2017 was 585-kilowatt hours (kWh), and per capita energy consumption in 2017 was 475 kWh. The per capita energy consumption in Pakistan is significantly lower than the average of middle-income countries (2355 kWh), and the neighboring countries of China (4475 kWh) and India (1122 kWh). According to the recent census of 2017, there are over 32 million households in Pakistan do not have access to electricity.

The Energy Generation of Pakistan is mainly from Fossil Fuels. The total installed generating capacity of Pakistan in 2017 was 28,172 MW in which 18,190 MW (64%) are from thermal sources, 7,115 MW (25%) from hydro, and the rest 2866 MW are from other renewable and nuclear sources. The major problem with the thermal is the high cost of electricity generation. These plants are not running up to their full capacity due to their dependence on imported fuel. With limited indigenous oil, Pakistan has to import over 70% of its requirements resulting in a debilitating drain on the country's balance of payments. Lack of foreign exchange to pay for fuel supplies has resulted in the production of electricity below the capacity of the existing plants. Although several gas-field plants have been commissioned during the last two decades, the reserves in these gas fields are dwindling. The energy sector is also the largest contributor to Pakistan's greenhouse gas (GHG) emissions at 46 percent of total emissions.

Lack of access to and poor reliability of electricity causing huge losses to Pakistan's economy. Lack of access to electricity and power shortages result in long hours of load shedding, impacting households, industrial and commercial activities. Lack of power affects people's quality of life, schools, colleges, clinics and hospitals; shops and businesses, reducing sales and revenues; and industry, reducing productivity. It also deters investment. This means, on a macro level, reduced economic growth, which translates into the loss of livelihoods, jobs, and income. The financial impact of load shedding has been estimated at 3 percent to 4 percent of GDP, costing about USD 10 billion a year. This situation is causing serious economic losses to the country and is responsible for increased unemployment and poverty. According to some estimates, Pakistani households spend about US$ 2.3 billion annually on alternative lighting products and services such as kerosene, gasoline, and battery-powered lighting.

Pakistan has Immense Hydropower Potential, most of which lies in Khyber Pakhtunkhwa Province. Pakistan is endowed with a hydropower potential of 40,000 MW, in which about 25,000 MW potential lies in KP. The total installed hydropower capacity in the country is 7,115 MW, in which about 4,000 MW is in KP. Pakistan Water and Power Development Authority (WAPDA) is a federal agency responsible for developing major to mega hydropower projects in the country, while the PEDO is the provincial agency responsible for developing small to major hydropower projects within the KP. PEDO, with the support of the German government, has identified several projects with an overall potential to generate 6,000 MW through the public sector, private sector, or public-private partnership. PEDO has approached the World Bank for funding of three priority hydropower projects identified in the above study, which included GKH.

World Bank Support in Hydropower Sector in KP. World Bank has been currently supporting the WAPDA on the implementation of two hydropower projects in KP, a 4500 MW Dasu Hydropower Project on Indus and 2820 MW Tarbela 4th and 5th Extension Hydropower Projects on Indus. Word Bank has also positively responded to the request of PEDO for financing its hydropower projects through the proposed Program.

1.2 Khyber Pakhtunkhwa Hydropower and Renewable Energy Development Program

The proposed 'Khyber Pakhtunkhwa Hydropower and Renewable Energy Development Program' (the Program) aims to help address the issues discussed in the previous section through the development of hydropower projects (HPP) and other renewable energy sources in KP. The Program will have the following components:

- **Component A:**
    - A1. Development of Gabral-Kalam Hydropower Project (GKH),
    - A2. Cascade development of the Swat River basin. Currently, two candidate projects are Kalkot-Barikot-Patrak HPP and Patrak-Shringal HPP, both on the Panjkora river in the Upper Dir District. However, other projects in particular of the Swat basin can also be considered for inclusion in the Program.
    - A3. Solar PV systems on hydropower assets.
- **Component B**: Institutional Strengthening and Energy Sector Development. This component will help prepare and implement a strategic roadmap and business plan for the development of KP energy systems and associated infrastructure to promote renewable energy, maximize investments and government revenue. It will also entail strengthening of institutional systems and processes so that the Energy Department GoKP and PEDO can efficiently and effectively manage their duties as a

developer of renewable energy program as well as operations and maintenance of existing and future energy projects

- **Component C:** Environment and Social Management. The objective of this component is to improve the environment, local living and economic development in the project area for GKH and other hydropower projects under component A2 as well as solar sites under A3.
- **Component D:** Project Implementation Support and Technical Assistance. This component would cover the cost of the consulting and other services to implement the three hydropower projects starting with the GKH and solar PV project, as defined under Component A and fulfill training and capacity building needs of PEDO and PMO to implement project-related activities effectively.

1.3 The Proposed Gabral Kalam Hydropower Project

Location. The Project will construct an 88 MW run-of-river hydropower project on the Gabral River to generate about 339 GWh of electricity annually. The weir site of the Project is located at longitude 35.505501°N and latitude 72.518729°E across the Gabral River (the tributary of the Swat River, which in turn is a tributary of the River Kabul) in the Swat district of KP. The Kalam town (population 12,300), a major tourist destination in the region, is located about 10 km from the weir site. The Kalam is located approximately 239 km from Peshawar and 326 km from Islamabad. The location of the Project site is shown in **Figure 1.1**.

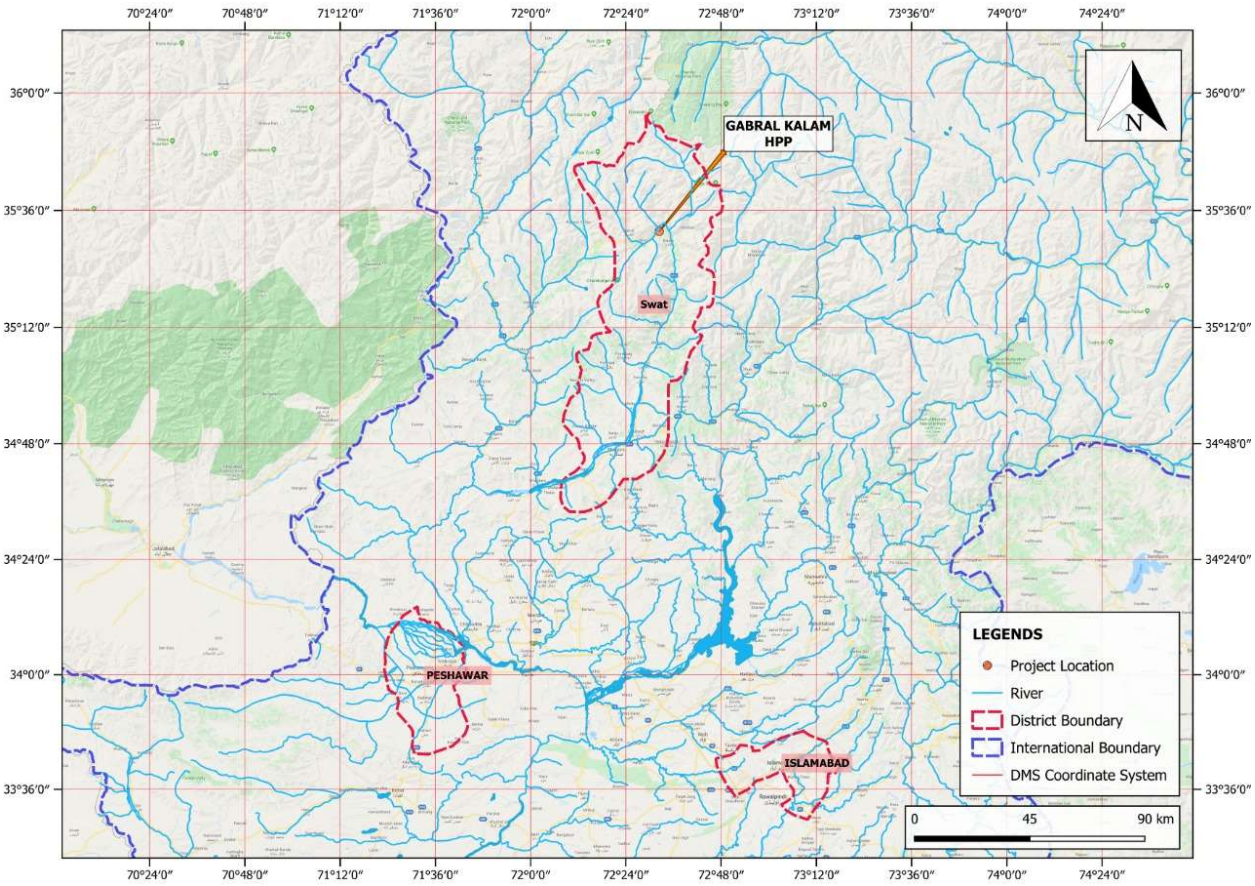


Figure 1.1: Location of the Project

Proposed Construction Works. A detailed description of the proposed facilities to be built is given in Chapter 3. A summary of the main physical works is given below:

- 21 m high (above the riverbed) and 100 m wide weir with spillways, under sluices, fish ladder and outlet structures
- 4.7 km long underground tunnel from the weir site to the powerhouse
- Powerhouse (with two units of 37.5 MW and one unit of 13 MW) and a switchyard
- 2.7 km long 220 kV transmission line from the switchyard to the interconnection point of an existing (under construction) transmission line from the Gorkin- Matiltan Hydropower Project
- Project colony with a necessary water supply and sanitation facilities for 50 O&M staff

1.4 The Environmental and Social Assessment of the Project

Studies and basic data: This ESIA is based on field studies and data collected during 2019 by the consultant team charged with the design of the project. A team of ecologists and environmental and social specialists of the design consultant have participated in the studies and collected data on the existing physical, biological and socio-economic environment of the project area. The team included Dr. Ashraf Bodla (biodiversity), Dr. Wasim Khan (wildlife), Prof. Ali Muhammad (fish), Ms. Hina Batool and Ms. Samina Parveen (environment), Mr. Umer Azeem (hydrology), and Mr. Shaukat Shahid and Mr. Zafar Bhatti (social). A team of independent consultants was retained by PEDO to guide the design consultants for necessary data collection and prepare an independent ESIA report as per the guidelines of the World Bank.

Independent consultants: PEDO has engaged two independent environmental and social consultants, Dr. Venkata Nukala and Ms. Samina Islam, to assess the environmental and social impacts of the project, provide input to the environmental and social aspects of the design, and to prepare this ESIA and RAP. During the ESIA preparation, the independent consultants regularly interacted with the design consultant, carried out their own field visits, participated in consultations, and conducted their independent analysis and impact assessment. While carrying out this assessment, the consultants also reviewed the environmental and social issues from other ongoing hydropower projects in KP, including World Bank-funded Tarbela 4th Extension and Dasu hydropower projects.

1.5 Content of the Report

Chapter 2 reviews the prevailing government regulatory requirements relevant to the environmental assessment and World Bank safeguard policies applicable to this Project, and actions taken by PEDO to comply with these requirements. **Chapter 3** presents a detailed description of the proposed project facilities and other salient information relevant to the environmental and social assessment. Possible design alternatives that have been considered and their influence on the environment and social situation are presented in **Chapter 4.** Description of the baseline environmental, biological and social conditions in the project area are presented in **Chapter 5**. Risks from climate change and earthquakes are described in **Chapter 6**. Potential environmental and social issues from the Project implementation, as well as the appropriate mitigation measures to address these negative impacts, have been discussed in **Chapter 7**. **Chapter 8** presents an assessment of the cumulative impacts resulting from the development of proposed and existing hydropower projects in the Swat basin. An Environmental and Social Management Plan (ESMP) is presented in **Chapter 9**, together with the proposed institutional arrangement, the management and monitoring requirements. Finally, **Chapter 10** describes the consultations that have been carried out with the stakeholders.

2 Legal, Regulatory and Administrative Framework

This chapter provides an overview of the national and provincial legislation and the World Bank safeguard policies that are relevant to the environmental and social assessment of the Project and actions that are taken (or to be taken) up by PEDO to meet these requirements.

2.1 Applicable Government Regulations

2.1.1 Pakistan Environmental Protection Act, 1997

The Pakistan Environmental Protection Act, 1997, 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, industrial liquid effluent, soil, marine, and noise pollution, as well as to the handling of hazardous wastes. As defined in the Act "environment" means: "(a) air, water, and land; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; (d) the ecosystem and ecological relationships; (e) buildings, structures, roads, facilities and works; (f) all social and economic conditions affecting community life; and (g) the inter-relationships between any of the factors in sub-clauses (a) to (f).

2.1.2 KP Environmental Protection Act

The KP Environmental Protection Act of 2014 is the provincial version of the Pakistan Environmental Protection Act, 1997 (PEPA) relevant to the Project. Responsibility for PEPA was transferred from the Ministry of Environment to the provincial governments by an amendment to the PEPA in 2012. The provincial versions continue to remain materially the same as the PEPA except where governmental bodies are referred.

The following are key features of the provincial Acts:

- Section 11 (Prohibition of Certain Discharges or Emissions) states that "Subject to the provisions of this Act and the rules and regulations made thereunder, no person shall discharge or emit, or allow the discharge or emission of, any effluent or waste or air pollutant or noise in an amount, concentration or level which is in excess of the Environmental Quality Standards."
- Section 13-I (Initial Environmental Examination and Environmental Impact Assessment) requires that "No proponent of a project shall commence construction or operation unless he has filed with the Federal Agency an IEE or, where the project is likely to cause an adverse environmental effect, an EIA, and has obtained from the Federal Agency approval in respect thereof." This EIA will be submitted by PEDO for EPA approval.
- Section 13-2b (Review of IEE and EIA): The Environmental Protection Agency shall review the EIA report and accord its approval subject to such conditions as it may deem fit to impose, or require that the EIA be re-submitted after such modifications as may be stipulated or rejected, the project as being contrary to environmental objectives.
- Section 15 (Handling of Hazardous Substances) requires that "Subject to the provisions of this Act, no person shall generate, collect, consign, transport, treat, dispose of, store, handle, or import any hazardous substance except (a) under a license issued by the EPA and in such manner as may be prescribed; or (b) in accordance with the provisions of any other law for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement, or other Instrument to which Pakistan is a party." Enforcement of this clause requires the EPA to issue regulations regarding licensing procedures and to define 'hazardous substance.'

- Section 16 (Regulation of Motor Vehicles): Subject to provision of this clause of the Act and the rules and regulations made thereunder, no person shall operate a motor vehicle from which air pollutants or noise are being emitted in an amount, concentration or level which is in excess of the EQS, or where the applicable standards established under clause (g) of subsection (1) of Section-6 of the Act.
- Section 18 (Penalties): Whoever contravenes or fails to comply with the provisions of section 11, 12, 13, or section 16 or any order issued thereunder shall be punishable with fine which may extend to one million rupees, and in the case of a continuing contravention or failure, with an additional fine which may extend to one hundred thousand rupees for every day during which such contravention or failure continues: Provided that if contravention of the provisions of section 11 also constitutes contravention of the provisions of section 15, such contravention shall be punishable under sub-section (2) only.
- Section 19 (Offences by Bodies Corporate): Where any contravention of this Act has been committed by a body corporate, and it is proved that such offense has been committed with the consent or connivance or, is attributed to any negligence on the part of, any director, partner, manager, secretary or other officers of the body corporate, such director, partner, manager, secretary or other officers of the body corporate, shall be deemed guilty of such contravention along with the body corporate and shall be punished accordingly.

Environmental approvals will be required under this act for the Project before starting the construction works and operation.

2.1.3 Pakistan Environmental Protection Agency (Review of IEE & EIA) Regulations, 2000

The IEE/EIA Regulations 2000 establish the framework for the preparation, submission, and review of the IEE and EIA. The regulations categorize development projects for IEE and EIA into two schedules (Schedules I and II). Schedule I include projects where the range of environmental issues is comparatively narrow, and the issues can be understood and managed through less extensive analysis. Schedule II covers major projects that have the potential to affect a large number of people in addition to generating potentially significant adverse environmental impacts. Preparation of a complete EIA is required for Schedule II projects. The following development projects fall under Schedule I:

- Hydroelectric power generation less than 50 MW
- Transmission lines less than 11 kV, and large distribution projects

The Project falls under Schedule II. Hence, an EIA will be required for those projects.

2.1.4 Land Acquisition Act of 1894

The Land Acquisition Act 1894 provides for the acquisition of private properties for public purposes, including development projects in Pakistan. It comprises 55 sections dealing with area notifications, survey, acquisition, compensation, apportionment awards, disputes resolutions, penalties, and exemptions. The key clauses of the Act are summarized in **Table 2.1**. The land acquisition for the Project will be carried out in accordance with this act.

Table 2.1: Key Clauses of Land Acquisition Act

LAA Section	Description
Section 4	Publication of preliminary notification and power for conducting the survey.
Section 5	Formal notification of land needed for a public purpose. Section 5a covering the need

LAA Section	Description
	for enquiry of the concerns or grievances of the affected people related to land prices.
Section 6	The Government makes a more formal declaration of intent to acquire land.
Section 7	The Land Commissioner shall direct the Land Acquisition Collector (LAC) to take order the acquisition of the land.
Section 8	The LAC has then to direct that the land acquired to be physically marked out, measured and planned.
Section 9	The LAC gives notice to all project-affected persons (PAPs) that the Government intends to take possession of the land and if they have any claims for compensation then these claims are to be made to him at an appointed time.
Section 10	Delegates power to the LAC to record statements of the PAPs in the area of land to be acquired or any part thereof as co-proprietor, sub-proprietor, mortgage, and tenant or otherwise.
Section 11	Enables the Collector to make enquiries into the measurements, value, and claim and then to issue the final "award". The award includes the land's market area and the valuation of the compensation.
Section 11 A	Enables the Collector to acquire land through private negotiations upon request of Head of the acquiring department. Upon receipt of any such request, the collector is empowered to constitute/notify a committee for assessment of the market value of land and verification of title of ownership. On agreement by Head of Acquiring Department, with negotiated market value determined by the committee, the collector shall then direct parties to execute sale deed in favor of acquiring department on stamp paper.
Section 11 B	Provides a time limit of six months to complete the land acquisition process from the date of notification under Section-4.
Section 16	When the LAC has made an award under Section 11, he will then take possession and the land shall thereupon vest absolutely in the Government, free from all encumbrances.
Section 18	In case of dissatisfaction with the award, PAPs may request the LAC to refer the case onward to the court for a decision. This does not affect the Government taking possession of the land.
Section 23	The award of compensation to the title holders for acquired land is determined at i) its market value of land, ii) loss of standing crops, trees and structures, iii) any damage sustained at the time of possession, iv) injurious affect to other property (moveable or immoveable) or his earnings, v) expenses incidental to compelled relocation of the residence or business and vi diminution of the profits between the time of publication of Section 6 and the time of taking possession plus 15% premium in view of the compulsory nature of the acquisition for public purposes.
Section 28	Relates to the determination of compensation values and interest premium for land acquisition.
Section 31	Section 31 provides that the LAC can, instead of awarding cash compensation in respect of any land, make any arrangement with a person having an interest in such land, including the grant of other lands in exchange.
Section 48A	If within a period of one year from the date of publication of declaration under section 6 in respect of any land, the Collector has not made an award under section 11 in

LAA Section	Description
(LAA-1986)	respect to such land, the owner of the land shall, unless he has been to a material extent responsible for the delay be entitled to receive compensation for the damage suffered by him in consequence of the delay.

2.1.5 Telegraph Act, 1885

The Telegraph Act (1885) was enacted to define the authority and responsibility of the Telegraph Authority. The law covers, among other activities, installation, and maintenance of telegraph lines and posts (poles). The Act defines the mechanism to determine and make payment of compensation associated with the installation of these lines and posts. Under this Act, the land required for the poles is not acquired (or purchased) from the owner, nor the title of the land transferred. Compensation is paid to the owner for any structure, crop or tree that exists on the land; the cost of the land is not paid to the owner. National Transmission & Despatch Company (NTDC) is the responsible agency for developing transmission line networks in the country and it has been following this act for building transmission line towers throughout the country.

2.1.6 Factories Act, 1934 (as amended to 1997)

The clauses relevant to the project are those which concern the health, safety, and welfare of workers, disposal of solid wastes and effluents, and damage to private and public property. The Factories Act also provides regulations for handling and disposal of toxic and hazardous materials. As construction activity is classified as 'industry', these regulations will be applicable to the construction contractors. Particular sections of the act applicable to the proposed Project are:

- Section 13(1): Every factory shall be kept clean and free from effluvia arising from any drain, privy or other nuisance.
- Section 14(1): Effective arrangements shall be made in every factory for the disposal of wastes and effluents due to the manufacturing process carried on therein.
- Section 16(1): In every factory in which, by reason of the manufacturing process carried on, there is given off any dust or fume or other impurities of such a nature and to such an extent as is likely to be injurious or offensive to the workers employed therein, effective measures shall be taken to prevent its accumulation in any work-room and its inhalation by workers and if any exhaust appliance is necessary for this purpose, it shall be applied as near as possible to the point of origin of the dust, fume or other impurities, and such point shall be enclosed so far as possible.
- Section 16(2): In any factory, no stationary internal combustion engine shall be operated unless the exhaust is conducted into open air and exhaust pipes are insulated to prevent scalding and radiation heat, and no internal combustion engine shall be operated in any room unless effective measures have been taken to prevent such accumulation of fumes therefrom as are likely to be injurious to the workers employed in the work-room.
- Section 20(1): In every factory effective arrangement shall be made to provide and maintain at suitable points conveniently situated for all workers employed therein a sufficient supply of drinking water.

2.1.7 Labor Laws

Labor laws in Pakistan are governed by many legislative tools. Principal labor rights are provided by the constitution of Pakistan. In addition to constitutional rights, acts and ordinances have been enforced from time to time for limiting working hours, minimum working age, and conditions of employment.

Of the 24 labor-related laws that existed in 2014 in Pakistan, those set out in **Table 2.2** relate directly to the International Labor Organization's (ILO's) core labor standards and will broadly be applicable to the proposed Project.

Table 2.2: Labor Laws of Pakistan

Legislation / Guidelines	Brief Description
KP Bonded Labor System (Abolition) Act (1995) and Punjab Bonded Labor System (Abolition) Act (2012)	The Bonded Labor System (Abolition) Acts seek to eradicate bonded labor practices prevailing in the respective provinces. The Acts define the `Bonded Labor System' as a system of forced or partly forced, labor under which a debtor enters or is presumed to have entered into an agreement with the creditor to the effect that: • In consideration of an advance obtained by him or by any of the members of his family (whether or not such advance is evidenced by any document) and in consideration of the interest, if any, due on such advance, or • In pursuance of any customary or social obligation, or • For any economic consideration received by him or by any member of his family.
KP/Punjab Minimum Wages for Unskilled Workers Ordinances (1969)	The ordinances state that every employer shall be responsible for the payment of minimum wages required to be paid under the ordinances to all unskilled workers employed, either directly or through a contractor, in his commercial or industrial establishment: • Provided that where an employer provides housing accommodation to a worker, he may deduct from the wages of such a worker, an amount not exceeding that in the ordinance; • Where the employer provides a worker with transport to and from the place of work, he may deduct from the wages of such a worker an amount not exceeding that specified in the ordinance.
KP/Punjab Industrial Relations Acts (2010)	These Acts seek to regulate the formation of trade unions, regulation, and improvement of relations between employers and workmen and the avoidance and settlement of any differences or disputes arising between them and ancillary matters.

Pakistan has ratified the ILO conventions for the core labor standards, including:

- Freedom of association and collective bargaining (conventions 87 and 98)
- Elimination of forced and compulsory labor (conventions 29 and 105)
- Elimination of discrimination in respect of employment and occupation (conventions 100 and 111)
- Abolition of child labor (conventions 138 and 182).
- Pakistan has also ratified the United Nations (UN) Convention on the Rights of the Child in 1990 but is not yet subscribed to the UN Convention of the Protection of the Rights of all Migrant Workers and Members of their Families.

The constitution of Pakistan contains a range of provisions with regard to labor rights found in Part II: Fundamental Rights and Principles of Policy:

- Article 11 of the constitution prohibits all forms of slavery, forced labor, and child labor.
- Article 17 provides for a fundamental right to exercise the freedom of association and the right to form unions.
- Article 18 prescribes the right of its citizens to enter upon any lawful profession or occupation and to conduct any lawful trade or business.
- Article 25 lays down the right to equality before the law and prohibition of discrimination on the grounds of sex alone.
- Article 37(e) makes provision for securing just and humane conditions of work, ensuring that children and women are not employed in vocations unsuited to their age or sex, and for maternity benefits for women in employment.

Pakistan's labor laws trace their origins to legislation inherited at the time of partition. The laws have evolved in response to socioeconomic conditions, shifts in governance, state of industrial development, population and labor force expansion, growth of trade unions, level of literacy, and the government's commitment to development and social welfare.

Under the constitution, labor is regarded as a 'concurrent subject,' which means that it is the responsibility of both the federal and provincial governments. However, for the sake of uniformity, laws are enacted by the federal government, stipulating that provincial governments may make rules and regulations of their own according to the conditions prevailing in or for the specific requirements of the provinces.
The labor laws are a comprehensive set of laws in Pakistan dealing with the following aspects:

- Contract of employment
- Termination of contract
- Working time and rest time (working hours, paid leaves, maternity protection and other leave entitlements).
- Minimum age and protection of young workers
- Equality
- Pay issues
- Workers' representation in the enterprise
- Trade union and employer's association regulation
- Other laws.

2.1.8 Pakistan Antiquity Act, 1975

The Pakistan Antiquity Act (1975) is applicable to the Khyber Pakhtunkhwa (KP). The current Antiquities Act 1975 (amended in 1990), redefined as 'ancient' any object that is at least 75 years old. It requires that all accidental discoveries are reported to the federal Department of Archeology. It also makes the federal government the owner of all buried antiquities discovered from any site, whether protected or otherwise. It bans all new construction within a distance of 200 feet from protected antiquities. The cultural heritage laws of Pakistan are uniformly applicable to all categories of sites regardless of their state of preservation and classification as monuments of national or world heritage. The Antiquities Act guarantees that no changes or repairs can be made to a protected monument even if it is owned privately without approval of the official agencies concerned with it.

2.1.9 Khyber Pakhtunkhwa Antiquities Act, 2016

KP has promulgated an act to protect, preserve, develop and maintain antiquities in the Province. The act defines “Antiquity” as any ancient product of human activity which has been in existence for a period of not less than one hundred years.

The act covers the establishment of different bodies; antiquities and related issues; development schemes; new construction and use of movable antiquities; excavation or exploration and related matters; and other miscellaneous provisions. It bans all new construction within a distance of 200 feet from protected antiquities except with the approval of the Directorate.

2.1.10 The Protection against Harassment of Women at the Workplace Act 2010

The act is applicable to Khyber Pakhtunkhwa (KP). The act protects women against sexual harassment at the workplace. The act is composed of 13 sections elaborating definitions, composition of the inquiry committee, procedure for holding inquiry, penalties (minor and major), powers of inquiry committee, role of the employer, the process for appeal against minor and major penalties, ombudsmen and powers of the ombudsmen.

2.1.11 The Khyber Pakhtunkhwa Prohibition of Employment of Children Act, 2015

According to this Act, "child" means a person who has not completed his fourteenth year of age. The act specifies that no child shall be employed or permitted to work in any establishment.
The act also states that a child not below the age of 12 years may be engaged in the light work, alongside his family member, for a maximum of two hours per day mainly for the purpose of acquiring skills, in a private undertaking or in any school established, assisted or recognized by Government for such purpose. It is also specified that no adolescent shall be employed or permitted to work in any hazardous work included in the Schedule.
The act also stipulates the constitution of committee on child labor and covers the important aspects related to hours and period of work, weekly holidays, notice to inspector, disputes as to age, maintenance of register, and display of notice, abstract of sections and health and safety.

2.1.12 Guidelines for Public Consultation, 1997

These guidelines issued by the Pakistan Environmental Protection Agency address possible approaches to public consultation and techniques for designing an effective program of consultation that reaches all major stakeholders and ensures the incorporation of their concerns in any impact assessment study. The guidelines cover consultation, involvement and participation of stakeholders; effective public consultation (planning, stages of an Environmental Impact Assessment (EIA) where consultation is appropriate); and facilitation of involvement (including the poor, women, and NGOs).

2.1.13 Other Relevant Environmental Legislation

An overview of other relevant legislation relevant to the environmental and social aspects of the Project is presented in **Table 2.3**.

Table 2.3: Other Relevant Social and Environmental Legislation

Legislation / Guidelines	Brief Description	Relevance to the Proposed Project
National Environmental	Powers for regulating Environmental Quality Standards (EQS) transferred from the national government to the	The Project will comply with these standards.

Legislation / Guidelines	Brief Description	Relevance to the Proposed Project
Quality Standards 2012	provincial governments in 2012. The EQS are materially the same as the National EQS (NEQS) that were established in 1993 and were subject to amendment in 2000, 2009, and 2010. EQS relevant to the Project include: • Municipal and liquid industrial effluents (32 parameters) • Industrial gaseous emissions (18 parameters) • Motor vehicle exhaust and noise (used and new vehicles) • Ambient air quality (9 parameters) • Drinking water quality (32 parameters) • Noise (four zones during day and night).	
Forest Act (1927) and Forest (Amendment) Act (2010)	The Forest Act of 1927 establishes the right of GoP to designate areas of reserved forest, village forest and protected forest. GoP is enabled to acquire such areas in order to prohibit or restrict the public use of such resources or other activities within them.	It has been confirmed in consultation with the Forest Department that no such areas are present within the study area
Protection of Trees and Brushwood Act (1949)	The Protection of Trees and Brushwood Act of 1949 prohibits the cutting or lopping of trees along roads and canals planted by the Forest Department unless the prior permission of the Forest Department is obtained.	PEDO will take prior permission from the Forest Department for cutting of trees
Wildlife and Biodiversity (Protection, preservation and conservation management act), 2015	The Act has been instated to consolidate the laws relating to protection, preservation, conservation and management of wildlife in KP. It places restrictions on hunting, possession and display of wildlife, trade and trafficking of wildlife or wildlife products, and protected areas. Wildlife offences and penalties for those offences are provided in the Act.	This act will apply to all the project workers
Workers Compensation Act, 2013 Minimum Wages, Act 2013	The Act provides for the regulation of minimum rates of wages and various allowances for different categories of workers employed in certain industrial and commercial undertakings and establishments.	The Project will ensure that all workers are paid at least minimum wages.
Rivers Protection Ordinance 2002	The ordinance has been instated to provide for the protection of aquatic ecology, water quality, economic and environmental value of rivers and their tributaries in KP. The ordinance has been instated keeping in view the increasing developments along rivers in KP and the need to maintain the quality of the rivers for public use. The rules set out will be applicable to any length of a particular river or stream or any part of a river or its tributary that has been specified by the Government.	The rules laid out in the ordinance relate mainly to encroachment onto the river and pollution of the river. It is important that Project-related activities do not pollute the river and that all construction activities along the river banks be carried out within the area designated for them.
Right to Information Act,	The Act provides for ensuring transparency and access to information in KP.	Information of the Project will be shared on PEDO's website

Legislation / Guidelines	Brief Description	Relevance to the Proposed Project
2013		
Motor Vehicle Ordinance (1965) and Rules (1969)	The ordinance deals with the licensing requirement for driving; powers of licensing authority, Regional Transport Authority and those of Court vis-à-vis disqualification for license and registration requirements to control road transport; compensations for the death of or injury to a passenger of public carrier; powers of Road Transport Corporation; traffic rules, power to limit speed, weight, use of vehicles; power to erect traffic signs; specific duties of drivers in case of accident and powers of police officers to check and penalize traffic offenders.	The contractor will have to comply with these Rules.
Highway Safety Ordinance (2000)	This Ordinance includes provisions for licensing and registration of vehicles and construction equipment; maintenance of road vehicles; traffic control offenses, penalties and procedures; and the establishment of a police force for motorways and national highways to regulate and control the traffic as well as keep the highways clear of encroachments.	PEDO's contractors will comply with this Ordinance.
Pakistan Penal Code (1860)	The Pakistan Penal Code deals with offences where public or private property and/or human lives are affected due to the intentional or accidental misconduct of an individual or body of people. In the context of the environment, the Penal Code empowers local authorities to control noise, toxic emissions and disposal of effluents.	PEDO's contractors will comply with this Code.
Pakistan Explosives Act (1894)	The Pakistan Explosive Act of 1884 provides regulations for the handling, transportation and use of explosives during quarrying, blasting and other purposes. The quarrying of stone for rip rap or concrete aggregates may need blasting at the quarry site. In this event these regulations will be applicable for this project.	PEDO's contractors will comply with this Act.
Regulation of Mines and Oil Fields/ Mineral Development Act (1948)	This legislation provides regulatory procedures for the quarrying and mining of construction material on the public as well as private lands.	PEDO's contractors will comply with this Act.

2.1.14 Legislation Related to Gender-Based Violence

Legal and Policy Framework of GoP/KP. Article 25 of the Constitution of the GoP, while guaranteeing gender equality, empowers the State to make special provisions for the protection of women. This includes the protection of the right to life, liberty, economic empowerment, and education. The gender based violence (GBV) is covered under the legal framework of GoKP to protect women against harassment in the workplace. The Khyber Pakhtunkhwa Harassment of Women in the Workplace (Amendment) Act, 2017 requires a number of actions to protect women against harassment in the workplace. As a result, the GoKP appointed a woman as the provincial Women's Ombudsperson for

receiving and disposing of complaints of working women against harassment in their respective places of employment. The Government of Khyber Pakhtunkhwa has also established a Commission on the Status of Women under the Khyber Pakhtunkhwa Commission on the Status of Women Act (2016). Moreover, a provincial Women's Empowerment Policy was launched in 2015 in pursuance of the province's commitment to gender equality. The Government of Khyber Pakhtunkhwa is committed to further improve the situation of women's rights and formulated a KP Human Rights Policy 2018, which also provides recommendations on violence against women and children. PEDO, being a part of GoKP, will comply with the Khyber Pakhtunkhwa Harassment of Women in the Workplace (Amendment) Act, 2017 of GoKP. The PEDO was instructed through a formal letter by Energy & Power Department dated 28-08-2017 on Implementation of "Protection Against Harassment of Women at Workplace Act 2010". The PEDO established requisite "Inquiry Committee" through Office Order No. 5958 dated 21/09/2017.

International Commitments Signed by Pakistan. The Government of Pakistan has ratified various international human rights instruments, committed to securing equal rights for women including, the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) and International Labor Organization (ILO) Conventions No. C-100 (Equal Remuneration Convention) and C-111 Discrimination (Employment and Occupation). CEDAW obliges member States, to eliminate all forms of discrimination against women and bring de-jure and de facto equality between men and women. It also obliges States to take all legislative, administrative and other measures to ensure women's participation in economic, political and national life. In addition to CEDAW, ILO Convention No. 100 and No. 111 provide for equality of opportunity and treatment in all employment-related matters including remuneration.

2.2 Environmental Approval Requirements of the Project

According to EIA/IEE regulations of 2010, the projects with hydroelectric power generation less than 50 MW and transmission lines less than 11 kV fall under Schedule 1, and require submission of IEE for environmental clearance from KP EPA. The projects more than these capacities will fall under Schedule II. The Project falls into Schedule II and PEDO will submit this ESIA for approval of KP EPA. The KP EIA approval process is illustrated in **Figure 2.1**. PEDO will submit this ESIA to KP-EPA after approval of the ESIA from the World Bank.

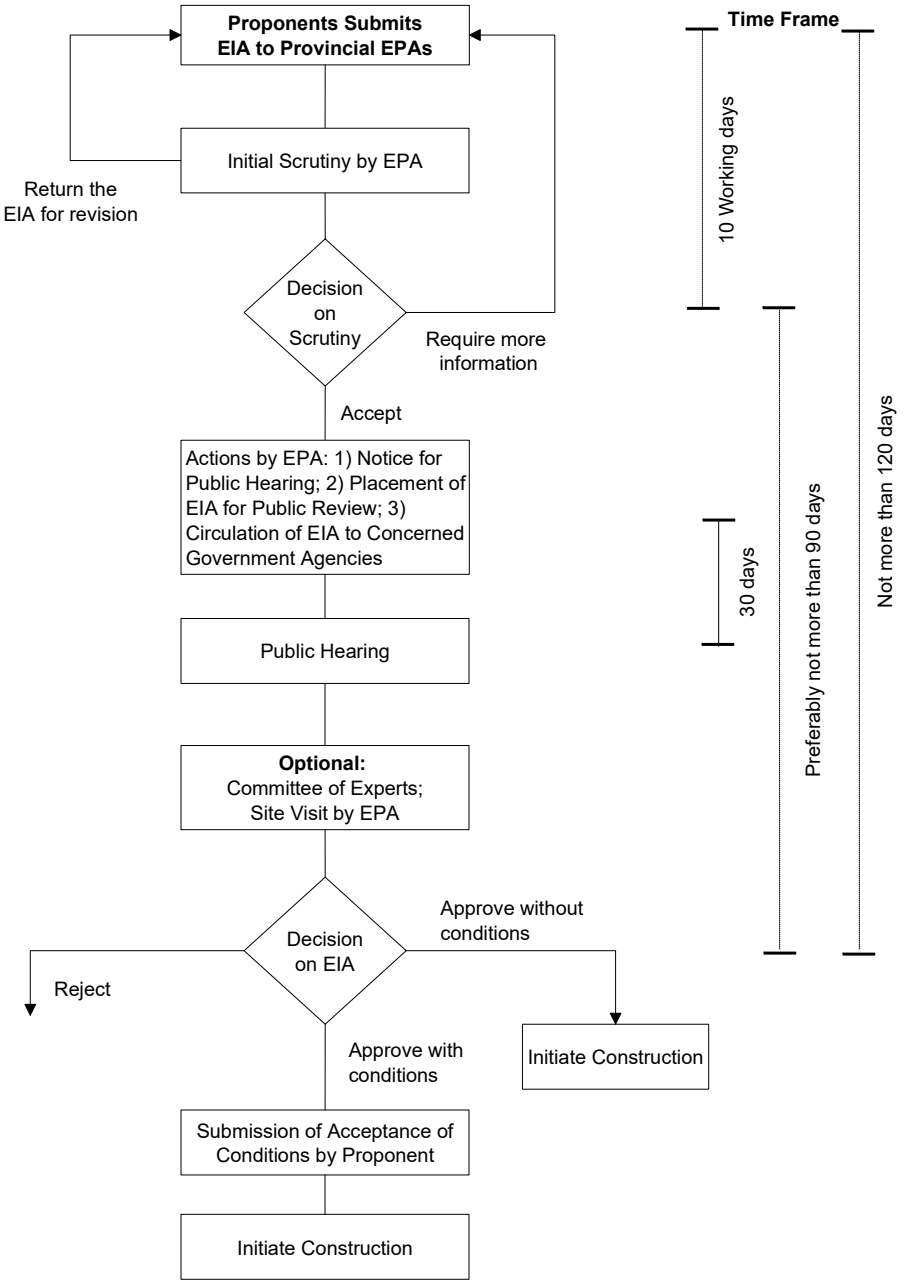


Figure 2.1: EIA Review and Approval Process

2.3 Environmental Regulatory Authorities

Since the project area falls in KP province, the KP Environmental Protection Agency (EPA) is the relevant environmental regulatory authority. The provincial EPAs are responsible for environmental regulation and implementing GoP environmental policies in their respective provinces. As part of their roles, provincial EPAs are responsible for reviewing EIA documentation for compliance with provincial EIA requirements and procedures and, using their district-based staff, also monitors the implementation of EMPs.

Statutory functions of the provincial EPAs are to:

- Administer and implement the Environmental Protection Act, its rules and regulations
- Review IEE/EIA, preparation of procedures and guidelines
- Prepare, revise and enforce EQS (industries, municipalities, vehicular emission)
- Establish and maintain laboratories, certification of laboratories for conducting tests and analysis
- Assist local Councils, Authorities and / or Government Agencies in the execution of projects
- Establish a system of surveys, monitoring, examination, and inspection to combat pollution
- Conduct training for Government functionaries and industrial management
- Provide information and education to the public on environmental issues
- Publish the Annual State of the Environment report
- Undertake surveys and qualitative and quantitative analysis of data on air, soil and water quality, and industrial, municipal and traffic emissions
- Take measures to promote environment-related Research and Development (R&D) activities.

Other key relevant departments in the province and their roles are summarized below.

- **Forest**
    - Preparation and implementation of policies and programs in the forestry sector.
    - Implementation of Forestry Laws and rules.
    - Protection, conservation, development, and management of renewable natural resources, particularly forests and rangelands in the province.
    - Sustainable management of forest for production of timber, firewood and other non-timber produce and services.
    - Demarcation and protection of Forest land against encroachment.
    - Raising of nurseries and plantations.
    - Provide extension services for mass awareness and conduct research and training for capacity building.
    - The Forest Department will be involved in case of the need to fell any trees in the government forests.
- **Wildlife**
    - Protection, conservation, preservation, and management of wildlife.
    - Management of protected areas, wildlife parks, safaris, and zoos.
    - Public and private participation through trophy hunting, private breeding farms and hunting associations.
    - As such no protected areas fall within or adjacent to the study area of the ESIA however contractor and its staff will have to comply with the relevant wildlife protection legislation.
- **Fisheries**
    - Extension services/fish farming/aquaculture development.
    - Conservation, management and development of natural resources.
    - Production of fish seed under controlled conditions.
    - Research and training activities.
    - Introduction of new technologies for enhancing fish production.
    - The Fisheries Department will be involved in case of any damage to any fish resources and fishponds caused by the project activities.
- **Revenue Department**

- The revenue department is responsible for the acquisition of land (permanent or temporary) including assessment, valuation, disbursement of compensation, and mutation in favor of PEDO.

- **Agriculture Department**
  - In case of an impact on crops and fruit trees, the Agriculture Department is fully responsible for the assessment and valuation of losses.
- **Communication & Works (C&W) Department**
  - The C&W will be involved in the assessment and valuation of losses in case of project impact on structures/ buildings and roads.

2.4 International Treaties Signed by Pakistan

Pakistan is a signatory to a number of international environment-related treaties, conventions, declarations, and protocols. The following are the relevant international treaties and conventions to which

- Convention on the Conservation of Migratory Species of Wild Animals
- Convention on the Control of Trans-Boundary Movements of Hazardous Wastes and their Disposal
- Convention concerning the Protection of World Culture and Natural Heritage
- Convention on the International Trade in Endangered Species
- International plant protection convention
- International Covenant on Economic, Social and Cultural Rights
- International Labor Organization's (ILO) Core Labor Standards on:
- Freedom of association (convention 87)
- Elimination of forced and compulsory labor (conventions 29 and 105)
- Elimination of discrimination in respect of employment and occupation (conventions 100 & 111)
- Abolition of child labor (conventions 138 and 182)
- Kyoto Protocol to the Convention United Nations Framework on Climate Change
- Stockholm Convention on Persistent Organic Pollutants
- United Nations Convention on Biological Diversity
- United Nations Convention on the Rights of the Child
- United Nations Framework Convention on Climate Change.

2.5 World Bank Safeguard Policies and Guidelines

The World Bank has developed a number of Safeguard Policies to ensure that all possible impacts are considered, and mitigation measures are spelled out prior to the implementation of any proposed project. These policies ensure that the quality of operations is uniform across different settings worldwide. If the decision is taken that a Safeguard Policy should be applied, mitigation measures and plans must be developed and in place before the implementation of a proposed project.

The Bank requires environmental screening and classification for all investment projects proposed for Bank financing, to help ensure that they are environmentally and socially sound and sustainable. Screening and classification take into account the natural environment (air, water, and land); human health and safety; social aspects (including especially involuntary resettlement and presence of Indigenous Peoples); cultural property; and trans-boundary and global environmental aspects.

The objectives of environmental screening and classification are to evaluate the environmental risks associated with a proposed operation; to determine the depth and breadth of Environmental

Assessment (EA); and to recommend an appropriate choice of EA instrument(s) suitable for a given project. The Bank recognizes that environmental screening and classification is not absolute and involves professional judgment on a case by case basis. When screening, careful consideration needs to be given to potential environmental impacts and risks associated with the proposed project. Judgment is exercised with reference to the policy expectations and guidance; real impacts on the ground; and established regional and Bank-wide precedence and good practice.

2.5.1 Environmental Assessment (OP/BP 4.01)

EA requirement. The World Bank requires environmental assessment (EA) of projects proposed for Bank support to ensure that they are environmentally sound and sustainable, and thus to improve decision making. The Bank Policy OP/BP 4.01 considers that EA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. EA evaluates a project's potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. EA takes into account the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples and physical cultural resources); and trans-boundary and global environmental aspects. The Bank Policy also envisages that the borrower Government is responsible for carrying out the EA and the Bank advises the borrower on the Bank's EA requirements.

The present ESIA has been prepared in compliance with this OP/BP.

EA classification. The World Bank classifies the proposed project into one of the four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. These categories are defined below.

- Category A: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works.
- Category B: A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas--including wetlands, forests, grasslands, and other natural habitats--are less adverse than those of Category A projects.
- Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.
- Category FI: A proposed project is classified as Category FI if it involves the investment of Bank funds through a financial intermediary (FI), in subprojects that may result in adverse environmental impacts.

2.5.2 Natural Habitats (OP 4.04)

The Policy highlights the importance of conservation of natural habitats, like other measures that protect and enhance the environment, for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank also supports and expects borrowers to apply a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. The Bank- promotes and supports natural habitat conservation and improved land use by financing projects designed to integrate into national and

regional development the conservation of natural habitats and the maintenance of ecological functions. Furthermore, the Bank promotes the rehabilitation of degraded natural habitats. The Bank does not support projects that involve the significant conversion or degradation of critical natural habitats.

2.5.3 Physical Cultural Resources (OP 4.11)

This policy addresses physical cultural resources, which are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings and may be above or below ground, or underwater. Their cultural interest may be at the local, provincial or national level, or within the international community.

The Bank assists countries to avoid or mitigate adverse impacts on physical cultural resources from development projects that it finances. The impacts on physical cultural resources resulting from project activities, including mitigating measures, may not contravene either the borrower's national legislation or its obligations under relevant international environmental treaties and agreements.

2.5.4 Forests (OP/BP 4.36)

This Policy recognizes the need to reduce deforestation and promote sustainable forest conservation and management in reducing poverty. The Bank believes that forests are very much essential for poverty reduction and sustainable development irrespective of their location in the world. The Bank assists borrowers with forest restoration activities that maintain or enhance biodiversity and ecosystem functionality. The Bank also assists borrowers with the establishment and sustainable management of environmentally appropriate, socially beneficial, and economically viable forest plantations to help meet growing demands for forest goods and services. The Bank does not finance projects that, in its opinion, would involve significant conversion or degradation of critical forest areas or related critical natural habitats. Furthermore, the Bank does not finance projects that contravene applicable international environmental agreements.

2.5.5 Projects on International Waterways (OP 7.50)

Projects on international waterways may affect the relations between the World Bank and its borrowers, and between riparian states. Therefore, the Bank attaches great importance to the riparian making appropriate agreements or arrangements for the entire waterway, or parts thereof, and stands ready to assist in this regard. A borrower must notify other riparian of planned projects that could affect water quality or quantity, sufficiently far in advance to allow them to review the plans and raise any concerns or objections.

2.5.6 Involuntary Resettlement (OP/BP 4.12)

The WB's experience indicates that involuntary resettlement under development projects, if unmitigated, often gives rise to severe economic, social, and environmental risks: production systems are dismantled; people face impoverishment when their productive assets or income sources are lost; people are relocated to environments where their productive skills may be less applicable and the competition for resources greater; community institutions and social networks are weakened; kin groups are dispersed; and cultural identity, traditional authority, and the potential for mutual help are diminished or lost. This policy includes safeguards to address and mitigate these impoverishment risks.

The overall objectives of the Policy are given below.

- Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs.
- Where it is not feasible to avoid resettlement, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the persons displaced by the project to share in project benefits. Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs.
- Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.

2.5.7 Projects in Disputed Areas (OP 7.60)

Projects in disputed areas may raise a number of delicate problems affecting relations not only between the Bank and its member countries but also between the borrower and one or more neighboring countries. In order not to prejudice the position of either the Bank or the countries concerned, any dispute over an area in which a proposed project is located is dealt with at the earliest possible stage.

The Bank may proceed with a project in a disputed area if the governments concerned agree that, pending the settlement of the dispute, the project proposed for country A should go forward without prejudice to the claims of country B.

2.5.8 Safety of Dams (OP 4.37)

When the Bank finances a project that includes the construction of a new dam,3 it requires that the dam be designed, and its construction supervised by experienced and competent professionals. It also requires that the borrower4 adopt and implement certain dam safety measures for the design, bid tendering, construction, operation, and maintenance of the dam and associated works.

For large dams (dams of more than 15 m height), the Bank requires

a) reviews by an independent panel of experts (the Panel) of the investigation, design, and construction of the dam and the start of operations;

b) preparation and implementation of detailed plans: a plan for construction supervision and quality assurance, and instrumentation plan, an operation, and maintenance plan, and an emergency preparedness plan;

c) prequalification of bidders during procurement and bid tendering, and

d) periodic safety inspections of the dam after completion.

2.5.9 Environment, Health and Safety Guidelines

The Environment, Health, and Safety (EHS) Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities or projects by existing technology at reasonable costs. In addition, there are also industry-specific EHS guidelines. The guidelines that are

relevant to the Project are: General EHS Guidelines[1] and Good Practice Note on EHS Approaches for Hydropower Projects[2].

2.5.10 Public consultation and disclosure requirements by World Bank

The Bank reaffirms its recognition and endorsement of the fundamental importance of transparency and accountability to the development process. Accordingly, it is Bank's policy to be open about its activities and to welcome and seek out opportunities to explain its work to the widest possible audience. According to 'OP 4.01: Environmental Assessment' of the World Bank, the following conditions apply to the Project.

Consultations. For all Category A and B projects, the borrower should consult the project-affected groups and local nongovernmental organizations (NGOs) about the project's environmental aspects and takes their views into account. The borrower should initiate such consultations as early as possible. For Category A projects, the borrower should consult these groups at least twice: (a) shortly after environmental screening and before the terms of reference for the EA are finalized; and (b) once a draft EA report is prepared. In addition, the borrower should consult with such groups throughout project implementation as necessary to address EA-related issues that affect them.

Disclosure. For a Category A project, the borrower should provide relevant information on project interventions in a timely manner prior to consultation and in a form and language that is understandable and accessible to the groups being consulted. The borrower should provide a summary of the proposed project's objectives, description, and potential impacts for the initial consultation. For consultation after the draft EA report is prepared, the borrower should provide a summary of the EA's conclusions. In addition, for a Category A project, the borrower makes the draft EA report available at a public place accessible to project-affected groups and local NGOs. The borrower also ensures that EA reports for Category A subprojects are made available in a public place accessible to affected groups and local NGOs. The document needs to be translated into Bengali. Public availability of the EA report for Category A project in the borrowing country and official receipt by the Bank are prerequisites to Bank appraisal of these projects.

2.5.11 Applicable World Bank Policies to the Project

The applicable World Bank policies for the proposed investments under the Project are given in **Table 2.4**.

Table 2.4: Applicable World Bank Policies for the Project

OP/BP	Triggered	Actions by PEDO
Environmental Assessment (OP4.01/BP4.01)	Yes	The Project is classified as Category A. PEDO has prepared this ESIA in compliance with the requirements of the policy.
Natural habitats (OP4.04/BP4.04)	Yes	The fish migration and river habitat will be obstructed due to the construction of the weir and diversion of water for power generation. PEDO has carried out studies to understand the fish habitat and biology in the project area and designed a fish ladder and environmental flows to ensure there will be no

[1] https://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES

[2] https://www.ifc.org/wps/wcm/connect/79ad4356-6f18-4955-bf35-adcd6d072897/GPN_EHSHydropower.pdf?MOD=AJPERES&CVID=mR5BwAV

OP/BP	Triggered	Actions by PEDO
		hindrance to the fish migration and degradation of aquatic ecology.
Pest Management (OP4.09)	No	Not relevant since the Project will not undertake any related activity such as purchase and or usage of agro-chemicals. Chemicals and pesticides are not used by transmission line companies to clear vegetation under the transmission lines.
Physical Cultural Resources (OP4.11)	Yes	The Project will not affect any PCRs. PEDO will include chance-find procedures in the contract documents. The Project will develop facilities to promote tourism around the project sites.
Involuntary Settlement (OP4.12)	Yes	PEDO has prepared a RAP for the Project in accordance with this policy and carry out land acquisition in accordance with the approved RAPs.
Forests (OP4.36)	Yes	There will be a limited impact on two small forest patches located on the right bank near the weir site and powerhouse site. About 636 forest trees and 48 fruit and wood trees owned by communities will be cleared from these areas. PEDO will compensate these losses by providing compensation, provide financial support to the Forest Department in the plantation development, and develop plantation in the colony and around the project facilities.
Indigenous Peoples (OP 4.10)	No	No indigenous people, as defined in the Policy, are known to exist in the Program area.
Safety of Dams (OP 4.37)	Yes	PEDO will appoint an independent panel of experts to review the project designs. PEDO will monitor the dam safety during the operation.
Projects on International Waterways	Yes	The Project is located on the Gabral River, which a tributary of the Swat River. The Gabral river originates in Pakistan. The Swat River also originates and flows through Pakistan only and joins the Kabul River within Pakistan.
Consultations and Disclosure		PEDO has consulted with various stakeholders, including the affected communities during the preparation of the ESIA and RAP. PEDO has also shared the draft ESIA and RAP, during a public consultation meeting on November 7, 2019, and updated the draft reports based on this consultation. The ESIA and RAP (including translated versions of the executive summaries) will be disclosed on the PEDO website and will be sent to World Bank for the disclosure on its external website.

3 Project Description

This chapter presents a detailed description of the proposed facilities in the Gabral Kalam Hydropower Project.

3.1 Project Layout

The Project will construct an 88 MW run-of-river hydropower project on the Gabral River to generate about 339 GWh of electricity annually. The power generated from the Project will be evacuated through a 2.7 km long transmission line to be built from the switchyard to the proposed transmission of Gorkin – Matiltan.

The main facilities of the Project include arrangements for power generation (weir, intake channel, sand trap, headrace tunnel, surge shaft, penstock, powerhouse, and tailrace) and facilities for power evacuation (switchyard and transmission line). A schematic drawing of the proposed project facilities is given in **Figure 3.1**, and a layout map of the proposed Project facilities is shown in **Figure 3.2.**

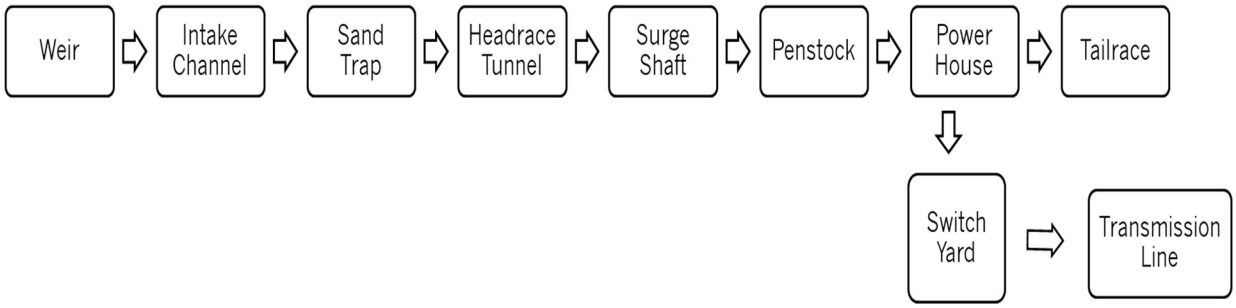


Figure 3.1: A schematic drawing of proposed project facilities

3.2 Key Project Facilities

Diversion Structure/ Weir

The proposed layout of the weir is given in **Figure 3.3** and cross-section of the weir is given in **Figure 3.4.** The weir site is accessible via motorable road / track along the left bank of the Gabral River. The height of the weir is 21 m above the riverbed (31 m including foundation) and the width of the river at this weir site is about 100 m. The water level observed at the weir site is about 2142 masl. The normal conservation (operational) level of the pond (reservoir) will be 2161 masl considering 21m pond depth. The weir will be a concrete gravity structure with overflow spillway and under sluices. Stilling basin has been made an integral part of the weir body.

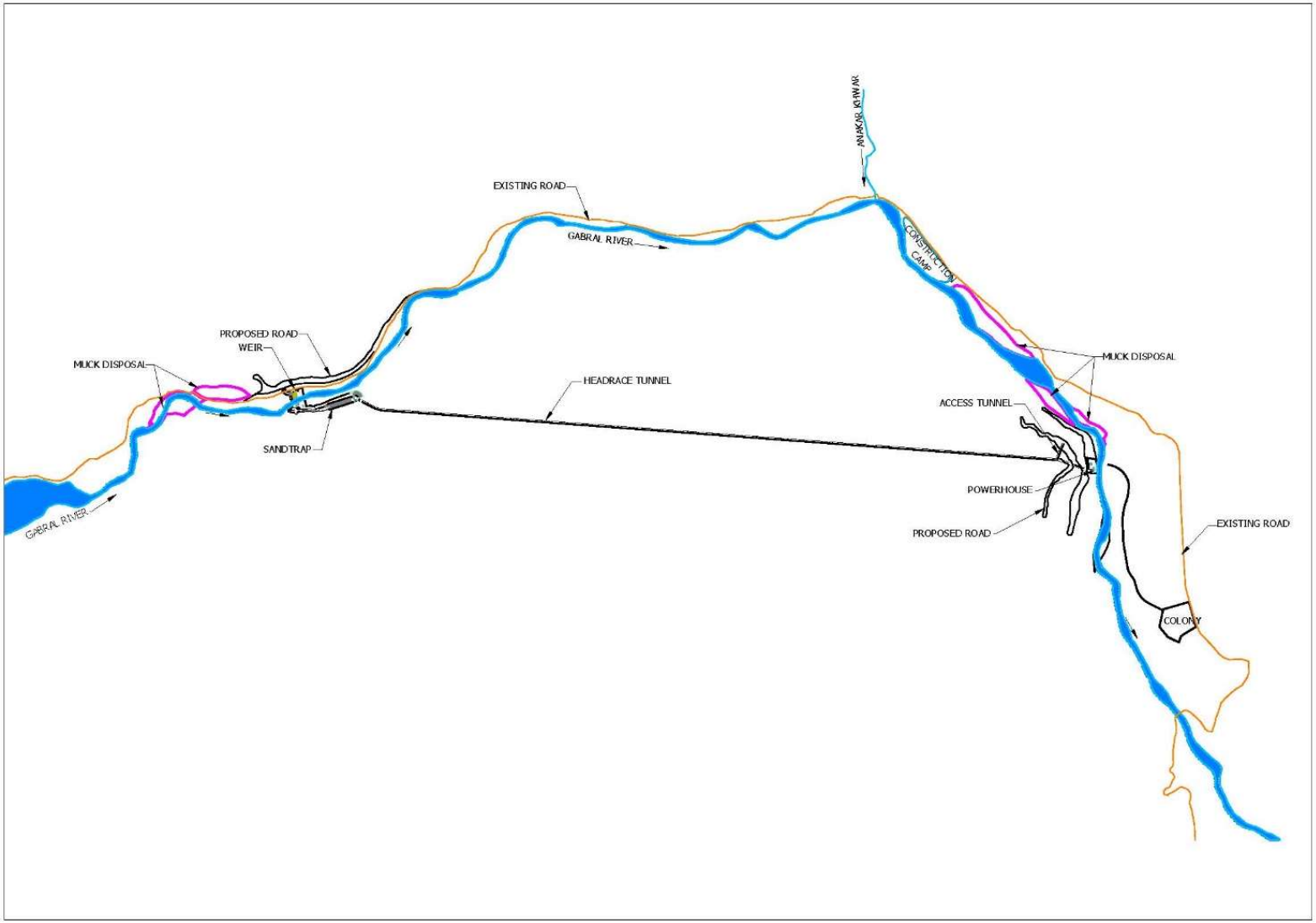


Figure 3.2: Project Layout

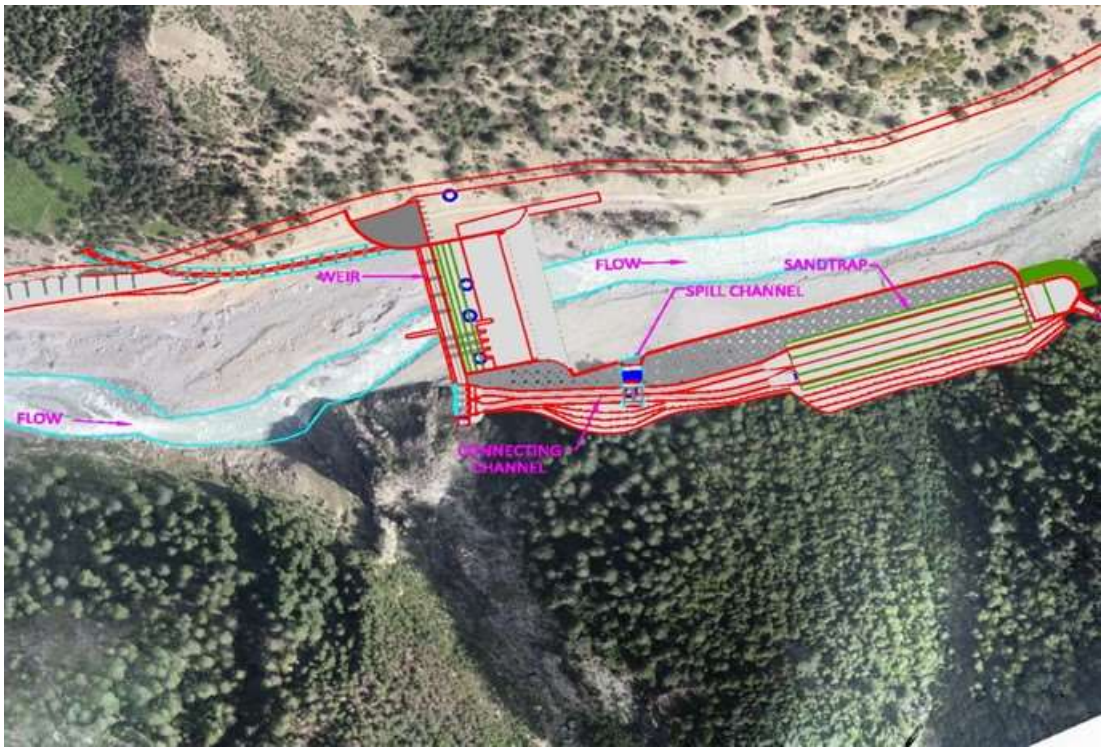


Figure 3.3: General layout of Weir, Intake Channel and Sand trap

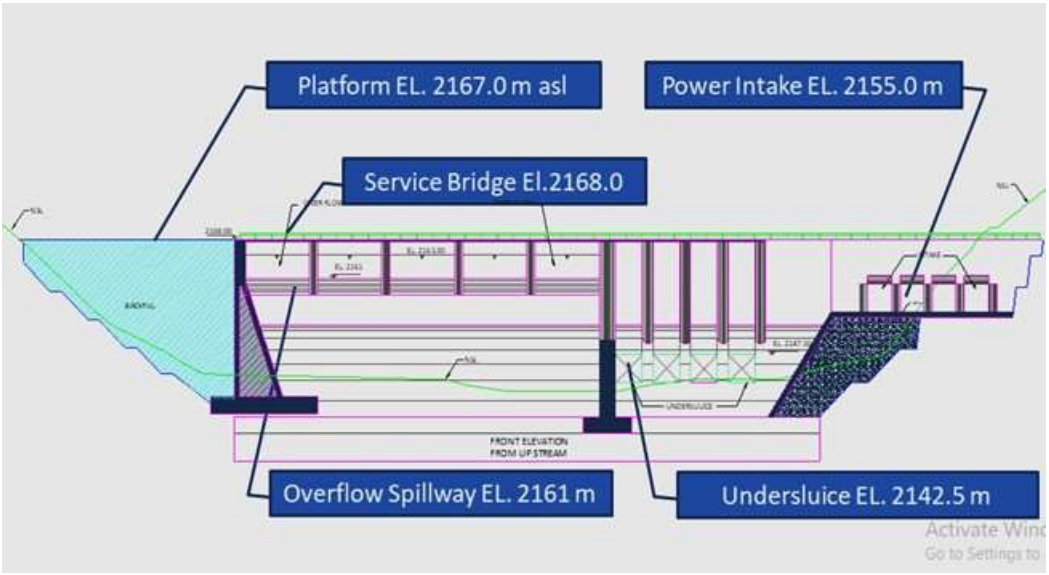


Figure 3.4: Cross-Section of Weir

Intake Channel and Sand trap

From the weir, the flow will be diverted through an intake channel to the sand trap. The intake channel will be a concrete-lined rectangular section with 35.0m x 27.5m dimensions. The depth of flow is 14 m and the design discharge speed is 0.5 m/sec. The invert level of the power intake is fixed below the normal reservoir level. The sand trap is of the gravity type and will remove particles up to 0.2 mm size

and it is designed as a twin cell box structure. The dimensions of the sand trap are 14.75 x 13.5m and it will be of vertical lift type with 2 flushing gates. The layout of the intake channel and sand trap is shown in **Figure 3.2.**

Headrace tunnel

The envisaged headrace tunnel is about 4750 m in length up to surge shaft and the diameter of the tunnel is 5.8 m. It is designed as a low-pressure headrace with a modified Horseshoe type shape. From the headrace tunnel, water will be conveyed to the powerhouse by a combination of vertical pressure shaft and pressure tunnel. The entrance to the headrace tunnel is streamlined so as to reduce head losses and avoid cavitation. The area of the inlet is larger as compared to that of the headrace tunnel to ensure low entrance velocity. The entrance velocity at the inlet is kept as 0.61m/sec and the average flow velocity will be 2.38 m/sec. The layout map for the headrace tunnel is shown in **Figure 3.2.**

Surge Shaft and Penstock

From the headrace, tunnel water enters the surge shaft (used as pressure neutralizer in hydropower water conveyance system to resists excess pressure rise and pressure drop conditions). Relief valves are provided to relieve the detrimental effects of the water hammer produced because of a sudden load rejection / closure of the generating units. Surge shaft is of a simple restricted orifice type of circular shape with minimum and maximum surge levels of 2135.5 to 2189.5 masl. The height of the surge shaft is 65 m and the diameter is 12.9 m. From the surge shaft water enters the penstock, which comprises three branch pipes and the diameter of each pipe will be 4 m and the velocity of design discharge will be 5.17 m.

Powerhouse

At the end of the manifolds, water runs the turbines in the powerhouse area, located on the right bank of the Gabral River. The river level at the powerhouse location is about 1995 masl. Two turbines of 37.5 MW each and one turbine of 13 MW (Vertical-shaft Francis turbines) will be installed in the powerhouse. The layout of the powerhouse is given in **Figure 3.5.**

Switchyard

The switchyard will be a 220KV gas-insulated (GIS) *s*witchgear and related equipment such as Circuit Breakers, Disconnectors, Earthing Switches, and Lightning Arresters. The connection between each generator breaker and step-up transformers will be made with cables. The switchyard will have bays to accommodate cable feeders from the generator to the transformers. The overhead transmission line will be directly terminated in the switchyard. The control and protection system for the switchyard will be located inside the powerhouse building.

Transmission Line

A 2.7-km long 220 kV transmission line (TL) will be installed (12 towers with a footing of 10m x 10m, and right of way of 30m) from the switchyard to the proposed TL of Gorkin – Matiltan Hydropower Project (to be built in 2020-2021) for the evacuation of the power produced by the Project. The alignment of the proposed transmission line is shown in **Figure 3.6**.

The 2.7 km TL under the project connects into under construction transmission line for 84 MW Gorkin-Matiltan Hydropower project (GMHPP). The GMHPP transmission line is not an associated facility of the project because it will not be constructed contemporaneously with the Gabral Kalam Hydropower Project. The TL for GMHPP is expected to be completed by the end of 2021 and the construction of Gabral-Kalam is expected to start in early 2022. GMHPP TL would be constructed in any case to

evacuate the power generation of GMHPP and would have been constructed even if the GKH was not constructed. Furthermore, it is not directly or significantly related to GKH.

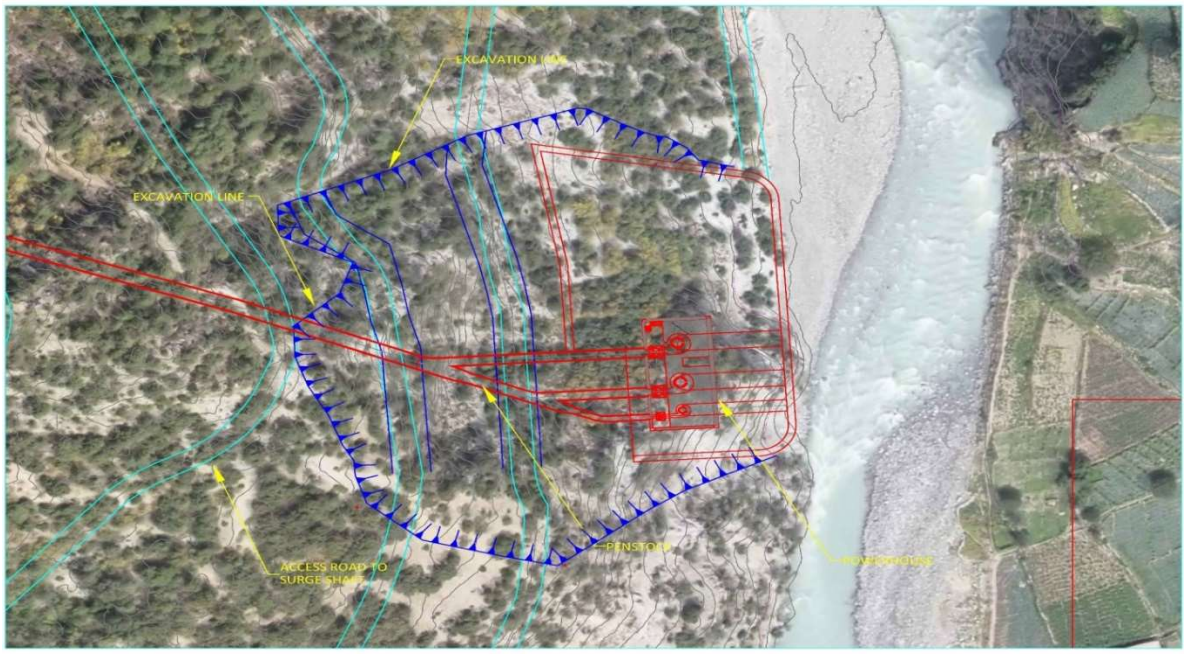


Figure 3.5: Layout of Powerhouse

Figure 3.6: Proposed Alignment of the Transmission Line

Fish Ladder

A fish ladder will be built in the weir to allow the movement/migration of fish on both upstream and downstream. The design of the fish ladder is based on the requirements of local fish species (depth of water, flow velocity, and slope). The drawing of the fish ladder is given in **Figure 3.7.**

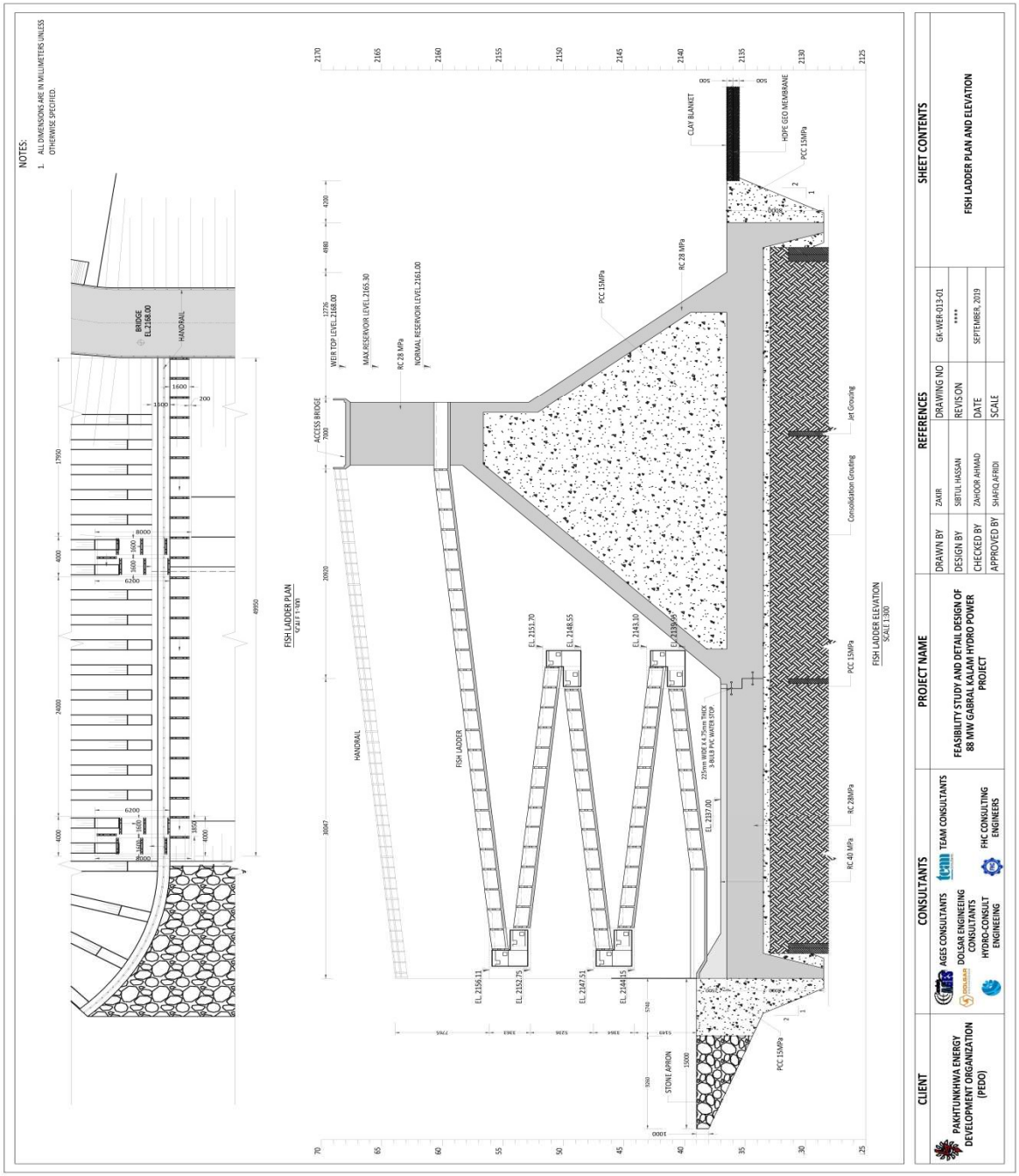


Figure 3.7: Design of Fish Ladder

3.3 Temporary Facilities

Diversion during Construction

Two cofferdams will be built on both upstream and downstream of the weir site to create a dry river bed for construction. The river flows from the upstream of the cofferdam will be diverted through an open channel below the downstream cofferdam. Cofferdams are earth-fill type embankments. The upstream cofferdam is 12 m high with 7 m wide crest. The downstream cofferdam is 7.5 m high with 7 m wide crest. The cofferdams will be used for the movement of vehicles during construction. Locations of the cofferdams are shown in **Figure 3.8.**

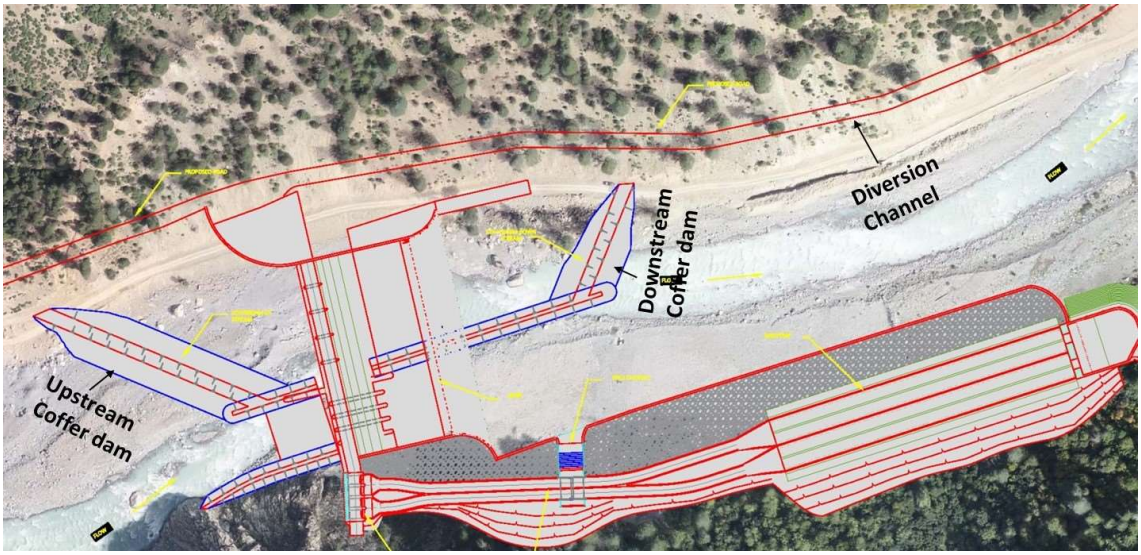


Figure 3.8: River Diversion Arrangement During Construction

Construction Camp

In principle, a construction camp should be located away from the main settlements as well as closer to the main construction components of the project. Keeping this in view, one construction camp will be established at a midpoint between Weir and Powerhouse.

An ideal location for the camp where almost all the contractor's facilities can be accommodated in the one on the left bank of the river just downstream of the confluence of Bhan Khwar (Anakar Khwar). The land available is about 10-12 acres along the main road. There are no settlements in the area, as this area was already eroded by the 2010 flood. The location of the proposed construction camp is shown on the map in **Figure 3.9.**

Spoil (Muck) Disposal Site

About 800,000 to 1,000,000 m^3 spoil (muck) material will be generated from the construction of weir, sand trap, tunnel, powerhouse, and other facilities. Most of these spoils will be generated from the weir site area, and hence a location close to the weir site is identified in a land that was eroded by the 2010 flood. The location of the spoil disposal site is shown in **Figure 3.10**. A spoil disposal site will also be developed near the powerhouse site.

Figure 3.9: Location of Construction Camp

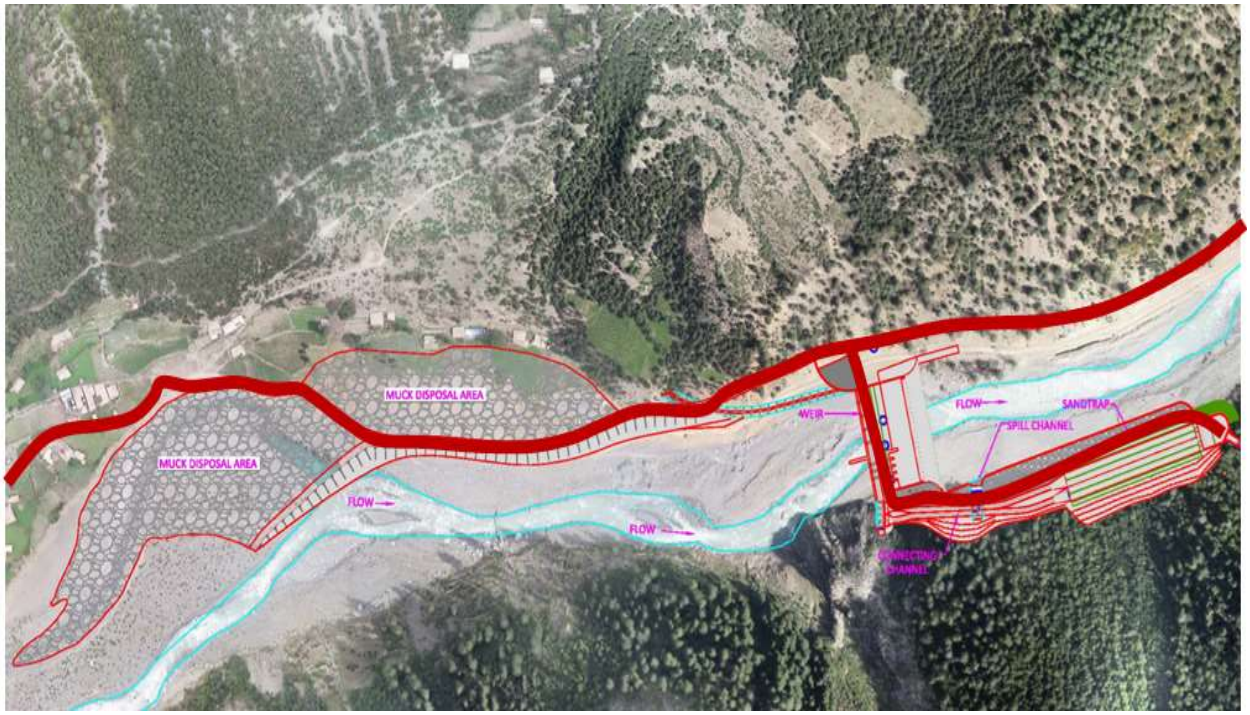


Figure 3.10: location of Muck Disposal sites and Access Roads (in dark red color)

3.4 Other Permanent Facilities

Access Roads

About 6.6 to 6.8 km of roads will be built to access the project facilities, and for the relocation of the existing road near the weir site. The proposed roads:

- Re-routing of the existing Kalam Gabral Road at weir site (1.4 km)
- The access road from the weir to tunnel inlet portal (300-400m)
- The access road to powerhouse (600-700m)
- The access road to surge shaft and headrace tunnel (4300m, including a 63.5 m long bridge)

The location of the proposed roads in the weir site is shown **in Figure 3.10,** and access roads to the powerhouse area are shown in **Figure 3.11.**

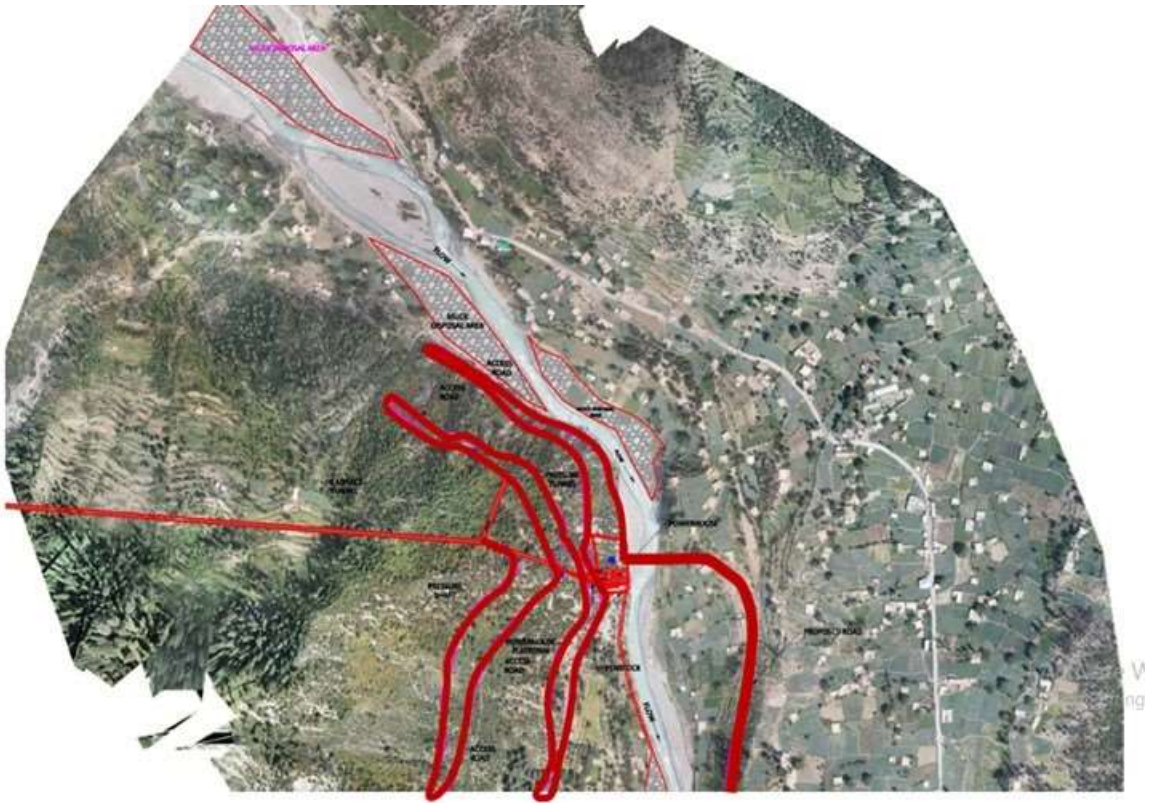


Figure 3.11: Location of proposed access roads in the Powerhouse area

Colony Area

A colony will be built for PEDO operation and maintenance (O&M) staff. The colony (in 9.3 acres) will include residences for 50 staff and facilities such as water supply and sanitation, roads, a primary school, a dispensary, a mosque, a park, a guest house, a community center, and shops. A layout of the colony is shown in **Figure 3.12.**

Figure 3.12: Colony for O&M Staff

3.5 Resource Requirements

Construction materials:

About 0.59 million cubic meters of aggregates (288,076 m^3 of fine and 303,651 m^3 of coarse) are required for the construction of the Project. Surface boulder deposits available on the riverbed and river embankment on the reservoir area of the weir will be used as aggregates. About 33,055 tonnes of steel and 170 million tonnes of cement will be required during construction.

Construction Equipment

The estimated requirement of construction equipment is given in **Table 3.1**. In addition, about 20 to 30 trucks per day will be used by the Contractor for the supply of material during construction.

Table 3.1: Estimated Construction Equipment

#	Type of Equipment	Quantity
1	Excavators	12
2	Tractors	5
3	Pavers	5
4	Dumpers	25
5	Batching Plants	1 Unit
6	Wheel Loaders	4
7	Bulldozers	2
8	Rock Drill	10
9	Compressor	4

#	Type of Equipment	Quantity
13	Fuel Truck	1
14	Crushing Plant	1
15	Loader	7
16	Grader	1
17	Compactors	5
18	Concrete Trucks	3
19	Concrete Cutting Machines	3
20	Cranes	2
21	Ambulance	1

#	Type of Equipment	Quantity
10	Diesel Generator	10
11	Water Sprinkler	2
12	Down-the-hole Drill	2

#	Type of Equipment	Quantity
22	Road Roller	2
23	Shotcrete Machines	2
24	Vibrators	4

Labor Requirements

About 500 workers, both skilled and unskilled, will be required throughout the construction period of five years. Out of which, about 200 will be outside workers (60 foreigners and another 140 will be from Pakistan but outside the project area), and 300 laborers are local, mostly un-skilled or semi-skilled labour. During the peak construction period, the requirement of local labour may increase up to 500 to 600.

3.6 Project Cost and Construction Schedule

The total cost of the Project is USD 224 million. The proposed construction period of 4 years and the detailed construction schedule is shown in **Figure 3.13**.

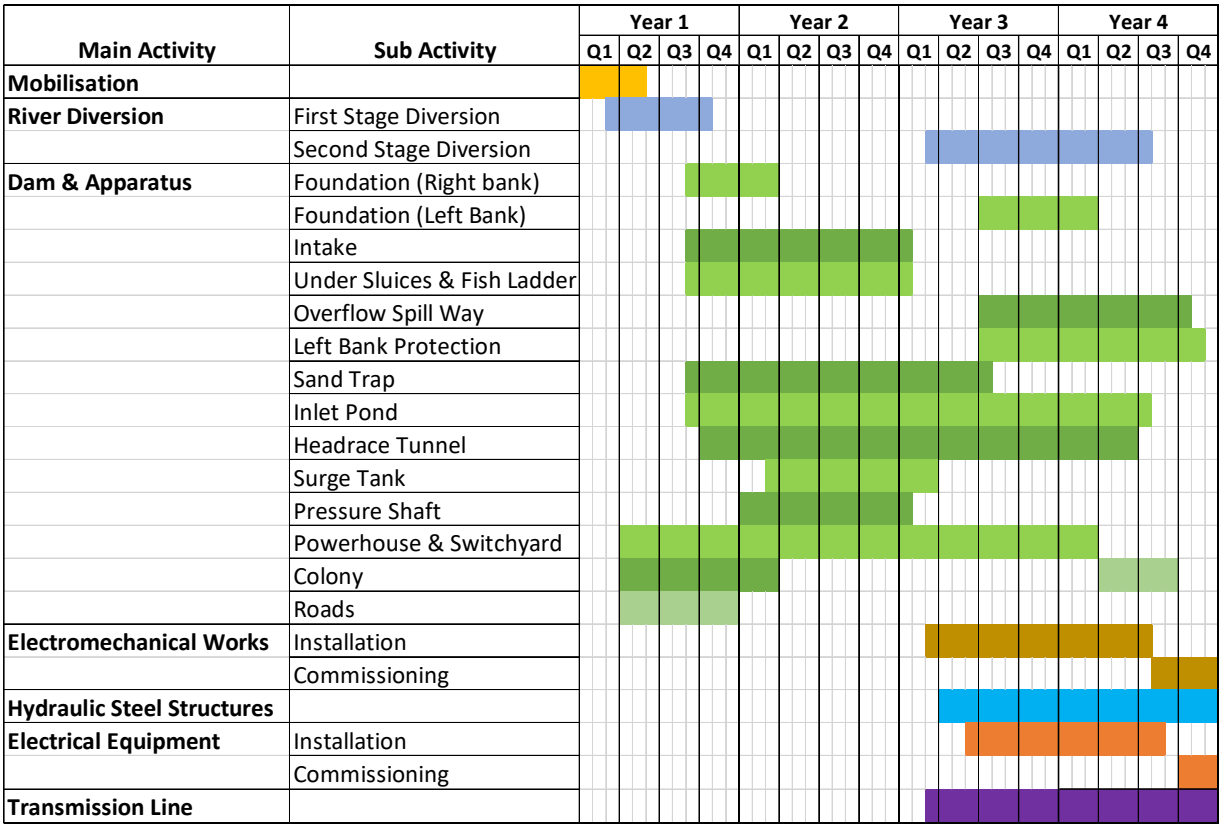


Figure 3.13: Construction Schedule of the Project

3.7 Operation Mechanism

The Project is a run-of-river scheme, and it does not involve any peaking operation so there will be no storage and peaking are involved. The length of the reservoir is 875 m with a capacity of 1.08 million m^3. When flows in the river are less than the design discharge (65 m^3/s), flows excluding environmental flows will be utilized for power generation. Whereas when the river is above design discharge, the design discharge will be utilized for power generation, and the rest of the water will be released in the river downstream of the weir in addition to environmental flows. The flows to be used for power generation and environmental flows are given in **Table 3.2**. Environmental flow estimates are calculated based on the requirement of water uses in the dewatered sections, including fish species, and details of these calculations are given in **Section 7.9.2**.

Table 3.2: Required Flows for Power Generation

River Flows			Environmental Releases	Flows Available for Power	Power Flows	Additional Spills in River
10 - Daily		(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)
Jan	I	7.90	2.00	5.90	5.90	
	II	7.55	2.00	5.55	5.55	
	III	7.28	2.00	5.28	5.28	
Feb	I	6.98	2.00	4.98	4.98	
	II	6.87	2.00	4.87	4.87	
	III	6.84	2.00	4.84	4.84	
Mar	I	7.13	2.50	4.63	4.63	
	II	8.07	2.50	5.57	5.57	
	III	9.79	2.50	7.29	7.29	
Apr	I	13.74	3.50	10.24	9.60	0.64
	II	20.66	3.50	17.16	17.16	
	III	33.21	3.50	29.71	29.71	
May	I	45.75	3.50	42.25	42.25	
	II	62.51	3.50	59.01	59.01	
	III	78.36	3.50	74.86	65.00	9.86
Jun	I	100.36	3.50	96.86	65.00	31.86
	II	118.04	3.50	114.54	65.00	49.54
	III	127.03	3.50	123.53	65.00	58.53
Jul	I	126.54	3.50	123.04	65.00	58.04
	II	118.66	3.50	115.16	65.00	50.16
	III	105.98	3.50	102.48	65.00	37.48
Aug	I	96.63	3.50	93.13	65.00	28.13
	II	80.76	3.50	77.26	65.00	12.26
	III	64.55	3.50	61.05	61.05	
Sep	I	49.73	3.50	46.23	46.23	
	II	38.55	3.50	35.05	35.05	
	III	29.16	3.50	25.66	25.66	
Oct	I	21.25	3.50	17.75	17.75	
	II	17.19	3.50	13.69	13.69	
	III	14.59	3.50	11.09	11.09	

Nov	I	12.73	3.50	9.23	9.23	
	II	11.38	3.50	7.88	7.88	
	III	10.20	3.50	6.70	6.70	
Dec	I	9.50	2.00	7.50	7.50	
	II	8.91	2.00	6.91	6.91	
	III	8.41	2.00	6.41	6.41	

3.8 Salient Features of the Project

A summary of the salient features of the Project is given in **Table 3.3**.

Table 3.3: Salient Features of the Project

S. No	Description	Details	
1	**LOCATION**		
	Country	Islamic Republic of Pakistan	
	Province	Khyber Pakhtunkhwa	
	District	Swat	
2	**HYDROLOGY**		
	Catchment Area at Dam Site	957	Sq.km
	Catchment Area at Powerhouse Site	1212	Sq.km
	Design Flood (QD)	65	m3/sec
	Design Flood (Q100)	1731	m3/sec
	Maximum Design Flood (Q1,000)	1731	m3/sec
3	**RESERVOIR**		
	Normal Conservation Level	2161.0	masl
	Flood Surcharge Level (Worst Case)	2165.3	masl
	Minimum Operating Level	2160.5	masl
	Depth of Reservoir at Weir Site	21	m
	Length of Reservoir	875	m
	Reservoir Capacity at NCL	1.08	MCM
4	**WEIR**		
	Weir Type	Concrete Gravity	
	Crest Elevation	2168	masl
	Slope: Upstream Face	1 in 0.8m	
	Slope: Downstream Face	1 in 1m	
	Height of weir above River Bed	21.0	m
	Maximum Height above Foundation	26.5	m
	Crest Length	149.5	m
	Crest width	7.0	m
5	**OVERFLOW SPILLWAY**		
	Type	Overflow ogee	
	Crest Level	2161.0	masl
	Length of Crest	67.5	m
	No. of Bays	5.0	m
	Design Flood (Q100)	1143	m3/sec
	Energy Dissipator	Hydraulic jump, Stilling basin	

S. No	Description	Details	
	Size of Stilling Basin	105 x 30 m	
	Stilling Basin Level	2137.0	masl
6	**UNDERSLUICE**		
	Type	Orifice type with ogee crest	
	Crest Level	2142.5	masl
	Head on Crest at NCL	18.5	m
	No. and Type of Gates	4.0 No's	Vertical lift
	Gate Size	5 x 5	m
	Total Length of Waterway	26.0	m
	Maximum Capacity at NCL	1293	m3/sec
	Crest Height above Foundation Level	6.5	m
	Energy Dissipator	Hydraulic jump stilling basin	
	Size of Stilling Basin	105 x 30 m	
7	**POWER INTAKE**		
	Type	Horizontal intake	
	Invert Level of Power Intake	2155.0	masl
	Working Head on Intake Crest	6.0	m
	Submergence Provided	1.0	m
	No. and Type of Gates	4.0 No's	Vertical lift
	Size of Gates	5 x 4.5m (H x W)	
	Total Width of Intake Structure	22.5	m
	Width of Waterway	18.0	m
	Design Discharge	65.0	m3/sec
	Discharge Capacity (Including Sediment Flushing Requirements)	78.0	m3/sec
	Intake Crest Height above River Bed Level	15.0	m
8	**FISH LADDER**		
	Type	Pool Pass type	
	Design Discharge	0.26	m3/sec
	Step Pools	109	No's
	Size of Pool	2.0m x 1.6m, (L x W)	
	Size of orifice	0.35m x 0.35m	
	Min. water depth	0.75	m
	Total Length of Fish Ladder	218.0	m
	Start Invert Level	2161.0	masl
	End Invert Level	2139.0	masl
9	**RIVER DIVERSION DURING CONSTRUCTION**		
	Coffer Dam		
	Type	Homogeneous fill type	
	Crest Elevation of Coffer Dams	2154.0 U/S	
	Diversion Flood (Q25)	10 years	Peak 781 m3/sec
	Embankments Upstream Slope	1 in 1.5	
	Embankments Downstream Slope	1 in 1.5	
	Diversion Channel	Concrete lined	

S. No	Description	Details	
	Type		
	Lining Thickness		
	Size of Diversion Channel (WxD)	16.0m wide & 7.5m deep	
	Length of Diversion Channel	620m	
	Depth of Flow in Diversion Channel at design flood 10 years	6.2m	
	Freeboard	1.3m	
	Flow velocity	5.1 m/sec	
10	**CONNECTING CONDUIT**		
	Type	Rectangular Box type	
	Number of Conduits	2.0	No's
	Design Discharge	39.0	m3/sec
	Size	5.2m x 5.0m, (W x D)	
	Average Length of Conduit	202.75	m
	Average Flow Velocity	1.60	m/sec
	Bed Level at Start	2155.5	m asl
	Bed Level at End	2155.44	m asl
	Friction Losses in Connecting Conduit	0.06	m
11	**SANDTRAP**		
	Type	Gravity type	
	Particle Size to be Removed	0.2	mm
	Average Velocity in Chambers	0.181	m/sec
	Length of Chamber	165	m
	Length of Upstream Transition	20.0	m
	Size of Sandtrap Chamber	14.75 x 13.5m	
	Invert Level of Sandtrap at Start	2155.44	masl
	Outflow Crest Elevation from Sandtrap	2156.5	masl
	Nos. and Type of Outflow Control Gates	2.0 No's	Vertical lift
	Outflow Control Gates Size	4.5m x 5.0m, (H x W)	
	Flushing Arrangement per Chamber	Gated control Orifice type	
	Flushing Discharge	13.0	m3/sec
	Total head losses in the sandtrap	0.062	m
	Trap Efficiency	79.0	percent
12	**INLET POND**		
	Type	Concrete lined rectangular section	
	Invert Elevation at Start	2147.0	masl
	Invert Elevation at Tunnel Inlet	2147.5	masl
	Size of Inlet Pond	35.0m x 27.5m	
	Depth of Flow	14.0	m
	Submergence to Headrace Tunnel	10.4	m
	Elevation of Inlet Pond Top	2162.5	masl
	Velocity at Design Discharge	0.5	m/sec
13	**HEAD RACE TUNNEL**		

S. No	Description	Details	
	Type	Low-pressure headrace	
	Shape	Modified Horseshoe type	
	Invert Elevation of Tunnel	2147.5	masl
	Flow Area	27.36	m2
	Average Flow Velocity	2.38	m
	Diameter of Tunnel	5.8	m
	Length of Tunnel up to Surge Shaft	4710	m
	Invert Level of Tunnel at Surge Shaft	2123.35	masl
	Head Loss in Tunnel	3.67	m
14	**SURGE SHAFT**		
	Type	Simple restricted orifice	
	Geometry	Circular type	
	Maximum Surge Level	2184.9	masl
	Minimum Surge Level	2137.86	masl
	Diameter of Surge Shaft	12.9	m
	Diameter of the Throat	4.0	m
	Full Operational Water Level	2156.83	masl
	Top Level of Surge Shaft	2193.0	masl
	Height of Surge Shaft	60	m
15	**PRESSURE SHAFT / TUNNEL**		
	Type	Pressurized tunnel	
	Geometry	Circular section	
	Pressure Shaft centerline at start	2126.25	masl
	Diameter of Pressure Shaft and Tunnel	4.0	m
	Flow Area	12.56	m2
	Length of Pressure Shaft	145.0	m
	Length of Pressure Tunnel	130.0	m
	Average Flow Velocity	5.17	m/sec
	Steel Lining thickness	10 to 26	mm
	Invert Level of Pressure Tunnel End	1990.1	masl
16	**PENSTOCK**		
	Invert Level of Penstock	1990.1	masl
	Length of Penstock	65.0	m
	Diameter of Penstock	4	m
	Thickness of Steel Lining	35.0	mm
	Velocity in Penstock at Design Discharge	5.17	m/sec
	Net Head at Penstock	159.61	m
	Head Losses in Penstock	1.98	m
	Invert Level of Penstock at Powerhouse	1991.23	masl
17	**MANIFOLD**		
	Type	Symmetrical wye	
	Number of Branches	three	

S. No	Description	Details	
	Diameter of each Branch Pipe	2.3	m
	Velocity in Manifold at Design Discharge	5.21	m
	Thickness of Steel lining	26	mm
18	**POWERHOUSE AND ACCESSORIES**		
	Type	Surface/Open	
	Size of Powerhouse	44x16 Meter	
	Turbine	Vertical frames/ Francis	
	Generation Units	3	No's
	Unit Discharge	2x27.7 & 1x 9.6	m3/sec
	Generator Type	Vertical synchronous type	
	Power Transformers	Step up-11kv- 220kv 3phase	
19	**TAILRACE**		
	Type	Concrete lined channel	
	Length of Tail race	15.48 m	
20	**SWITCHYARD**		
	Size of switchyard area	44x16 inside	
	Switchgear	Gas Insulated System (GIS) 220kv-3 phase	
21	**TRANSMISSION LINE**		
	Transmission line Length	2.75 km approx.	
	Type	Loop in loop out (double circuit twin bundle)	
22	**HEAD AND DISCHARGE**		
	Gross Head	161.0	m
	Rated Net Head	153.0	m
	Head Loss at Design Discharge	8.0	m
	Design Discharge of Plant	65.0	m3/sec
23	**CAPACITY AND OUTPUT**		
	Plant Capacity	88 MW	
	Capacity per Unit	2 x 37.5 & 1 x 13.0 MW	
	Plant Factor	44.7	
	Average Annual Energy	339 Gwh	

4 Analysis of Alternatives

This chapter presents the analysis of various alternatives considered during the planning and design stages of the project and provides a comparative evaluation of their respective environmental and social benefits and impacts.

4.1 The Without Project Option

Pakistan is suffering from an acute power and energy crisis, which is primarily caused by the increasing gap between the supply and the demand for electricity. Between 2013 and 2017, the supply of electricity increased with an average of 6.84 percent per year from 14,600 MW to 19,020 MW. The demand for power meanwhile increased with 7.47 percent per year from 18,827 MW to 25,117 MW. This resulted in an escalating gap between supply and peak demand.

Due to a large gap between the demand and the supply, aggravated by the fact that existing thermal power plants do not produce at their full capacity due to their dependence on imported fuel, there is load shedding. Fuel for power plants is imported, and there is a shortage of fuel due to the lack of foreign currency. Presently, the current deficit between demand-supply is the range of 4,000 to 6,000 MW. Load shedding is 4 to 6 hours in urban areas and more in rural areas per day. Load shedding is applied throughout the year, which varies according to the consumption type, season, peak and off-peak hours.

Hydropower production as a percent of total energy production declined from about 64 percent in the period 1970- 1980 to about 27 percent in recent years, despite the huge hydropower potential in the country. Since the nineties, the power system in the country has steadily relied more and more upon thermal energy. In 2016-17, about 64 percent of the total installed power capacity originated from fossil power plants, about 25 percent from hydropower production, and the remaining from other renewable and nuclear sources. The greater reliance on thermal sources also resulted in increasing dependency on imported fuel (oil, gas, and coal). As much as 85 percent of oil and allied products are imported. The imports result in the high cost of power production and these high imports require USD 4 billion in foreign currency in fuel payment for power generation.

Case of "Without Project Alternative"

The “without project” alternative is not realistic, because Pakistan will build additional generating plants to eliminate power shortages. Given the increasingly prohibitive costs of fuel oil-based electricity generation, the development of Pakistan’s hydropower resources at a variety of scales represents the only reasonable prospect of eliminating these shortages. The above mentioned negative effects of short supply and high demand for electricity in the country confirm that 339 GWh to be produced by the Gabral Kalam Hydropower Project is genuinely needed and will be easily absorbed in the National Grid to help ease the load-shedding up to some extent.

4.2 Analysis of Alternatives in Project Planning and Design

During the project conception and planning stages, a number of alternatives were considered while taking into account the technical, social and environmental aspects at the fore. After the selection of the technically feasible, financially viable and socio-environmentally acceptable alternatives, the selected project layout and sub-structures were further fine-tuned to minimize the related impacts through alternative planning/design options. Various aspects of the alternatives and fine-tuning of the finally selected project layouts are described below.

4.2.1 Project Development Alternatives During Planning Stage

At the planning stage, various alternatives were considered in the river stretch between the Utror village (near the confluence of Gabral and Batal Khwar) and Kalam. Three possible locations for weir (W1, W2, and W3) and two possible locations for powerhouses (P1 & P2) were identified. Some of these locations were identified by previous studies of PEDO. From the available locations of weirs and powerhouses, eight (8) alternatives were developed and the best options were selected from the perspective of avoiding and minimizing social and environmental impacts, as shown in **Figure 4.1** and **Table 4.1**.

Table 4.1: Description of Alternative Layouts for Project development

S.No.	Alternative Name	Description	Power Potential (MW)
1	W1A – P1	Weir (50 meters) at GTZ location and Powerhouse opposite Ashuran	82
2	W1B – P1	Diversion Weir (10 meters) at GTZ location and Powerhouse opposite Ashuran	57
3	W1A – P2	Weir (50 meters) at GTZ location and Powerhouse at the right bank of Desan Khwar	116
4	W1B – P2	Weir (10 meters) at GTZ location and Powerhouse at the right bank of Desan Khwar	91
5	W2 – P1	Diversion Weir (20 meters) near Batindar and Powerhouse opposite Ashuran	88
6	W2 – P2	Diversion Weir (10 meters) near Batindar and Powerhouse at the right bank of Desan Khwar	122
7	W3 – PI	Diversion Weir (5 meters) at Dhamaka Jheel and Powerhouse opposite Ashuran	112
8	W3 – P2	Diversion Weir (5 meters) at Dhamaka Jheel and Powerhouse at the right bank of Desan Khwar	147

Amongst the alternatives, the ranking was done on the basis of power potential, geology, socio-environmental, and planning and design aspects. Each important component of the scheme, i.e. weir, sand trap, tunnel, powerhouse, accessories and access roads, etc. was given due weightage for ranking. Based on the ranking exercise, Alternative W2-P1 was selected for the feasibility study. Though with the increase in the height of weir, the power potential of the selected layout could be increased; however, due to social and environmental aspects, the project was optimized on 88 MW. All P2 options of powerhouse were downstream of the Kalam town. Gabral River is the lifeline of Kamal tourism in Swat valley, and significant depletion of water (due to water diversion) in the Gabral River could severally affect the tourism and local economy that could warrant associated socio-economic risks.

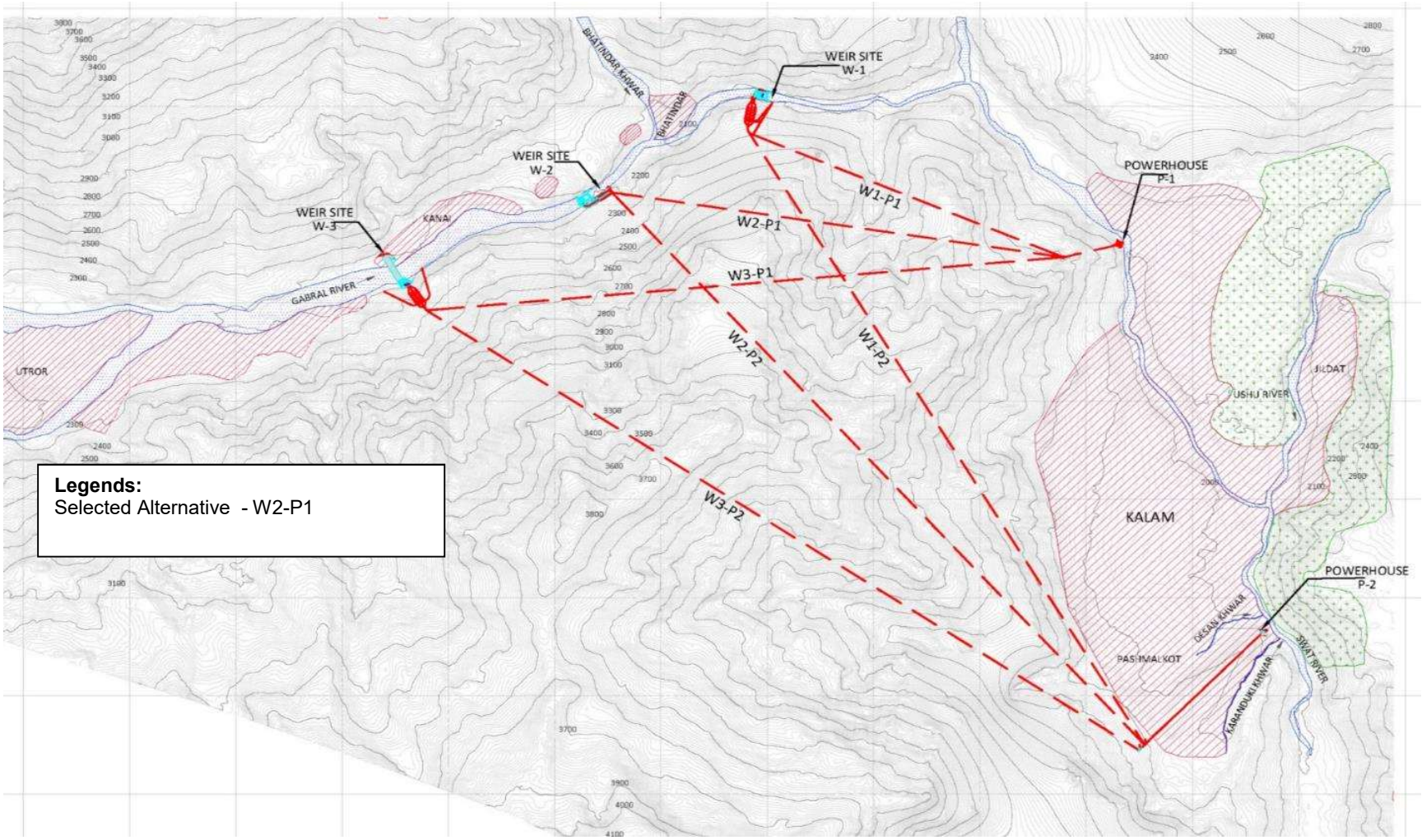


Figure 4.1: Alternative Layouts for Project development

4.3 Analysis of Alternatives in Project Design

During the design stage, several alternatives are considered to minimize the environmental and social impact for each sub-structure of the selected layout. They are briefly described below.

4.3.1 Reservoir Limitations and Weir Height

Theoretically, a dam of more than 70-100m height is possible at the selected location due to high abutment on both banks of the river, however, due to avoid inundation of Kanai and Utror villages, the height of weir is selected to keep at a level such that both the villages have no inundation and associated socio-economic and environmental impacts.

River level at the proposed weir site is 2140 masl. The corresponding level of the villages / terraces in Utror and Kanai villages are given in **Table 4.2** and shown in **Figure 4.2.**

Table 4.2: Level of Terraces and Settlements in Utror and Kanai Villages

Location	Terraces Level (masl)	Settlement Level (masl)
Lower Terraces of Utror Village	2195	2195
Upper Terraces of Kanai Village (Right of Kanai Nallah)	2190	2195
Upper Terraces of Kanai Village (Left of Kanai Nallah)	2170	2175
Lower Terraces of Kanai Village	2160	2165

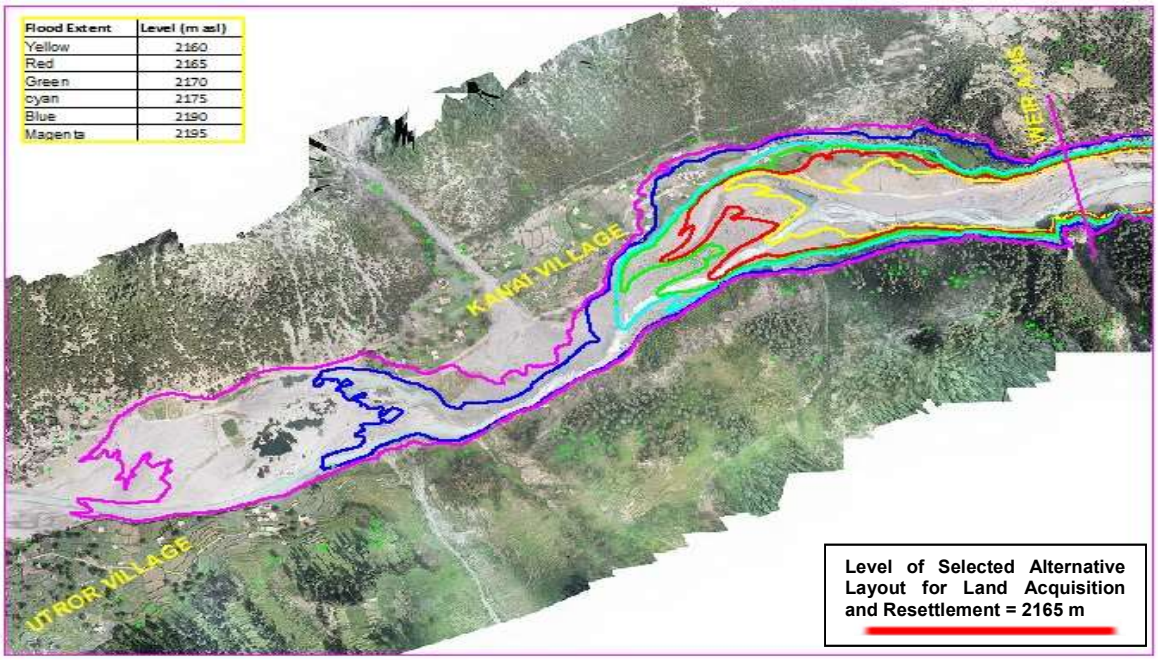


Figure 4.2: Possible Weir heights and associated inundation up to the Utror village

As evident from the above table, the most critical one is the level of the lower terraces of Kanai village. The main settlements of the Kanai village are along the left and right banks of the Kanai stream at lower terraces. There are few isolated houses in the lower terraces of Kanai village, whereas most of the

irrigated land of lower terraces were eroded by the 2010 flood. The level of the five houses is about 2165 masl. Therefore, for socio-environmental considerations, a conservation level of about 2160 masl will be having no or nominal socio-environmental impacts. The level has been further tuned to 2161 masl during the course of study and recommended for the normal conservation (operational) level of the reservoir.

4.4 Social and Environmental Considerations in the Design

After the selection of the recommended project location, the sub-components were further studied to minimize the cost and socio-environmental impacts. Some of these considerations are described hereunder.

4.4.1 Type of Weir/Dam

Potential options for the type of weir include earth-fill dam, rockfill dam, and concrete gravity dam. Earth fill dams are the easier and simpler type for construction, but there is no adequate clayey material available in the region within the acceptable transportation limit so that the project may become attractive economically. Further, spillway cannot be constructed on the body of the earth-fill dam and thus, separate arrangements have to be made (requiring additional land acquisition). The location selected for the weir axis has no option for the separate spillway. In the case of a rockfill dam, though the rock is adequately available locally, the problem with the spillway will remain the same. A concrete gravity dam is selected since spillway and other outlets can be constructed within the dam body, availability of material locally, and other technical advantages.

4.4.2 Non-Peaking Reservoir

A peaking reservoir is recommended for the Project by the earlier study for economic reasons, wherein water would have stored in the reservoir for 18 to 20 hours and release in 4 to 6 hours for electricity generation. However, during the current study, it was identified that the Swat River flow is being utilized at Upper Swat and Lower Swat Canals for 24 hours of supply based irrigation. If the peaking system is used in the Project, the 100-year-old entire irrigation system would have disturbed in terms of water distribution timings and would have required additional infrastructure to re-regulate irrigation water distribution. Therefore, the peaking concept is dropped, and a non-peaking reservoir is selected.

4.4.3 Diversion During Construction

Diversion during construction was considered “with tunnel” and “without the tunnel (open channel).” Apart from the technical reasons, an important aspect of the selection of “Diversion in Channel” was the risk involved in the tunnel blockage due to logs in the floodwater, pose risks to the overflow of cofferdam which has serious social impacts terms of health and safety of construction workers, protection of equipment and material.

4.4.4 Headrace Tunnel Alignment

The headrace tunnel is passing deep in the intermediate valley to avoid the possibility of opening of the tunnel in the stream (daylighting), which would have required acquisition of additional private and forest land due to the construction of new access road.

4.4.5 Reservoir Levels and Freeboard

Weir is designed to pass the 1000 years flood in the basin safely. The normal conservation (operational) level of the reservoir is 2161.00 m. To pass the 1000 years flood, a surcharge of 3.90m is expected. Thus

a level of 2164.90 m is the extreme flood level. A freeboard of 1.85m is kept above the flood level up to the soffit of the bridge. Whereas the bridge top on the weir is 2168m (7m above normal conservation level).

4.4.6 Employer's Facilities

Three different locations were considered for the project Employer's facility. An area that is safe from sloughing from hill slope and away from the riverbank is selected. This is also closer to the community so that the facilities like the school, hospital, shops, etc. provided in the colony are open for use by the locals as well. And the affected population demanded these facilities under the project.

4.4.7 Reclamation / Reuse of Area

Some parts of the lower irrigated terrace of Kanai village will be inundated in the reservoir. A flood protection bund is proposed along the existing road to protect land in the vicinity from inundation. However, due to the low level, the area may become waterlogged. To avoid this scenario, it is proposed to put the dump material in this area to raise it, which is also a strong demand by the local population. After rising off the area, a soil cover will be spread on the top to reuse the lands for agriculture purposes.

4.4.8 Spoil (Muck) Disposal Areas

Apart from the muck disposal areas at the weir site, a number of areas were identified at the powerhouse as well. These areas are basically the washed irrigated land due to the 2010 flood event. The areas will be acquired on a temporary basis for muck disposal, which will recover their lost agriculture lands. On the request of the local community, the land will be leveled to enable them to reuse these lands for agriculture after construction activities. These lands can also be used for commercial activities.

4.4.9 Aesthetics / Tourism Attractions

The Kalam town, near the project sites, is a tourism hub in the Swat valley. Due to the tourism potential in the project area, the project facilities can be converted to better aesthetics and tourist attraction places. The Project has taken the following measures :

- The most important aspects with respect to tourism and environment are the shifting of powerhouse upstream of the Kalam village and weir downstream of *Dhamaka Jheel* at the planning stage. A number of options with three weirs and two possible powerhouse sites were identified. The pros and cons of these alternative options were discussed at the planning stage and have briefly been described in Section 4.2. By shifting the powerhouse, the entire Gabral River water is allowed to flow in Kalam round the year to keep the attraction for tourism. Similarly, weir W3 at *Dhamaka Jheel* (a tourist site) near Kanai village was shifted to the W2 location based on various reasons, including tourism.
- An artificial lake is itself an attraction for tourists as well as the locals to develop commercial activities along the reservoir banks. The spoil disposal area along the reservoir can be handed over after restoration to the original owners, which can be used for livelihood activities such as the establishment of small eateries, kiosks, water sports during the operation phase of the Project.
- Although a spillway fall is an attraction for tourists during high flow months when surplus water can be released from the spillway, yet another attempt was made to keep the spillway further attractive. The chute of the spillway is provided with deflector blocks so that even with the small

surplus water, the chute beauty can be improved for tourists' attraction. This will also help in dissipating the flow as well.

- The left bank of the Gabral River at the weir site is composed of overburden material where the existing road will be re-routed up to the weir top level. For the stability of the road, the slopes of the bank will be excavated along with cutting off a number of trees. The cut slopes of the road will not only be stabilized with structural measures, but plantations will be made from the very first day after rerouting the road so that the trees become mature till the end of the project. Toe of the slope along with the existing road, will be restored to attract the tourist to stay and enjoy the chute spillway in operation.
- Upstream of the weir, the left bank will be stabilized by constructing a wall along the riverside. Due to the construction of this wall, a space of 15-20m, in addition to the proposed road, will be available as a raised platform. This is the location where both the spillway chute and reservoir can be seen simultaneously. Therefore, the space up to a distance of 150-200m will be converted into a scenic point for tourists.
- The protection wall along the right bank at the weir site will be designed with the architectural measures to improve its scenic beauty.
- The road at powerhouse location with a bridge will be an additional facility to the locals to cross the river through a short route instead of going far away to cross the river, and the two-third distance will be reduced.
- The road from powerhouse to the surge shaft is passing through dense vegetation on the upstream side however, there is less dense vegetation on the downstream side. A part of the additional plantation, this road, after the construction of the project, will be a very good track for the tourists for hiking. An open space near the surge shaft area will be developed for tourists to see the Kalam village along with the Ushu and Gabral Rivers.
- There is a very narrow gravel road used by the locals to reach the Kalam. The construction of roads will also cover a significant part of this track, which will improve the local mobility to Kalam easily.

5 Baseline Environment

This chapter defines the project influence area and presents a detailed overview of the physical, biological, and socio-economic environment within the project influence area, and results of the primary investigations carried out under the Project.

5.1 Definition of Project Influence Area

The Project influence area (or the project area) comprises of about 11 km-long valley of the Gabral River and its mountains, from Kanai village (one km upstream of the weir site to cover the reservoir area, and the Kanai village, which is affected by land acquisition) to Kalam town (10 km downstream of the weir site, where it joins the Ushu River to form the Swat River). The project activities are not likely to have any impact beyond one kilometer upstream of the weir site, and hence has been considered the upstream boundary of the project area. The rationale for defining the 10-km downstream boundary is that all project facilities, including the temporary facilities and access roads, will be located within this boundary. The project activities will have minimal impact on the downstream hydrology and aquatic ecology beyond 10-km downstream of the weir site due to the joining of another major river, Ushu to form the Swat River. The influence area covers all those areas that will likely to be directly (by the footprints of all the proposed project infrastructure, including land acquisition) or indirectly (by the temporary facilities such as construction camps and disposal areas, and access routes) affected by the proposed construction and operational activities.

Detailed environmental, ecological, and socio-economic surveys were carried out in the project area through a review of secondary literature, field investigations for primary data collection, sampling, and analysis of water, air and noise quality, questionnaire surveys, and community and stakeholder consultations. The map of the Project influence area is given in **Figure 5.1.**

Figure 5.1: Location Map of Project Area of Influence

5.2 Physical Environment

5.2.1 Physiography

The physiography in the project area is dominated by mountainous terrain, narrow valleys of the Gabral river and its tributaries, eroded riverbanks, and agricultural lands in the valleys and forests on the hillslopes. The valley near the weir site is narrow (100m), but it gradually widens on both upstream and downstream (up to 500 m). The elevations along the Gabral River, in the project area, range from 1974 to 2180 meters above sea level (masl), while the elevations of the mountains range from 3700 to 4300 masl. The river carries high water flows during summer months due to the melting of snow and glaciers and very little flows during winter months. Riverbank erosion from the high sediment flows during floods is noticed on both banks of the river. A typical photograph of the project valley area is shown in **Figure 5.2.**

Figure 5.2: A View of the Project Area

Physical Setting and Land use: The project site is located in a rural setting with all lands in the valley along the river are extensively used for agricultural uses, and the hills are covered with the forest vegetation. The major settlements in the project area are Kalam (a major tourist town with a population of about 12,300 people and 1351 households). Ashuran is another major settlement in the project area with a population of 5100 (676 households) , which is further divided into sub-villages (including Paler, Mahai, Rashnail, Sher Kally, and Chirat, which are located close to the project facilities). The nearest settlement close to the major construction site is Kanai village (which is located 0.9 km away from the weir site, on the upstream). A gravel road is located along the right bank of the river, which connects the project villages to the Kalam. Other important feature of the area is severe erosion on the left bank of the river by the 2010 flood, which engulfed the previously existing agricultural lands and filled them with the river sediments and huge boulders and made them not suitable for any cultivation (these lands are referred as 'barren lands' in the social context). The land use map of the project area along the project facilities is shown in **Figure 5.3**.

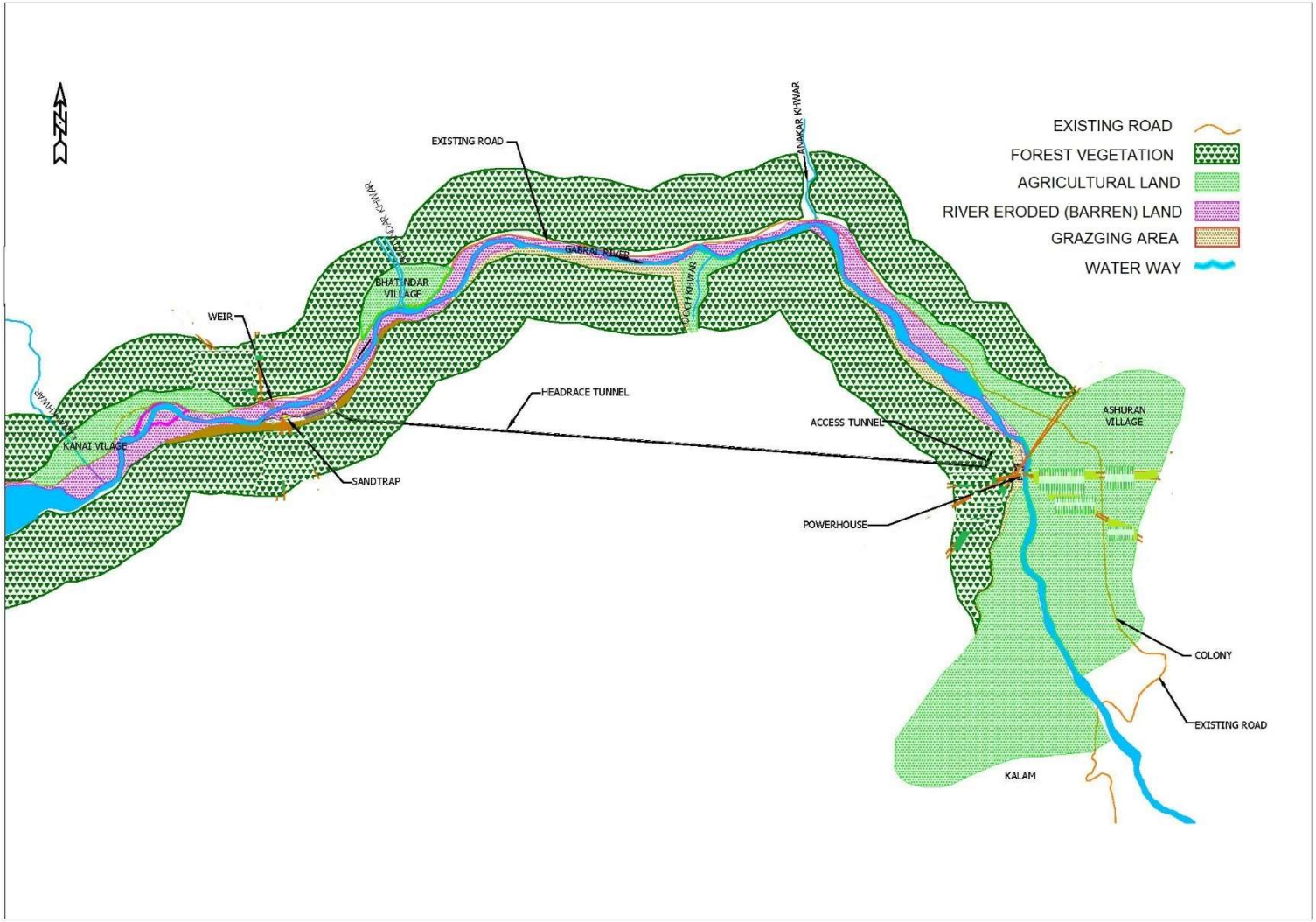


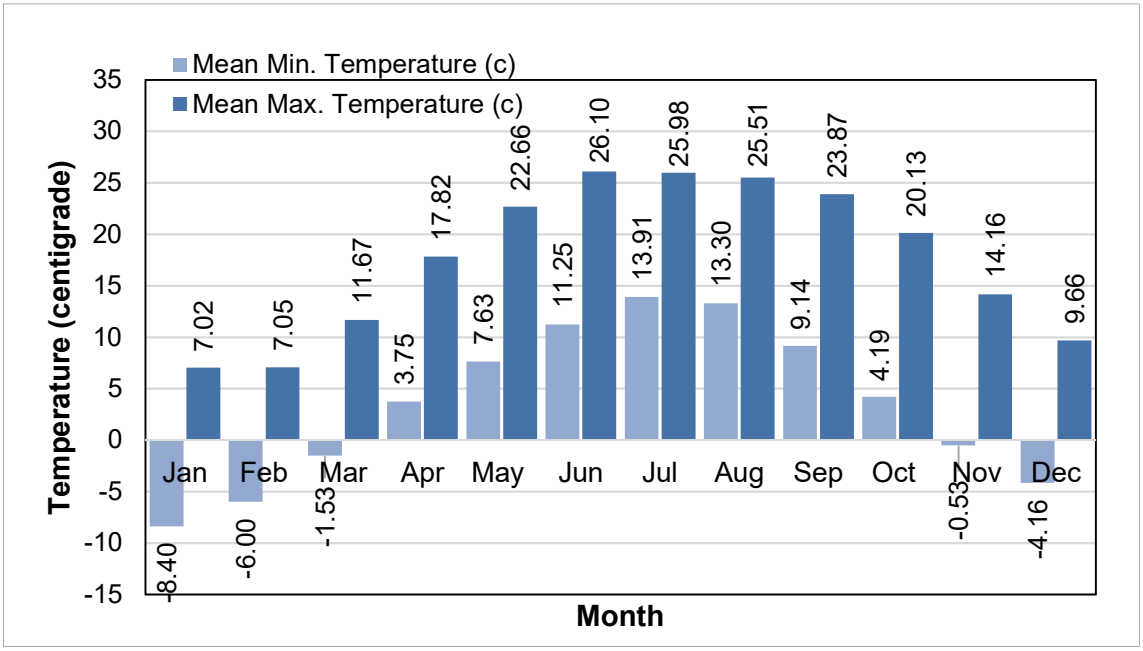
Figure 5.3: Land Use Map along with the project facilities in Project Area

5.2.2 Climate

According to Koeppen climate classification, the project area can be classified as 'humid subtropical climate,' characterized by warm and humid summers, and cold to mild winters. The winters in the project area are freezing with minimum temperatures ranging from -0.4 °C to – 8.4 °C from November to March. The temperatures in Spring (April and May) and in Autumn (September and October) are usually warm in the daytime (17 to 20 °C) and cold on the night time (3 to 10 °C). The mean monthly maximum temperature in the summer months (June to August) is around 26 °C. The summer (July to August) are hot with maximum average temperatures ranging from 25.5 °C to 26.1 °C.

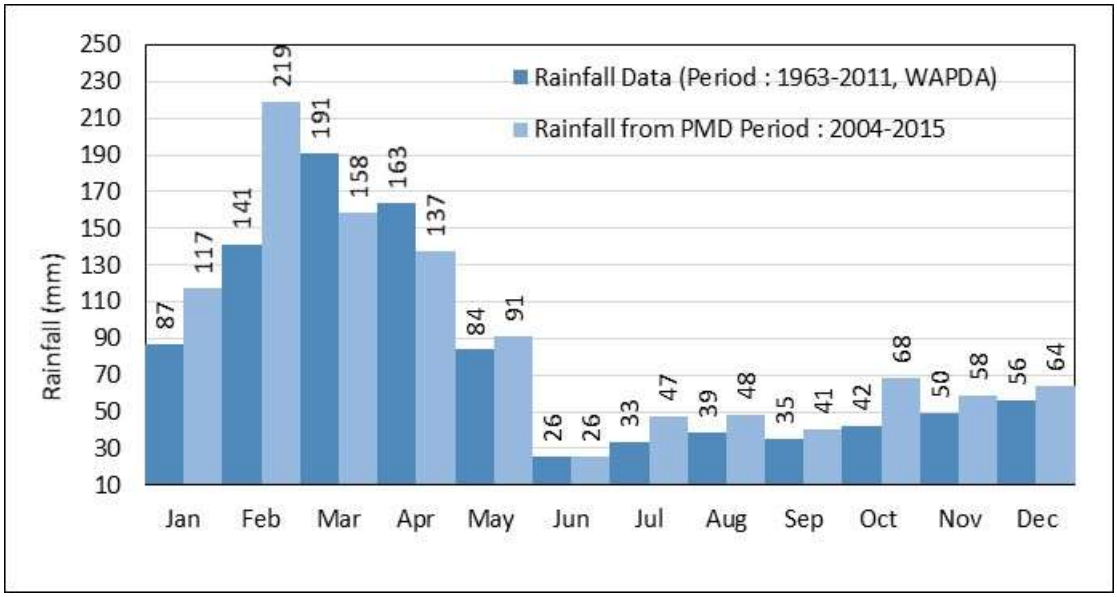
The average annual precipitation is about 1076 mm, with nearly 58 percent of precipitation falls as snowfall during winter. The minimum temperature recorded in Kalam was -11 °C in January, while the maximum temperature recorded was 32.4 °C in June. Monthly climate data at Kalam is given in **Figures 5.4 and 5.5**. The permanent snowline in the region starts above 4500 masl.

The average wind speed in the project area is 10.89 km/hr. The maximum wind speed is observed during the months of January to March (up to 13.8 km/hr), whereas the minimum wind speed is recorded in the months of September (8.1 km/hr).



(Source: Pakistan Meteorological Department PMD)

Figure 5.4: Mean Monthly Temperature Pattern at Kalam



(Source: Pakistan Meteorological Department PMD)

Figure 5.5: Mean Monthly Precipitation Pattern at Kalam

5.2.3 Hydrology

5.2.3.1 Hydrology of Gabral River

The catchment of the Gabral River lies in the upper region of the Hindu Kush mountains of the Swat River basin and can be classified as a "high mountain catchment." The highest mountain peak of the river reaches above 5500 masl. Snow and glacier melt during summer are the major sources of river flows. The length of the Gabral River up to the weir is about 35.40 km. The average river bed slope ranges from 0.02 to 0.03. The catchment area of the Gabral basin is shown in **Figure 5.6**. The major tributaries of the Gabral river are Shahi Bagh Nullah, Batal Khwar, and Bhan Khwar. The Bhan Khwar rivers join the Gabral on the downstream of the proposed weir. The catchment area of the Gabral up to the weir site is 951 km^2 and up to the confluence with the Ushu River is 1218 km^2.

The mean 10-daily flows of the Gabral river at the weir site are shown in **Figure 5.7** and they vary from 6.8 m^3/s to 127.0 m^3/s. The river flows are usually higher during the months of May to August due to the melting of snow. During these months, the river carries higher flows than the 65 m^3/s (peak design discharge of the project) and hence there will always be excess flows from the weir during these months. The river flows start to decrease from September, and the river flows are low (6.8 to 9.8 m^3/s) from December to March.

5.2.3.2 Sediment Concentrations of the Gabral River

The average sediment concentration of the Gabral River is 0.01% (by weight[3]) or 100 parts per million and containing approximately 24% sand, 45% silt, and 31% clay at high flow. The annual estimated suspended sediment load carried by the Gabral river is 126,492 tons, in which 86% of the load is carried during five months of high flow season (May to September). The monthly sediment load of the Gabral River is shown in **Figure 5.8**.

[3] Feasibility study of GKH Report, 2019

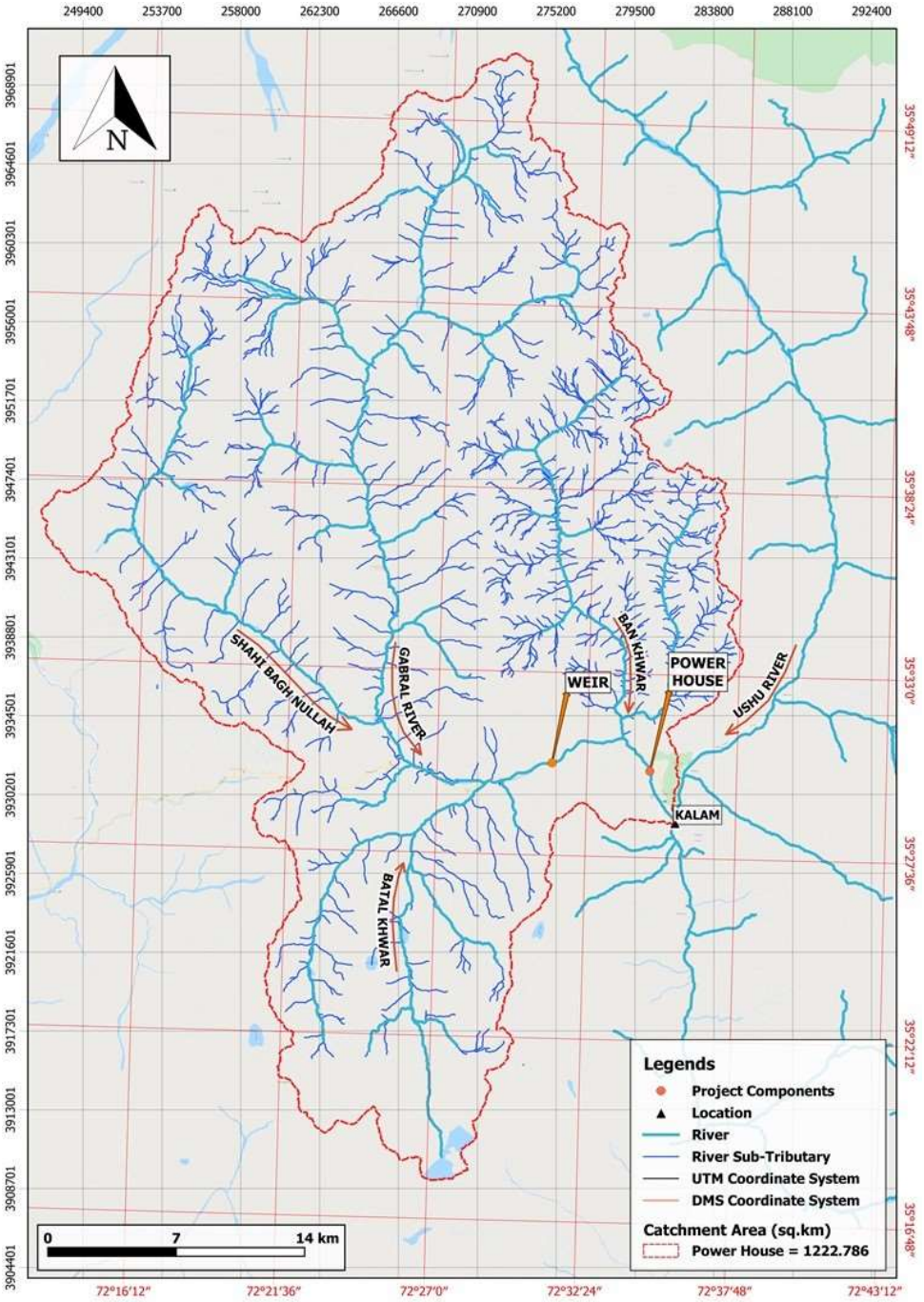
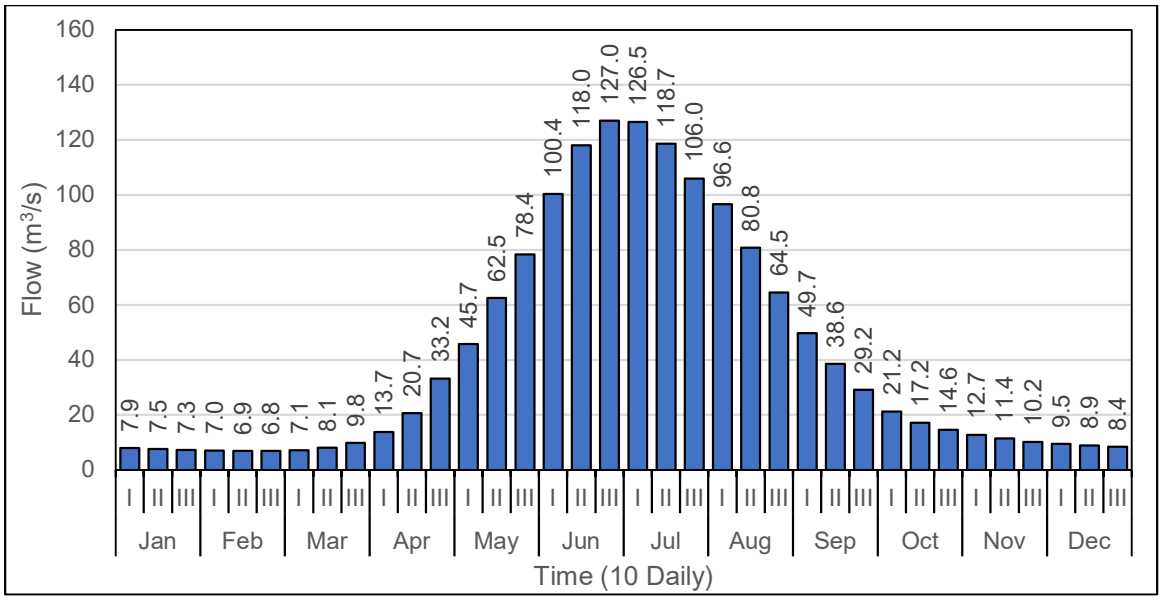


Figure 5.6: Catchment Area of the Gabral River



(Source: The Feasibility study report of GKH, 2019)

Figure 5.7: Mean 10-day Discharges of the Gabral River

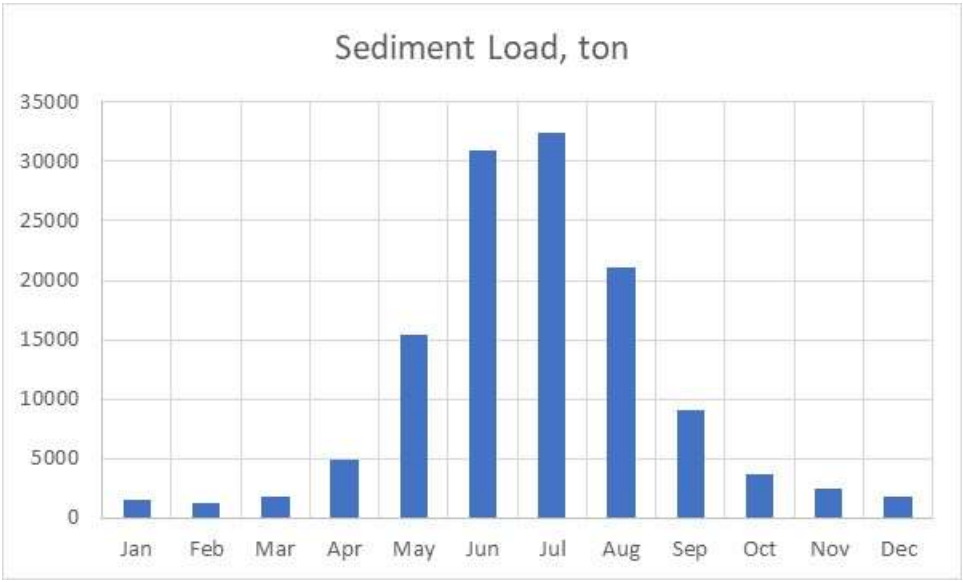


Figure 5.8: Monthly Sediment Loads of the Gabral River

5.2.3.3 Floods of the Gabral River[4]

The peak instantaneous discharges of the Gabral River during the floods vary from 77 m^3/s (in 2001) to about 1400 m^3/s (in 2013). The flood in 2010 (a flood of 300-year return period) is one of the worst in the region and caused severe damages to the infrastructure and the agricultural land abutting the river.

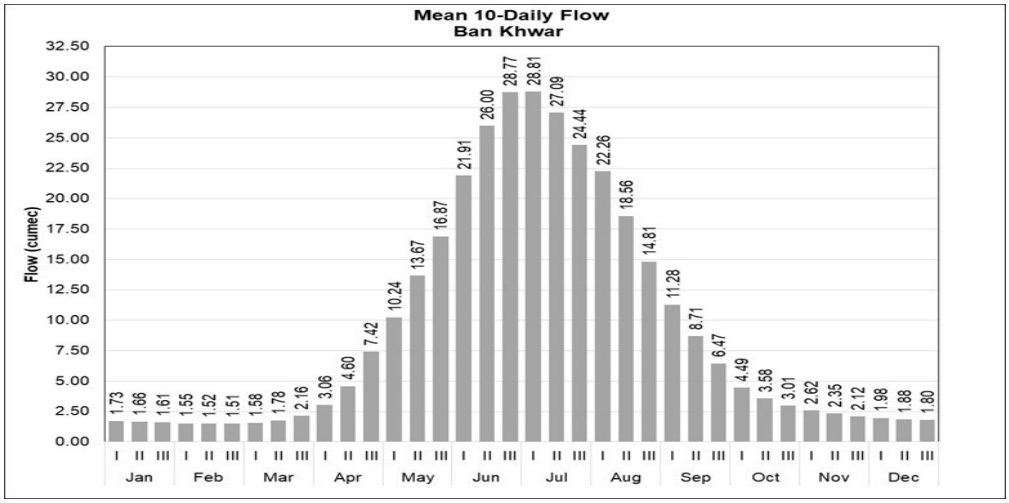
[4] Feasibility study Report of GKH, 2019.

A detailed flood frequency analysis is carried out for the project and the following results are used for the design of the project facilities:

- Flood of 10-year return period: 781 m^3/s (used for temporary river diversion works during construction)
- Flood of 100-year return period (Design Flood): 1293 m^3/s
- Flood of 1000 year return period (Maximum Design Flood): 1791 m^3/s

5.2.3.4 Hydrology of the Bhan Khwar River

Bhan Khwar is the perennial tributary of the Gabral River, located 4 km downstream of the proposed weir site (in the dewatered section, between the weir and tailrace). The mean 10-day flow of Bhan Khwar is shown in **Figure 5.9**. The 10-day mean flows in the winter months vary from 1.5 to 3 m^3/s and in summer varies from 10 to 28 m^3/s. The winter flows from the Bhan Khwar river contributes to additional environmental flows from the weir to be released from the Project. A 1.2 MW hydropower site is located on the river, which supplies electricity to the local villages in the project area.



(Source: The Feasibility study report of GKH, 2019)

Figure 5.9: Mean 10-day Discharges of the Bhan Khwar River

5.2.3.5 Groundwater

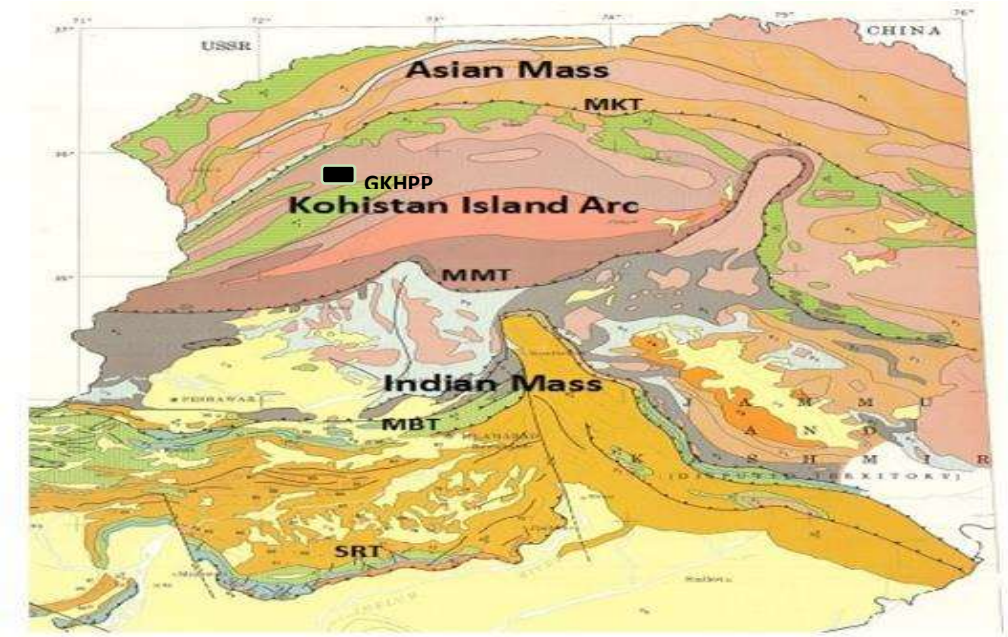
Groundwater in the project area is assessed by using the geotechnical investigations carried out during the feasibility study. The groundwater levels within the riverbed are shallow, with depths ranging from 0.8 to 4.5m, due to the presence of overburden riverine deposits. Whilst, the groundwater was not encountered in the boreholes that were drilled away from the riverbank due to the lack of fractures in the underground phyllite and schist formations. The boreholes drilled at the left abutment, tailrace, powerhouse and surge shaft did not show the presence of groundwater up to a depth of 200m. Hence it is not anticipated that groundwater is going to be a problem during the construction of foundations on the river banks, although there is a possibility of ingress of water through joint planes and discontinuities.

There is no extraction of groundwater in the area either through open wells or borewells for the drinking and irrigation uses. There are several springs located in the project area on both sides of the mountain, which are being extensively used for drinking and irrigation purposes by the local communities.

5.2.4 Seismicity

According to the Tectonic Map of Pakistan (**Figure 5.10**), the project area is located in a tectonically active region affected by the continuing northward drifting of the Indian plate and its subduction below the southern flank of the Eurasian plate. The collision of the two plates began about 50 million years ago, and the full contact between them was completed about 40 million years ago. Yet the Indian plate keeps on slowly drifting northward.

According to the building code of Pakistan Seismic Provisions (2007), the project area falls in zone 3 (corresponding to intensity VII and higher of the Modified Mercalli intensity scale) with recommended peak ground acceleration (PGA) of 0.24 to 0.32g. Risks of earthquakes are further discussed in **Section 6.4.**

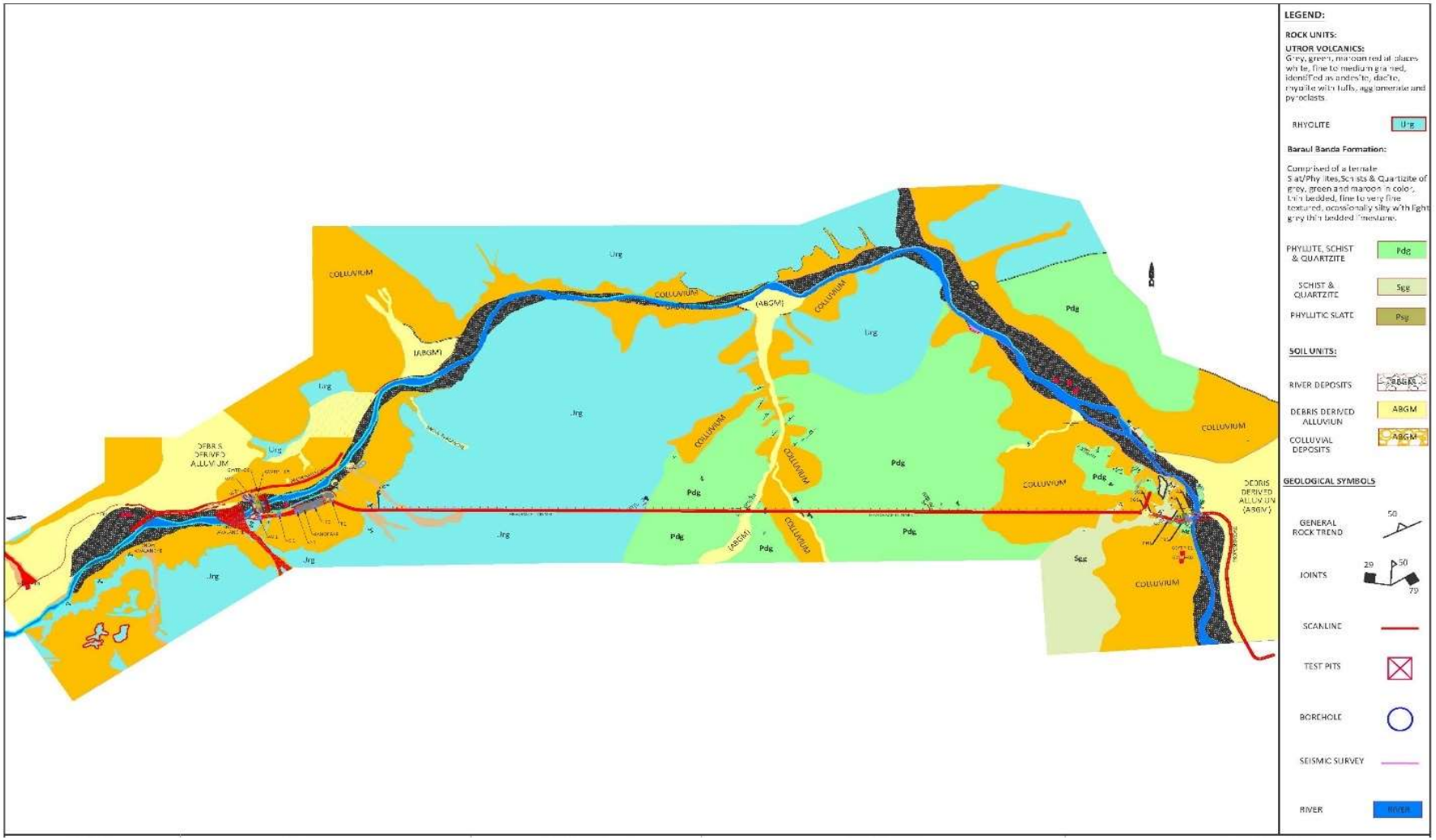


(Source: Feasibility study of GKH Report, 2019)

Figure 5.10: Tectonic Map of Northern Pakistan

5.2.5 Geology

The rock units of the project area belong to the Dir group. The Dir group includes dominantly pellitic rocks and associated Volcanics of Upper Swat and Dir. The group has been divided into two parts, Utror Volcanics, and Baraul Banda Slates. Exposures of these rock types are noticed in the project area. The Utror Volcanics comprises varicolored rhyolites, meta-andesite, dacite, tuffs, and agglomerates. The Baraul Banda Slates are light to greenish-grey, thin-bedded, fine-textured and occasionally silty. A geological map of the project area is shown in **Figure 5.11.** The soil units in the project area comprise alluvial, colluvial and glacial deposits. The alluvial deposits comprise young river deposits of rounded to sub-rounded boulders and gravel with sand and an appreciable amount of fines. The colluvial includes scree, talus, and landslide debris. The glacial (moraine) deposits are an accumulation of boulders, cobbles, and gravel into a silty and sandy matrix with the origin of outwash from glaciers. The left bank materials near the weir site consist of colluvial deposits, and hence an abutment will be constructed along the left bank of the weir site.



(Source: Feasibility study of GKHPP Report, 2019)

Figure 5.11: Geological Map of the Project Area

5.2.6 Water Quality

Water quality of the Gabral River, Bhan Khwar River, and spring at Kanai village is measured during January 2019, and the results are given in **Table 5.1**. The water quality is generally good, with total dissolved solids ranging from 58 to 67 mg/L. The existing sources of threats to the water quality are the disposal of solid waste into the river by the settlements located along the river, and mainly from the Kalam town. There are no industries and sand/gravel mining activities in the project area that are affecting groundwater quality.

Table 5.1: Water Quality of Rivers and Springs in the Project Area

Parameters	Unit	Detection Limit	Gabral River (at Weir Site)	Bhan Khwar (at Ashuran village)	Spring (at Kanai)
Temperature	^{0}C	-	5	4	4
pH	pH unit	0.01	6.89	6.82	7.02
Total Dissolved Solid	mg/l	1	61	58	67
Biological Oxygen Demand	mg/l	1	<1.0	<1.0	<1.0
Chemical Oxygen Demand	mg/l	1	<1.0	<1.0	<1.0
Total Suspended Solid	mg/l	1	<1.0	<1.0	<1.0
Chloride	mg/l	0.24	5.78	7.71	7.71
Fluoride	mg/l	0.01	<0.01	<0.01	<0.01
Sulphate	mg/l	0.41	26.34	23.04	28.4
Silver	mg/l	0.0032	<0.0032	<0.0032	<0.0032
Cadmium	mg/l	0.0028	<0.0028	<0.0028	<0.0028
Chromium	mg/l	0.0054	<0.0054	<0.0054	<0.0054
Copper	mg/l	0.0045	0.0088	0.0074	0.005
Lead	mg/l	0.013	<0.013	<0.013	<0.013
Mercury	mg/l	0.0008	<0.0008	<0.0008	<0.0008
Nickel	mg/l	0.008	<0.008	<0.008	<0.008
Arsenic	mg/l	0.01	<0.01	<0.01	<0.01

5.2.7 Air and Noise Quality

Air and noise quality is measured at three villages in the project area during August 2019. The ambient air and noise quality in the project area are generally good and well below the national standards (NEQS).

Table 5.2: Air and Noise Quality in the Project Area

Parameters	Unit	Kanai Village (at weir site)	Ashuran Village (at colony site)	Ashuran Village (at powerhouse site)	Standard (NEQS)
Sulphur dioxide	µg/m^3	14.96	16	15.13	120
Oxides of Nitrogen (NO_2)	µg/m^3	20.9	19.93	23.16	80
Carbon Monoxide	µg/m^3	0.27	0.3	0.32	5
Particulate Matter ($PM_{2.5}$)	µg/m^3	22.7	22.7	21.3	35

Particulate Matter (PM_{10})	$\mu g/m^3$	22.7	31.9	35.5	150
Night time Noise	dBA	43.3	50.1	39.2	55
Day time Noise	dBA	53.9	61.1	50.0	65

5.3 Biological Environment

Ecological surveys in the project area are carried out by a team of ecological experts, during September and October 2019, using various field survey methods such as line transects or strip census, pellet counts, howling records, mating calls and interviews with local residents and forests and wildlife departments. Detailed surveys will be further carried out during project implementation covering all seasons and to monitor the potential impacts of the project activities during construction. ToRs for further studies and monitoring are given in **Annex 4.**

5.3.1 Biodiversity of the Project Area

An ecological screening exercise is carried out to identify the key biodiversity of the project area using an Integrated Biodiversity Assessment Tool (IBAT) developed by the International Union for Conservation of Nature (IUCN) and published literature. The overall biodiversity within the 50 km of the project area includes 245 species of plants, 41 species of fish, six species of amphibians, 18 species of reptiles, 283 species of birds and 70 species of mammals. A detailed list of these species is given in **Annex 2.**

However, the overall species observed/recorded project area include 72 plant species, two fish species, three amphibians, 11 reptiles, 100 birds and 13 mammalian species (**Annex 3**). The biodiversity along the valleys in the lower elevations is comparatively low due to the tremendous increase in the human population (annual growth rate 3.32). The undisturbed patches of vegetation /habitats are restricted to the higher elevations (above 3200 masl), which are highly inaccessible due to the difficult nature of the terrain and geographic features. These habitats are in the alpine zone and can be found on the high mountains of the Bhan Khwar (tributary of the Gabral River) catchment area. The whole catchment area of the Bhan Khwar has been declared as the community game reserve in 2005.

The list of threatened species that can be found within the 50 km of the project area is presented in **Table 5.3**. Four threatened mammalian species (Himalayan musk deer, Common Leopard, Snow leopard, and Black Bear), five endangered birds (Pallas's fish-eagle, Egyptian vulture, Greater spotted eagle, White-headed duck and Indian skimmer), one endangered fish species (golden mahseer). In addition, one endangered plant species (Atlas daisy) is also reported from the area. The mammalian species are an inhabitant of higher altitudes where there is no human disturbance but are reported to come down sometime to the project area during the winter season.

5.3.2 Terrestrial Ecology

The project area and its surrounding areas can be classified into the following three ecological regions based on their elevations

(i) **Dry temperate ecoregion** which covers the elevations up to 2700 masl,
(ii) **Sub-alpine ecoregion**, which covers elevations between 2700 to 3200 masl and
(iii) **Alpine pasture ecoregion**, which covers elevations between 3200 to 4700 masl.

The ecological map of the project area is shown in **Figure 5.12**. Flora and fauna of these ecological regions are described in the following sections.

Table 5.3: Threatened Species within 50 Km of the Project area

	Species name	Common name	IUCN Category
A	**Mammals**		
1	*Moschus leucogaster*	Himalayan musk deer	EN
2	*Panthera pardus*	Common Leopard	VU
3	*Panthera uncial*	Snow leopard	VU
4	*Ursus thibetanus*	Asiatic black bear	VU
B	**Birds**		
5	*Haliaeetus leucoryphus*	Pallas's fish-eagle	EN
6	*Neophron percnopterus*	Egyptian vulture[5]	EN
7	*Clanga clanga*	Greater spotted eagle	VU
8	*Oxyura leucocephala*	White-headed duck	EN
9	*Rynchops albicollis*	Indian skimmer	VU
C	**Fish**		
10	*Tor putitora*	Mahseer	EN
D	**Plants**		
11	*Anacyclus pyrethrum*	Atlas daisy	VU

Note: EN (Endangered), VU (Vulnerable)

Source: Integrated Biodiversity Assessment Tool and Field Investigations

[5] Although this species is Endangered But it is found in the region only during summer season as summer breeder. Its breeding area comprises of whole western Boundary of Pakistan starting right from top in Gilgit Baltistan to KP and Balochistan.

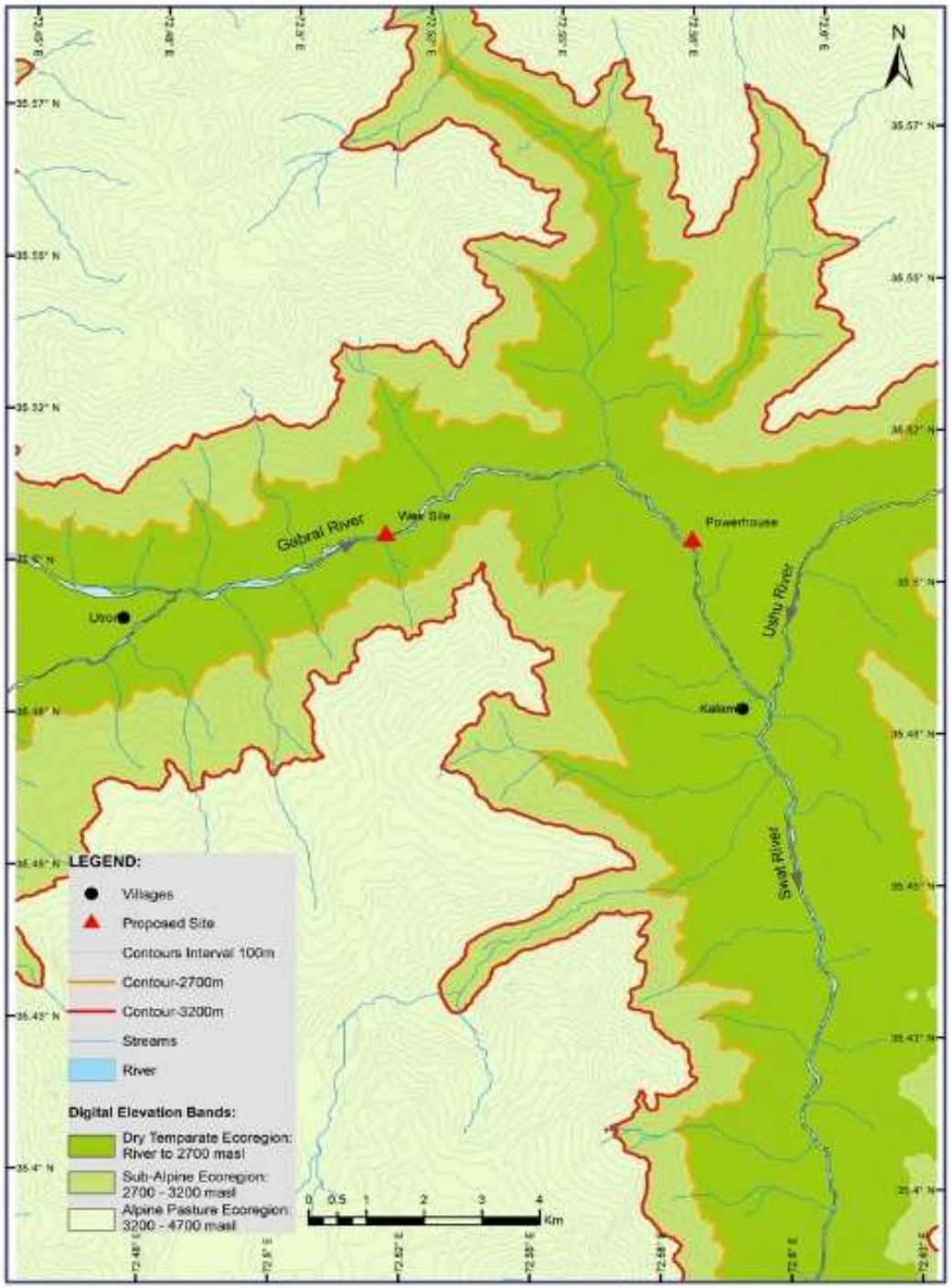


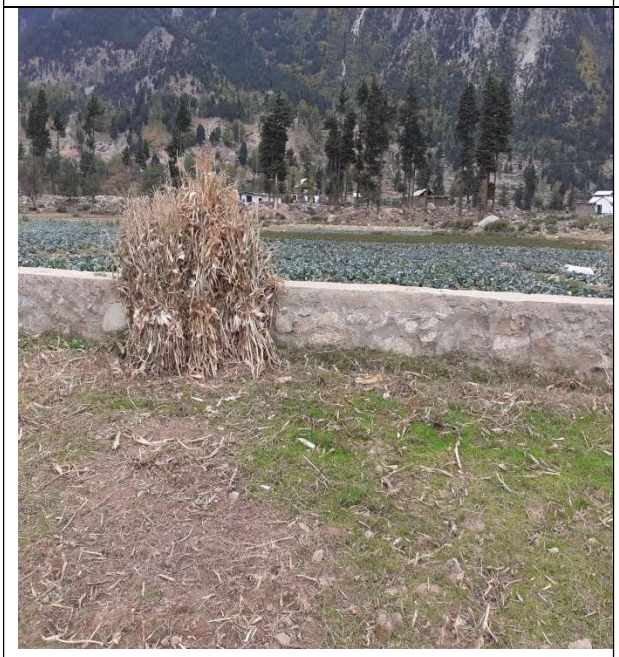
Figure 5.12: Ecological Regions of the Project Area and its Surroundings

5.3.2.1 Dry Temperate Ecoregion

The project facilities and its immediate surroundings up to 2700 masl are located in the dry temperate ecoregion, which mainly consists of coniferous forests that play a vital role in the economy of the area as a source of supply of timber, fuelwood, non-timber forest products (NTFPs), forage, and grazing. A few photographs from this region are shown in Figure 5.13.

Dry Temperate Ecoregion: Pure stand of *Cedrus Deodara*

Vegetation (*Betula pepyrifera* (front) and *Cedrus deodara* (behind) on the right bank of the weir site



Cultivated Land (proposed colony site)

River Bed near the proposed weir site

Figure 5.13: Vegetation Types in the Project Area

5.3.2.1.1 Flora

A total of 72 plant species are recorded in the project area and detail of these species is given in **Annex 3**. The natural flora in this ecoregion mainly consists of Oak (*Quercus dilatata*), Deodar (*Cedrus deodara*), Blue pine (*Pinus wallichiana*), Wild Almond (*Purnus dulcis*), Birch (*Betula utilis*), Fir (*Abies pindrow*), Spruce (*Picea smithiana*), Willow (*Salix bablonica*), ajavayan (*Artemisia meritima)*, Sada Bahar (*Ephedra gerardiana*), Jangli Podina (*Indigofera heterantha*), Sumblo (*Berberis lyceum*) and Guch (*Viburnum nervosum)*. The fodder and forage species include Mauritian grass (*Apluda mutica)*, grass (*Cymbopogon stracheyi)*, khabal (*Cynodon dactylon*), Kotar Ghas (*Dicanthium annulatum*), Sirwala (*Galium aparine*, Prewatei (*Hedera nepalensis)*, Rewari kalan (*Lathyrus sp)*. and Maina (*Medicago polymorpha)*. None of these species are listed in the IUCN threatened category.

The forest trees are owned by the provincial government, but the land is owned by the community but with all types of rights of extraction of timber and firewood, grass cutting and grazing for local use unless specifically disallowed in certain areas. The forests are commercially logged, and in which 60% of the sale price is the community's share and the rest 40% is received by the provincial government.

The non-timber forest products from forests include medicinal plants, morals (black mushrooms), honey and several fruits such as walnuts, peaches, apples, wild persimmon, etc. These products will supplement the income of the local communities.

It was reported[6] that Kalam valley inhabits many important medicinal plants, majority of which are used in medicines (**Table 5.4**), but due to anthropogenic activities including unplanned tourism, deforestation, uprooting of medicinal plants and overgrazing, majority of these plant species are rapidly heading towards regional extinction in the near future.

Table 5.4: Medicinal Plants in the Kalam

Sr.No	Local Name	Botanical Name	Part being used
01	Zaharmora	*Aconitum violaceum*	Rhizome
02	Sakha Waja	*Acorus calamus*	Rhizome
03	Sumbal	*Adiantum venustum*	Leaves
04	Jawaz	*Aesculus indica*	Fruit, oil
05	Boti	*Ajuga bracteosa*	Whole plant
06	Terkha	*Artimisia brevifolia*	Shoots
07	Marjarey	*Arisaema Flavum*	Rhizome
08	Bargak	*Atropa acuminate*	Plant
09	Kowarey	*Berberis lyceum*	Plant
10	Gat Panra	*Bergenia ciliate*	Rhizome
11	Tarwa Panara	*Bistorta ampilexicaulis*	Rhizome
12	Makan Path	*Caltha alba*	Floral shoot
13	Mamera	*Corydalis stewartii*	Floral shoot
14	Kowanjey	*Dryopteris jaxtaposta*	Whole Frond
15	Kaga Velaney	*Feoniculum vulgare*	Fruit
16	Papra	*Fumaria indica*	Whole plant
17	Prewatei	*Hedera nepalensis*	Leaves
18	Spirkey	*Isodon rugosus*	Stem and leaves
19	Velaney	*Mentha longifolia*	Shoots
20	Podina	*Mentha spicata*	Leaves and stem
21	Mamekh	*Paeonia emodi*	Rhizome
22	Kakora	*Podophyllum emodii*	Rhizome
23	Noor-e-alam	*Polygonatum verticilatum*	Rhizome
24	Chotial	*Rheum austral*	Roots, Rhizome, leaves
25	Nazar Panra	*Skimmia laureola*	Leaves
26	Kamachoo	*Solanum nigrum*	Leaves and fruit

[6] Bakht N., Jan A., Haider A., Manzoor H., Mujtaba S., Siraj A., Abbas H.S., and Azhar M. 2018. Conservation Status Assessment of Native Vascular Flora of Kalam Valley, Swat District, Northern Pakistan. International Journal of Biodiversity and Conservation. Vol. 10(11), pp. 453-470.

Sr.No	Local Name	Botanical Name	Part being used
27	Banerya (Teen)	*Taxus buccata*	Bark
28	Mushk-e-Bala	*Valeriana jatamansi*	Rhizome
29	Banafsha	*Viola odorata*	Flower
30	Guch	*Viburnum nervosum*	Whole Plant
31	Persoshan	*Adiantum capillus*	Whole plant
32	Anjabar	*Polygonum amplexicule*	Roots
33	Unab	*Zizyphus vulgaris*	Fruits
34	Zakhmi-Hayat	*Bergenia ligulata*	Rhizome

(Source: Divisional Profile of Kalam Forest Division, 2014)

5.3.2.1.2 Mammalian Species

According to literature review, key mammalian species associated with this habitat are: Yellow-throated Marten (*Martes flavigula*), Kashmir Flying Squirrel (*Hylopetes fimbriatus*), Giant Red Flying Squirrel (*Petaurista petaurista*), Common Leopard (*Panthera pardus*), Rhesus Macaque (*Macaca mulatta*), Asiatic Black Bear (*Ursus thibetanus*), Porcupine (*Hystrix indica*),Murree Vole (*Hyperacrius wynnei*), Field Mouse (*Apodemus sylvaticus*), Turkistan Rat (*Rattus turkestanicus*), Whiskered Bat (*Myotis muricola*), and Long-eared Bat (*Pleclotus austriacus*). Among these species, Himalayan musk deer, Common Leopard, Snow leopard and Black Bear are listed as Vulnerable by IUCN.

During the field surveys, 12 species of mammals belonging to six orders, 10 families and 12 genera were recorded from the study area. The mammalian species observed from the project area along with their conservation status are listed in **Table 5.5.** According to the IUCN Red List of Threatened species, 10 species have Least Concern status, one species has not been evaluated while one species (Asiatic Black Bear) has Vulnerable status.

Table 5.5: List of the Species Recorded in the Project Area

Sr. No.	Recorded Mammals	Zoological Name	IUCN Red List (2019)	Population Trend (IUCN, 2019)
1	Western Himalayan White-toothed Shrew	Crocidura suaveolens	Least Concern	Stable
2	Greater Horse-shoe Bat	Rhinolophus ferrumequinum	Least Concern	Decreasing
3	Common Pipistrelle	Pipistrellus pipistrellus	Least Concern	Stable
4	Cape Hare	Lepus capensis	Least Concern	Decreasing
5	Giant Red Himalayan Flying Squirrel	Petaurista petaurista albiventer	Least Concern	Unknown
6	Himalayan Wood Mouse	Apodemus rusiges	Least Concern	Unknown
7	House Rat	Ratus ratus	Not Evaluated	Unknown
8	House Mouse	Mus musculus	Least Concern	Stable
9	Rhesus monkey	Macaca mulatta	Least Concern	Unknown
10	Indian Wolf	Canis lupus	Least Concern	Stable
11	Asiatic Jackal	Canis aureus	Least Concern	increasing
12	Asiatic Black Bear	Ursus thibetanus	Vulnerable	Decreasing

5.3.2.1.3 Herpetofauna

The common herpetofauna species in this ecoregion include Kashmir Rock Agama (*Laudakia tuberculata*), Skimm keelback (*Amphiesma sieboldii*), Himalayan keelback (*Amphiesma platyceps*), Blunt nosed pit viper (*Macrovipera lebetina obtusa*), Himalayan pit viper (*Gloydius himalayanus*)[7]

During field investigations, a total of 14 species of herps belonging to two orders, seven families and 11 genera were recorded from the study area, including three amphibians and 11 reptiles. The list of recorded species is given in **Table 5.7**. None of the other recorded species have a Threatened status according to IUCN. Among these species, the poisonous snake.

Table 5.6: List of recorded amphibians and reptiles from the study area

Sr. No.	Zoological Name	Common Name	Order	Family
1	Bufo stomaticus	Indus valley toad	Anura	Bufonidae
2	Bufo pseudoraddei pseudoraddei	Indus valley toad	Anura	Bufonidae
3	Euphlyctis cyanophlyctis microspinulata	Skittering frog	Anura	Ranidae
4	Laudakia himalayana	Himalayan Agama	Squamata	Agamidae
5	Laudakia pakistanica auffenbergi	North-Pakistan Agama	Squamata	Agamidae
6	Laudakia tuberculata	Blue Rock Agama	Squamata	Agamidae
7	Ophisops jerdonii Blyth	Rugose-spectacled lacerta	Squamata	Lacertidae
8	Ablepharus pannonicus	Snake-eyed skink	Squamata	Scincidae
9	Scincella himalayana Gunther	Himalayan skink	Squamata	Scincidae
10	Platyceps rhodorachis ladacensis	Ladakh Cliff racer	Squamata	Colubridae
11	Pseudocyclophis persicus	Dark-head Dwarf racer	Squamata	Colubridae
12	Ptyas mucosus mucosus	Rope-snake	Squamata	Colubridae
13	Spalerosophis diadema diadema	Blotched diadem snake	Squamata	Colubridae
14	Naja oxiana	Brown cobra	Squamata	Elapidae

5.3.2.2 Sub-Alpine Ecoregion

The sub-alpine ecoregion represents a very fragile but ecologically significant ecosystem found at the elevations between 2700 to 3200 masl. This zone is characterized by mild summer and a very short growing season in summer starting in June to August. The winter season is almost six months long with heavy snowfall and remains under snow for 3-4 months. The climatic conditions are very harsh and allow a very few tree species to establish themselves, except those equipped with specific adaptations and niche adjustments. The high mountains of the Gabral valley and Bhan Valley fall in this ecoregion.

[7] Khan, M.S., 2006. *Amphibians and reptiles of Pakistan.* Krieger Publishing Company, Malabar, Florida. pp.311.

5.3.2.2.1 Flora

The common flora of this ecoregion is *Betula utilis*, *Juniprus saquamata, Rhododendron arboretum, Euphorbia kanaorica, Salix himalayensis, Alopecurus pratensis, Saxifraga sibirica, Polygonum affine, Veronica alpine, Plantago lanceolate, Agrostis gigantean, Poa nemoralis, Poa pratensis, Primula macrophylla, Phleum himalaicum,* and *Aconitum heterophyllum*[8]*.*

Figure 5.14: Sub- Alpine Region (Mixed forest)

This region also linked to the forest resource, which includes medicinal and aromatic plants, wild vegetables, wild fruits, Chilghoza nuts, and grasses. Medicinal plants found in this area include *Valeriana wallic shii, podo-phullum emodii, Saifraga spp Artemisia maritime, Viola serpens and Atropoa belladonna.*

5.3.2.2.2 Fauna

Key fauna associated with this habitat are; Royle's High Mountain Vole (*Alticola roylei*), True's Vole (*Hyperacrius affinis*). Chinese Birch Mouse (*Sicista concolor*), Musk Deer (*Moschus chrysogaster*), Snow Leopard (*Panthera uncia*), Markhor (*Capra falconeri*), Monal Pheasant (*Lophophorus impejanus*), Himalayan Snowcock (*Tetraogallus himalayensis*) and Snow Partridge (*Lerwa lerwa*)[9]. These species are found in the high mountains of Bhan Valley Game Reserve.

5.3.2.2.3 Herpetofauna

The common herpetofauna can be found in this ecoregion are: Swat Green Toad (*Bufotes pseudoraddei*), Indus Valley Toad (*Duttaphrynus stomaticus*), Asian common toad (*Duttaphrynus melanostictus*), Himalaya paa frog (*Nanorana vicina*), Himalayan ground Skink (*Asymblepharus himalayana*), Kashmir Rock Agama (*Laudakia tuberculata*), Himalayan pit viper (*Gloydius himalayanus*), Dice snake (*Xenochrophis tessellata*)[10].

[8] Beg, A.R. 1975. Wildlife habitats of Pakistan. Bull, no. 5. Pak.Forest. Institute, Peshawer

[9] Roberts, T. J. 1997. The mammals of Pakistan. Oxford University Press, Karachi. 361 p.

[10] Khan, M.S., 2006. *Amphibians and reptiles of Pakistan.* Krieger Publishing Company, Malabar, Florida. pp.311.

5.3.2.3 Alpine Pastures Ecoregion

The alpine pastures are located on the higher peaks of the mountains between the elevations 3200 to 4700 masl. Alpine plants are adapted to the harsh conditions, which include low temperature, dryness, ultraviolet radiation and a short growing season. The area is rich with a wide diversity of flora and fauna.

5.3.2.3.1 Flora

The key flora in this habitat are; *Rhododendron arboretum, Juniprus saquamata, Saussurea lappa, Sedum trullipetalum, Aconitum heterophyllum, Saxifraga parnassifolia, Viola odrata, Bistorta affinis, Bistorta amplexicaulis, Alium himalynica, Colchicum luteum, Crataegus oxyacantha, Cynoglossum officinale, Festuca kashmiriana, Inula royleana, Poa alpine, Rheum austral, Trifolium repens, Thymus serpyllum, Potentilla fruticose, Primula macrophylla, Primula denticulate,* and *Diapensia purpurea*[11].

5.3.2.3.2 Mammals

Key mammalian species associated with this habitat include Snow leopard (*Panthera uncia*), Himalayan Ibex (*Capra ibex sibirica*), Red bear (*Ursus arctos*), Long-tailed Marmot (*Marmota caudata*), Lesser Shrew (*Sorex thibetanus*), Royle's High Mountain Vole (*Alticola roylei*), Ermine (*Mustela erminea*), and Chinese Birch Mouse (*Sicista concolor*)[12]. High mountains of Bhan khwar tributary has some of these species.

5.3.2.3.3 Herpetofauna

Alpine toad (*Scutiger occidentalis*), Himalayan toad (*Duttaphrynus himalayanus*), Baltistan toad (*Bufo latastii*) Himalaya paa frog (*Nanorana vicina*), Himalayan ground skink (*Asymblepharus himalayana*), Kashmir Rock Agama (*Laudakia tuberculata*), Himalayan agama (*Laudakia himalayana*), Badakhshan rock agama (*Laudakia badakhshana*), Toed gecko (*Altigekko yarkandensis*), Ladakh ground skink (*Scincella ladacensis*), Himalayan pit viper (*Gloydius himalayanus*)[13].

5.3.2.4 Avifauna

A total of 656 bird species belonging to 272 genera have been reported in Pakistan. Of these, 38% are winter migrants, 29% are Palearctic visiting species, 13% are regular winter visitors, and 20% breed on the subcontinent[14]. Pakistan is a wintering habitat for several migratory species of birds that use the Indus Flyway. The Indus Flyway is one of the world's major migration routes, running from Siberia to various destinations in Pakistan traversing the Karakorum, Hindu Kush, and the Suleiman mountain ranges.

A total of 283 bird species are noticed in the region and out of these 100 bird species have been observed/reported from the project area. The list of observed/reported species is given in **Annex 3.**

Forests and high mountain lakes are the preferred habitats of these species. The bird fauna includes pheasants such as Himalayan Snowcock, Chukar, Koklas Pheasant, Himalayan Monal Pheasant, and Snow Partridge.

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[11] Beg, A.R. 1975. Wildlife habitats of Pakistan. Bull, no. 5. Pak.Forest. Institute, Peshawer.

[12] Roberts, T. J., 1991. *Birds of Pakistan* Vol. I Oxford University Press, Karachi.

[13] Khan, M. S., 2000. *Amphibians and Reptiles of Pakistan*. (In Urdu) Urdu Science Board, 299 upper Mall, Lahore. 138 pp.

[14] Ali, S., Ripley, S. D., & Dick, J. H. (1987). Compact handbook of the birds of India and Pakistan.
Roberts, T. J., 1991. *Birds of Pakistan* Vol. I Oxford University Press, Karachi.
Mirza, Z. B., & Wasiq, H. (2007). A field guide to birds of Pakistan Bookland.
Grimmett, R., Roberts, T. and Inskipp, T. 2008. *Helm Field Guide Birds of Pakistan.* Christopher Helm. London.

Dubair is the nearest Important Bird Area (designated by Birdlife International) is located about 60 km from the project area and is located in the Upper Kohistan region, is an internationally important area due to the presence of Western Tragopan Phesant.

5.3.2.5 Bhan Valley Game Reserve

Bhan Khwar is the tributary of the Gabral River. The alpine and subalpine habitats of the Bhan Khwar catchment area provide a rich habitat of 21 mammals, including threatened species of snow leopard, and black bear. The entire 250 km^2 of the Bhan Khwar catchment area was notified as the Bhan Valley Community Game Reserve on June 25, 2005. Community-based conservation in this valley started during 2000-2007 under the Mountain Area Conservation Project by IUCN and the provincial Wildlife Department.

The objective of the community game reserve is to make the communities responsible for protecting the wildlife in those areas, and in turn, they will benefit from the fee collected for the hunting of game species such as Markhor and grey goral. Otherwise, these habitats and species are threatened by habitat degradation (due to grazing, fuelwood collection and timber exploitation) and illegal hunting. Markhor, National Animal of Pakistan, was until recently categorized as 'Endangered', but because of similar conservation measures in Northern Pakistan involving the community, especially trophy hunting, its status has been upgraded to 'Near Threatened'.

The location map of the Bhan Valley Game Reserve and the Project locations shown in **Figure 5.15**. About 0.08 Km^2 of the reserve is located in the project area. The alpine and subalpine habitats of the reserve are located about 10 to 20 km from the project facilities. The valley consists of 12 villages with a population of about 10,000. The rights of use of natural resources are divided among three major tribes of the valley, i.e., *Jalfor, Neelior* and *Dare Khail*. Wildlife Department and local community organization jointly take care of the reserve.

Figure 5.15: Location Map of the Bhan Valley Game Reserve

The key flora in this area is *Picea smithiana*, *Pinus willachiana*, *Cedrus deodara*, *Quercus balloot*, and *Taxus baccata*. Main medicinal plants in the valley are Kakora, Banafsha, Musk bala, Mamaikh, Kwarai, Mameera, Noor Aalam, Ziar Gulai, Somani, Kanaiz, Chatyal, Nazar Panra, Ratan jok and Zakhmi hayat. The species of agroforestry are Walnut (*Juglans regia*), Acorn (*Quercus balloot*), Horse Chestnut

(*Aesculus indica*), Wild Rose (*Rosa webbiana*), Hippopi (*Hippopi rhamnoides*), Morel Mushroom (*Morchella conica*) and Ephedrine (*Ephedra sp*.).

The amphibians include Indus valley toad and skittering frog. Among reptiles are the Himalayan rock agama, Pakistan rock agama, some skinks and snakes like wolf snake, Himalayan pit viper and brown cobra. The valley is also rich in some of the endemic reptilian species like Pakistan Rock Agama (*Ludakia pakistanica*).

The key mammalian species in reserve include markhor, snow leopard, and black bear. According to surveys carried out by wildlife department in 2005, the mammals in the game reserve include markhors (10 to 15 numbers), ibex (up to 30 numbers), black bear (30 to 35 numbers), musk deer (10 to 13 numbers) and snow leopard (2 numbers). The mammalian species usually exists in the upper regions of alpines during summer and in the lower regions of alpine during winter.

More than 100 avian species are found in reserve including passerine and non-passerine birds, winter visitors, summer breeders, passage migrants, and resident birds. The avian fauna includes the Himalayan Snowcock, Chukar, Koklas Pheasant, Himalayan Monal Pheasant, Snow Partridge, and several seasonal migrants. These are considered common game species in the area.

5.3.3 Aquatic Ecology

Fish fauna diversity and abundance in northern Pakistan, including in the project area, are generally low due to high-altitude tributaries, low water temperature, high water velocity, and low benthic productivity. In comparison, much higher diversity and abundance of fishes are found on the lower reaches of the Swat River and the Kabul River. There are 41 fish species listed as inhabiting cold waters of Pakistan, and most of them belong to the indigenous species snow carp sub-family Schizothoricinae *(genera Schizothorax* and *Schizopyge*), and loaches of the genera Triplophysa, Schistura and Glyptothorax. None of these species are listed in IUCN Red List. All these taxa inhabit torrential and swift streams and rivers of the mountain region and have evolved morphometric features adapted to these habitat conditions[15]. In order to enhance the fish resource, two species of the family Salmonidae (brown trout and rainbow trout) were introduced in the Gabral River and adjoining streams in the early 1960s. Khyber Pakhtunkhwa Provincial Fisheries Department has established small hatcheries in the province where seeds of trout are produced and stocked in the Rivers of Northern Pakistan.

5.3.3.1.1 Aquatic Habitat

The Gabral River and its tributaries are characterized by relatively steep gradients and substrate sizes, fast-flowing, and turbulent waters. The river is mainly fed by melting of snow and glaciers; flow is high during summer and contribution from rainfall is very small. Quality of river water changes between the summer and winter seasons due to the sediment load, which is higher during summer. The nutrient contents of Gabral River were assessed at six different locations[16] and presented in **Table 5.7**. The tributaries of Gabral pass along steep gradients through rocky areas of high mountains, exhibiting variable cascades, riffles and pools and, at the confluence with the Gabral, gravel, and sand where most spawning sites of snow carp and other species are believed to be located. Streambed substrate mainly consists of boulders, cobbles, and gravels. The banks of some streams have patches of vegetation such as herbs, shrubs, and trees.

[15] Rafique, M. (2000). Fish diversity and distribution in Indus River and its drainage system. *Pakistan Journal of Zoology*, *32*(4), 321-332.

[16] Locations of sampling sites are : Kanai up Stream weir site (ID 1), downstream weir site (ID 2), downstream Bhan khwar (ID 3), weir site (ID 4), Ashuran power house area (ID 5) and colony area (ID 6)

Table 5.7: Nutrient contents for Plankton

Parameters	Units	Results[17]						Expended Uncertainty (±)
		Sample ID 1	Sample ID 2	Sample ID 3	Sample ID 4	Sample ID 5	Sample ID 6	
Nitrate	mg/L	4.20	3.25	2.80	1.75	2.15	1.69	-
Potassium as K	mg/L	1.8	1.3	2.83	1.87	0.97	2.30	-
Phosphate as Po4	mg/L	7.8	7.8	7.4	6.9	7.45	7.53	-
Dissolve Oxygen (DO)	mg/L	9.8	9.65	9.92	9.7	9.89	9.68	-

Phytoplankton of river waters of Northern Pakistan consists of 6 families Cyanophyte, Chlorophyte, Chrysophyte, Bacillariophyta, Cryptophyte, and Euglenophyte. Zooplanktons were rare as few rotifers, some daphnia/moina were found. It was observed that due to torrential water planktons cannot stay in the main flow of the river or tributaries. Phytoplankton/periphyton is present inside waters, shallow water which is lentic type and warmer. Most of the algae especially filamentous algae is produced on the exposed surface of stones where sunlight effect directly. Zooplankton like daphnia/moina and paramecium were observed entangled in this type of algae.

Snow carp, the dominant fish species, is herbivorous and feeds on the algae on stones. It has a frontal mouth at the tip of the head to scrap algae, Phytoplanktons, Zooplankton and invertebrates present.

5.3.3.2 Fish

According to surveys carried out in the project area, two species of fish are noticed in the Gabral River. *Schizothorax plagiostomus* (snow carp or locally known as *Swati*), an indigenous species and *Salmo trutta (B*rown trout), an invasive fish species. The IUCN status of the snow carp species has not been assessed and it is widely distributed along the Himalayan Foothills of Pakistan, India, and Nepal. The population of native snow carp species is reported to be decreasing in the Gabral and Swat Rivers after the introduction of the brown trout. A brown trout hatchery is located in Madyan (located 50 km away from the project area), which annually releases thousands of fries into the River. A GoKP has also established a hatchery for snow carp for improving its population.

5.3.3.2.1 Snow Carp Habitat and Migration

Based on the review of available literature[18], the habitat, spawning and migration conditions of snow carps are presented below:

Habitat. Snow carps thrive in the snow-fed river habitat (altitude of 1200 to 3000 masl) of clear, shallow water of stony substratum with an average depth from 0.5 to 3 meters, and river flows with low to high

[17] Locations of sampling sites are : Kanai up Stream weir site (ID 1), downstream weir site (ID 2), downstream Bhan khwar (ID 3), weir site (ID 4), Ashuran power house area (ID 5) and colony area (ID 6)

[18] (i) Petr, T.; Swar, D.B. (eds.), Cold water fisheries in the trans-Himalayan countries. FAO Fisheries Technical Paper. No. 431 Rome, FAO. 2002. p. 376. (ii) Shrestha, T. K., and S. S. Khanna. "Structure and histological changes in the ovary of the Nepalese snow trout Schizothorax plagiostomus (Heckel)." Matsya 5 (1979): 23-34, and (iii) Aquatic Ecology Report of Dasu Hydropower Project.

velocities (0.5 to 1.5 m/s). The average temperature tolerance range is from 4 to 20 ^{o}C and dissolved oxygen requirements lie in the range of 8 to 12 mg/l. Snow carps are bottom feeders and mainly feeds on periphytic algae and diatoms.

Migration: Snow carps are short distant migrants, and they migrate mostly within the tributaries (headwaters areas to lower elevations and to confluence areas of the major rivers such as the Swat River; and vice versa). From April to September (spring and summer, high flow), they prefer upstream headwaters habitats at higher elevations. During September to April (low flow and winter), they prefer lower elevations. The triggers for migrations are high flow, high sediment load, and low temperatures. During spring, when the flow starts increasing in the rivers due to the melting of snow, the fish within tributaries migrate upstream from April to May due to high flows and turbidity at lower elevations. During autumn, when the temperatures start to drop at higher elevations, the fish migrate downstream from September to October.

Spawning: Female fish spawn in two seasons, one in September-October and the other in March - April. Sexually matured snow carps (when they reach 18-24 cm length, at the age of 2-3 years) spawn in tributaries in clear water (along stream banks, backwater pools and near confluences of other tributaries) on gravelly/stony ground or on fine pebbles at 10-30 cm depth. Low water currents of 0.5-1.5 m/sec, pH 7.5, the dissolved oxygen concentration of 8-12 mg/L and gravel size of 50-60 mm are the optimum conditions for spawning. Mature fish typically change color during the breeding season. Mature males develop tubercles on either side of the head . Females are chased by males during the breeding season. The eggs laid remains attached to the substratum, while fry stays on sand and gravel bottom. A mature female can produce from 25000 to 39000 eggs/year.

5.3.3.2.2 Brown Trout Habitat and Migration

Habitat: The fish is found up to 3000 m high altitudes where the water temperature seldom rises 12 degrees Celsius. Such streams are highly oxygenated and clean water. The fish is carnivorous in nature and feeds on crustaceans, insects and their larvae and other smaller fish. The KP Fish department regularly stocks the river with thousands of fries.

Breeding: The fish becomes sexually mature within two years when the size is about 8 inches. The breeding season starts from November and December up to February. The female lays 300 to 1500 eggs in one episode, depending on the size of the female. Eggs are laid in slow running streams in nature by making a pit in the bottom gravel bed. Males fertilize the eggs with semen or milt and hide the eggs with gravel and sand. The fish has a short and stout body — eggs hatch in 40 to 70 days. Low water currents of 0.5- 1.5 m/sec, pH 7.5, the dissolved oxygen concentration of 8-12 ppm and gravel sizes of 50-60 mm are the optimum conditions for spawning. Brown trout share the same habitat for breeding with snow carp.

Migration: The fish is not migratory, and it generally moves between shallow pools to deep waters based on the availability of the flows.

5.4 Socioeconomic Environment

5.4.1 Overview Villages in the Project Area and Details of Surveys

The project influence area (or the project area) is located in a rural area and the settlements located in the project area between the reservoir area to Kalam are: Kanai (located about 900m away on upstream of the weir site; village population is 620 and households are 95), Bhatindar (along the access road, 1.2 km downstream of the weir; 665 people and 70 households), and Ashuran (along the access road to project facilities; 5100 people and 676 households). The locations of these villages are shown in **Figure**

5.1. The Ashuran is further divided into several sub-villages and six of these sub-villages are located near the project facilities, and they are Paler (710 people, 122 households), Mahai (650 people, 58 households), Rashnail (60 population, 13 households), Sher Kally (255 people, 30 households), and Chirat (550 people and 75 households). Administratively, the villages in the project fall into Ashuran Union council of Bahrain Tehsil in the Swat District.

The socioeconomic baseline of the project area is collected through questionnaire surveys, focus group discussions, consultations and review of secondary literature. Structured questionnaire surveys of 169 randomly selected households were carried out in the project villages (24 from Kanai – near the weir site, two from Chirat – near colony area, 66 from Ashuran – along the access road, 54 from Mahai, 23 from Sher Kally – near the powerhouse area). The key socio-economic aspects studied include the demography, housing patterns, nature of agriculture, availability of social infrastructure and amenities, livelihood opportunities, and economic well-being.

5.4.2 Demography of Surveyed Households

The total population of the surveyed households is 1365, in which males are 717 and females are 648. The proportion of male and female members is 52.5% and 47.4%, respectively, with a gender ratio of 1: 1.11.The gender-segregated statistics of household members are given in **Table 5.8**. The age of the family members has been distributed into the various age brackets to understand their level of contribution to the household income keeping in view the adult equivalent. About 28.13 percent and 23.07 percent of the male and female members respectively belong to the age-group of 10 to 60 years.

Table 5.8: Gender Segregated Age Distribution

Gender	Total HHs (number)	Household Members		
		Up to 10 years	Above 10 - 60 years	Above 60 years
Male	717	301	384	32
Female	648	310	315	23
Total	1365	611	699	55

Major cast groups in the project area are dirya khel, mirza khel, nalyoor khel, kalam khel, cheenal khel, knnai, gujar, malyer, bozae khel and mahai.

5.4.3 Education

The educational facilities in the project area are very limited and hence, literacy levels are also very low. There are six primary schools, one middle school for boys (in Ashuran village) and one higher secondary school (separately for boys and girls in Kalam). The level of illiteracy was to the extent of 42.5% for males and 84.8% for females. Gender segregated education details are summarized in **Table 5.9**.

Table 5.9: Average Literacy Rate of the Sample Households Members

Gender	Level of Education (%)						
	Illiterate	Primary	Middle	Metric	Inter-mediate	Bachelor	Masters
Male	42.5	23.0	11.8	13.5	4.3	2.8	2.1
Female	84.8	8.6	3.3	1.4	1.7	0.3	0.0
Overall	60.9	16.8	8.1	8.2	3.1	1.7	1.2

Access to primary school education for boys and girls found 34.5% and 12.6%,respectively. In the case of other levels of education for both boys and girls, access to Middle and High schools was quite limited (**Table 5.10**).

Table 5.10: Access to Educational Institutions

Access to Educational Facilities (in percent)					
Primary Schools		**Middle Schools**		**High School**	
Boys	Girls	Boys	Girls	Boys	Girls
34.5	12.6	13.2	1.7	5.2	0.6

5.4.4 Income and Livelihood Analysis

The major source of livelihood for the project population is agriculture. Other occupations and income-generating activities are being practiced in the project area include farming, employment in government and private sectors, daily wage labour, operating businesses such as running a grocery shop and working abroad. Details of livelihood sources of sampled households are given in **Table 5.11.**

Table 5.11: Livelihood Sources of Sampled Households (in percent)

Farming/ livestock	Labor	Government Service	Private Service	Business	Employed Abroad	Others (Unemployed/ students)
31.5	12.5	1.5	2.1	1.5	3.5	47.4

5.4.5 Livelihood Sources

Although agriculture is the main livelihood source for the majority of the households, the availability of the agricultural land is limited to the valley along the riverbanks. The average landholding of 73 % of the surveyed households is less than one acre. About 27% of the households have a land holding of 1 to 5 acres.

The cropping season is between April to October, and there will be no agriculture during winter due to severe cold conditions and snowfall. Generally, two crops are grown, one in from April to July and the second one is from July to October. Major crops grown are vegetables (tomatoes, potatoes, and cabbage); maize, pulses, and millets. The cropping pattern in the project area is given in **Table 5.12**.

Table 5.12: Cropping Pattern

S.No	Crops	Pattern	Percentage (%)
1	Vegetables (tomatoes, potatoes)	April to July	57
2	Pulses	April to July	23
3	Vegetables (cabbage, potatoes)	July to October	60
4	Maize	July to September	40
5	Millet	April to August	20

Income from livestock also contributes to the agriculture income through milk production and the sale and purchase of animals. About 57% of the surveyed households **(Table 5.13)** have livestock (mainly cows and goats), with an average number of 3.85 per household. The average number of poultry birds per household is 7.

Table 5.13: Livestock Inventory of Surveyed Households

Type of Animal	No. of HHs with Animals	No. of total Animals	Average No. of Animals/ HH
Buffaloes	3	3	1.00
Cows	98	379	3.86
Horse	9	20	2.22
Donkey	12	24	2.00
Sheep	24	153	6.37
Goat	90	329	3.65
Overall	**-**	**908**	**3.85**

5.4.6 Income and Poverty Levels

5.4.6.1 Income Levels

The assessment of annual household income is one of the important indicators to measure the well-being/livelihood of the household. The average household income was computed to be Rs. 68,998 per month. The survey results shown in **Table 5.14** reveal that a major proportion (45.5%) of the surveyed households fall in the income category of Rs. 20,000 to Rs. 50,000, while 14.4% and 40.1% come under the income bracket of less than Rs. 20,000 and above Rs. 50,000 per month, respectively. The average per capita income was computed to be Rs. 98,333 per annum and Rs. 8,194 per month. In accordance with the poverty line (Rs. 25,475/ month per household), the level of poverty of the sample households is 14.4 percent.

Table 5.14: Average Income of Surveyed Households

Income	Household Income Bracket			Total
	Upto Rs. 25,000	Above Rs. 25,000 – Rs. 50,000	Above Rs. 50,000	
Percent of HHs	14.4	45.5	40.1	100.0
Average HH Income	Average Annual Income			827,973
	Average Monthly Income			68,998
Average Per Capita	Rs./ Annum			98,333
	Rs./ Month			8,194
Level of Poverty (%)	Rs. 3,030/ person per month			14.4%

5.4.7 Household Expenditure

The average annual expenditure and pattern of expenditure provide an indication for assessing the standard of living. The expenditure on food items includes wheat or maize flour, cereals, pulses, sugar, cooking oil, and milk; while the non-food items include fuel, education, health, clothing, shoes, cosmetics, utility charges, and other miscellaneous expenditures.

The average household expenditure was estimated to be Rs. 787,973 per annum, out of which, the proportion of food and non-food expenditure was to the extent of 43.3% % and 56.7%, respectively.

5.4.8 Land Tenure, Land Use, and Natural Resources

Most of the land is allocated to individuals using informal methods of identification of plots like placing stones/markers at the boundaries and also accepted by the local community. There is no formal updated land record available with the Revenue Department in the entire project area. In general, the area is hilly/mountainous and there is a scarcity of flat and arable land. It is noted that on the whole, about more than 81% of the land is hilly/mountainous & barren. About 19% of the land is under cultivation in the form of terraces. The water streams are divided among communities or sub-tribes, and everyone knows who owns what piece of land.

5.4.9 Credit Levels of Households

5.4.9.1 Status of Credit Obtained by the Households

The aspects discussed in this section include the extent of sample households who obtained credit, amount of credit, major sources of credit and the purpose of credit. Generally, credit is obtained to supplement income to meet routine and some occasional expenditure of the household, including household purchasing, investment, social needs, construction and maintenance of the house, purchase of farm input/livestock and other expenditures. Credit is obtained from formal sources (banks/ institutions/ private money lender) and non-formal sources (like friends, relatives, and landowners). In the project area, it was observed that on the whole, 16.0% of the sample households obtained credit from non-formal sources, including money lenders, relatives/ friends. A major proportion of the households (81.5%) have obtained credit above Rs. 50,000, while the remaining 18.5% of households obtained credit up to Rs. 50,000. Details are given in **Table 5.15**.

Table 5.15: Average Amount of Credit Obtained by Sample Households

Amount of Credit Bracket	**Households Obtained Credit**	
	(Nos.)	**%**
< Rs. 20,000	2	7.4
Rs. 20,000 – Rs. 50,000	3	11.1
>Rs. 50,000	22	81.5
Total	27 (16.0%)	100.0

5.4.9.2 Source of Credit

The majority of the respondents had taken credit for investment purposes in some business activities and have taken a loan from their relatives. Among surveyed households (16.0%) who obtained credit, most of them have obtained it from non-formal sources. None of the sample households obtained credit

from formal institutions due to the requirements of collaterals and payment of interest rates. The details regarding sources of credit are presented in **Table 5.16**.

Table 5.16: Sources of Credit

Sources of Credit	Households who Obtained Credit (Nos.)	Percentage (%)
Formal sources (banks)		
Informal sources	-	-
Private money lender	5	18.5
Relatives	19	70.4
Shopkeeper	-	-
Other	3	11.1
Total	27 (16% of the total sample HHs)	100.0

5.4.9.3 Purpose of Credit Obtained

The purpose of credit obtained is to supplement income to meet routine and some occasional expenditures of the household. Most of the sample households (about 50%) obtained credit for house matters (social obligations) and treatment for health-related issues. Details of purpose and amount of credit are summarized in **Table 5.17**.

Table 5.17: Purpose of Credit Obtained

Purpose of Credit Obtained	Households Obtained Credit (Nos.)	%	Amount (Rs.)
Purchase of house	2	6.7	1,015,000
Business	3	10.0	650,000
Farm inputs	3	10.0	70,000
Livestock (purchase of animals)	3	10.0	86,667
Household matters	9	30.0	362,222
Repair & maintenance of house	4	13.3	141,250
Others (health)	6	20.0	415,000
Total	30 (17.8%)	100.0	2,740,139

5.4.10 Housing Conditions

The ownership and housing condition are some of the key indicators for the assessment of the living standard and well-being of households. The main household structures consist of living rooms, animal shed/ room, and washroom. The details regarding the type of construction/ housing conditions of different structures/ sub-structures are presented in **Table 5.18.**

Table 5.18: Housing Conditions

Housing Condition	Percentage of Housing Conditions			
	Concrete	Semi-concrete	Mud	Wooden structures
Type of Room				
Living rooms	53.3	24.2	17.0	5.5
Animal shed/ room	26.5	18.4	41.8	13.3
Other sheds	23.3	36.7	25.0	15.0
Shelters	18.8	21.9	12.5	46.8
Bathroom	53.0	24.0	14.2	8.8

5.5 Public Health Facilities

The health facilities in the project area are very limited. There is only one Basic Health Unit (BHU) in Kalam, which has five medical doctors, three nurses and lady health workers, and ten medical technicians. The nearest Rural Health Centre (RHC), which has beds and in-patient treatment facilities, is located in Mingora, about 80 km from Kalam.

According to the information provided by the surveyed households, about 0.6% complained about the prevalence of stomach related diseases, especially in the summer season. Flu and Fever were reported as the most common disease by 14.2% and 5.3%, respectively. Diarrhea is a seasonal disease and reported by 0.6% of the respondents. Other diseases like Asthma, Chest Congestion, Eye infection, Heart-Related Diseases, Joint issues, Kidney Related Diseases, Paralysis, Shoulder pain, Human Immunodeficiency Virus (HIV), were rarely reported by the respondents. Tuberculosis (TB) was reported by 3.6 % of the respondents and Hypertension and Hepatitis patients were also reported. The main reasons for the prevalence of these diseases are unhygienic sanitation and indoor smoke from heating.

5.5.1.1 Access to social amenities

During the field survey, the availability of the social amenities/ basic infrastructure in the communities in the project area was determined. The results indicate that facilities such as drinking water, electricity, and roads are generally available in the villages. However, the availability of fuel (such as liquefied petroleum gas, LPG) and access to telecommunication facilities are quite limited.

Springs are the major sources of drinking water in the project area (85%) and water supply schemes contribute only a small proportion (15%).

5.6 Employment and Business Opportunities for the Locals

Men from better-off families are employed in public and private sectors or run their own businesses. The survey revealed that the majority of the middle-income group run their businesses whilst the poorer households work as daily wage laborers. Out of the total, 70 percent of the men from middle-income groups work in agriculture fields whilst a majority of the men from lower-income families work as daily wage laborers or as agriculture tenants. The females from both middle income and low-income groups work in agriculture fields to support the male members of their families. Almost 15 percent of the men from middle-income households run their own dry fruit and other small businesses and 15 percent work as government and private sector employees. Men and women are also involved in animal rearing and wood cutting and collecting.

5.6.1 Ownership Pattern of Land

Most of the surveyed households own the agriculture land and a few are also tenant farmers. All of them owned a piece of land on which their houses are built. In cases of tenant farming, the tenant farmers take one-third of the total produce of the farm. Until the head of the family is alive, only residential land is allotted to the sons, and once the patriarch's head passes away, the agriculture land is divided. A majority of the households only distribute land in between the sons, and daughters rarely get a share. In cases the daughters are offered their share of agriculture land, they refuse to take it due to cultural reasons.

5.6.2 Prevalence of Conflict and Cohesion

Peace and solidarity prevail in the Project area. The community is homogeneous, and members are known to each other. There are not many serious issues or tensions in the local communities except few individuals having feuds and rivalries. In case of any feud, the local *Jirga* resolves the issues then and there. The most common causes of tensions are land and forest disputes. There is a dispute between the Forest Department and the local population as the Forest Department wants people to inform the officials before the locals cut trees as the trees are legally owned by the Forest Department. However, the locals are of the opinion that the forest is owned by the locals and that they do not need to inform them before cutting trees. Tree cutting in the forest is illegal and the locals cut trees at night. Only the locals cut trees. The locals have demanded that they would stop cutting trees if the government was to provide them with free electricity to help them heat their houses and for cooking purposes.

5.6.3 Decision-Making Forums in the Local Communities

Jirga is a commonly acceptable decision-making forum in the project area for conflict resolution, as reported by the 83.9% sample respondents. A *jirga* is a traditional assembly of leaders that make decisions by consensus and according to the teachings of Pakhtunwali. The Pakhtunwali is a traditional lifestyle of the Pakhtuns and interpreted as "the way of the Pakhtuns" or "the code of honor."

5.6.4 Seasonal Migration Trends in The Project Area

Kalam is also a tourist destination during the summer season and therefore, the men in the area are engaged in seasonal employment. However, in winter, it is hard to find any tourists in Kalam and thus during winter, due to extremely cold weather, a number of locals migrate to plain areas, mainly the central districts of KP and Punjab provinces. Migration starts in the month of October and November before the snow starts to fall. Due to harsh weather conditions, schools remain closed and open in spring. The migrated people work in cities and towns as agriculture labor, household helpers, and drivers and as shop keepers. Families from better-off families of projects do not migrate during the winter season as they can afford to live in the harsh weather. Some of the well-off families in the area also own homes in the lower districts and move there. However, families from lower-income backgrounds who do choose to stay back, look after the homes, animals, and land of the families that migrate and are paid to do so by the owners.

5.6.5 Physical Cultural Resources

5.6.6 Cultural Sites

There are no archeological sites, historical sites, and sites of significant religious value are located in the project area. It is common that every village has a mosque and graveyards, and details of these cultural sites are given in **Table 5.19.** None of these sites will be affected by the proposed project activities.

Table 5.19: Cultural sites in the project area

S.NO	Village	Cultural sites	
		Mosque	Graveyard
1	Kanai	1	2
2	Paler	1	2
3	Mahai	1	1
4	Rashnail	1	1
5	Sher Kally	1	2
6	Chirat	1	1

5.6.7 Tourism

The region is famous for lush green hills, thick forests and bestowed with mesmeric streams, meadows, and waterfalls which are worth seen features of the landscape. Kalam is a famous tourist station in the region along with some other smaller hill stations such as Ushu (in the northeast of Kalam valley), Matiltan (location of large glaciers, thick forests, and lofty mountain peaks) and Utror (surrounded by snow-clad mountains). There are about 350 hotels in the Kalam town and about 400,000 tourists visit the Kalam annually. There is also a tourist location near the Kanai village (about 2 km upstream of weir site), known as *Dhamaka Jheel*, where the width of Gabral River is wide with a picturesque view. This tourist attraction is located outside the project influence area, and there will be no impact on this location from the proposed project activities.

5.7 Gender Assessment

5.7.1 Overall Context

Pakistani women face numerous gender inequalities in the social context and therefore, it impacts their participation in water resources related debates, policy, programs and community-level initiatives. As per Human Development Report 2018, Pakistan ranks 150 out of 189 on the Gender Development Index, with a value of 0.750 and on the Gender Inequality Index ranks at 150 out of 189 and has a value of 0.541. As per the Global Gender Gap Report 2018, Pakistan ranks at 148 and has a score of 0.550 points. The importance of empowering women across the board and mainstreaming women in the management and governance of water has been recognized at the global level since the 1980s, and Pakistan is a signatory to all the relevant water declarations and commitments. Gender inequalities are deeply rooted in the country's social and cultural norms and practices, resulting in discrimination with women and girls, which affect the quality of their life. Gender inequality in Pakistan in general and specifically in Khyber Pakhtunkhwa is characterized by the society and thereby, men on average are better positioned in social, economic, and political hierarchies.

Gender roles are constructed on the basis of the concepts of production and reproduction. The unequal gender roles are reinforced and maintained and influence male and female life circumstances. Women and girls experience differential access to food, education, medical care and access to resources and opportunities; their general and reproductive health is negatively affected due to restrictions on decision making and their mobility. Most of the women's roles are limited to family and are excluded from main decision making at household and society level. Lack of sufficient time, gender bias, social and cultural norms as well as family responsibilities are the most significant challenges women face to achieve balance in a patriarchal society. The gender analysis of AHs revealed that female' domestic roles, strict cultural values, and their early marriages are a great reason for the low enrolment of

females in the schools and higher-level education. The sections below documented the outcome of gender assessment. As a result of gender assessment, a Gender Action Plan has been developed for gender mainstreaming in the Project, attached to ESIA of the project.

5.7.2 Family Composition

The households live as joint families, with the male patriarch as the head of the household. Single marriage system is in vogue, but in case a wife continually has 3 or 4 girls, then in the majority of the cases, the husband opts for a second marriage. The second wife lives in the same house with children. Joint family systems are prevalent in the project area wherein all family members deposit each of their earning in one exchequer and fulfill their needs from the same exchequer. The patriarchal family system persists in the project area; the elderly male member of the family is head of the family.

The respondents mentioned that commonly acceptable age for marriage for both boys and girls is 18 years, but the better-off income households prefer to marry their boys at the age of 25 and girls after 18 years of age. The better-off income households believe that the boys should first complete their education and then marry. In middle income and lower-income households, boys are married after they turn 18, and the girls are married between the age of 15-18 years.

5.7.3 Education Facilities

There are no social and cultural restrictions for the girls of the better-off income group to get an education from outside of Kalam. Middle income and lower-income families do not send their children outside of the locality for an education due to financial unaffordability, non-availability of educational facilities in the periphery, and due to social pressures to keep the girls at home. People of the area are aware of the importance of education, especially for girls. They are of the view that by getting a formal education, girls to become good wives, mothers, and daughters and thus become aware of their duties, rights, and responsibilities in society. On the other hand, non-formal education is a big source of socialization within society. They are also aware that education helps them improve their lifestyles and provide them with a ray of hope to get out of the darkness towards light.

The ratio of education is very low within the project area. The reasons for this are the non-availability of schools or madrasas (religious schools) in the nearby locality. Students have to go to faraway areas to get an education. The ratio of education in men is slightly higher than that of women. The majority of women are illiterate; however, they are aware of the importance of education for their new generation.

5.7.4 Constraints in Accessing Schools

Due to hilly terrain, hard weather, lack of transport facilities, non-affordability of transportation, and due to social and cultural barriers, the children are deprived of education. There are some small madrassas where students are getting religious education. There is a need for skill development in the project area, including that of making decoration items, embroidery, and dressmaking, etc.

5.7.5 Women Health

Information on the women's health issues has been gathered through discussions with the respondents as well as meetings with the health officials in the project area. According to the information gathered, very few women receive treatment from antenatal care centers; similarly, a very negligible number of women receive any form of post-natal care from skilled birth attendants. The majority of the respondents perceive it as unnecessary. Other reasons are the cost of treatment, a long distance from the health facilities, lack of roads and financial constraints, and social pressures.

5.7.6 Health Facilities/Issues for Women

The project area has limited health facilities (a BHU in Kalam). Even in case of delivery, traditional birth attendants are not available in the nearby localities. The most common illnesses among women are joint pain, anemia, seasonal fever, and depression. Women relayed that the bearing of children without any break is a cause of concern for their health and is also added a financial burden on the household. As the lifestyles of middle income and lower-income households are similar, the people have reported having similar diseases. There are no registered traditional Birth Attendants, Midwives available within the project area and people turn to local midwives and, in case of emergencies, either visit the Kalam BHU or the RHC in Mingora. The better-off families take their women to Private hospitals in Mingora. The women from middle income and lower-income groups give birth to their children at home with the help of elderly women.

5.7.7 Role of Women In Decision Making

The assessment reflects that the majority of the decisions within the households are made by the male members of the family, whilst the decision about children's marriages is made in consultation with elderly women. The decision about the sale and purchase of property and major expenditures is made by men across all income groups. Community-level decisions are always taken by the male members through the customary Jirga system. Women are not part of the Jirgas and no women-specific jirgas exist in the project area. Women related issues are mostly addressed by male Jirgas.

5.7.8 Mobility of Women

Women visit families, friends, and weddings and go out for shopping. However, as the markets are an average of 4.5 km away from the villages, and the women are accompanied by either an elderly woman or a male member of the family or a male child. Women travel for up to 30 minutes, 3-4 times a day to collect water from nearby streams and springs and use the water for drinking, cooking and cleaning and washing purposes. They also help the male members of their families in agriculture fields, which are generally next to their homes. However, women go in pairs and do not travel alone. Women always accompany the male members of the households to the BHU and to the hospital. Women rear animals and collect wood. It is pertinent to mention here that the women are allowed to visit their relatives and family friends on their own tribe within or outside of their villages. Women rarely go out for the purchase of grocery items and grocery shopping is mostly done by the male members of the family. The girls of better-off and middle-income households are allowed to go out to get an education while in lower-income households they are not allowed to go out without an accompanying male member of the household.

5.7.9 Women Social Protection

The women in consultation reported that none of the households have access to any social protection program such as the Benazir Income Support Program, Baitul Mall, or any other charity organization.

5.7.10 Availability of Skill Centers

There are no technical or vocational training centers for the women in the project area or in Kalam or in other nearby towns. The local artisans, both male, and female prepare many items from the local wood, including decoration pieces, beaded bracelets, and other such items. Some of the women are engaged in embroidery, but their products are taken to the market by men for selling. About 30 % of women of affected households are involved in stitching for women and children's clothing and earn up to PKR 200

per suit. On a monthly basis, a woman earns up to PKR 5000. About 25% of women from households' stitch clothes of female members of their families and children.

5.7.11 Concerns of Women about the Project

The local women know that the government intends to start a hydropower project in their area and their main concern was related to loss of land and physical displacement.

The women have an expectation that the project will elevate their low-lying barren lands and after leveling they will be able to grow crops on it. Local women identified the following problems in their area for the interventions through the Project:

- A middle and high school for girls in Kanai and Ashuran villages
- Vocational training center in Kanai and Ashuran villages
- Microfinance for women income-generating activities, including skill development as they want to improve their craft by designing handmade embroidery so they can compete in the market and get better rates for their products.
- Maternity home for women
- Microfinance institution that would help to develop and polish the skills of the local women as it would enable them to take loans, expand their work and be able to sell them to the locals and the tourists.
- The pavement of road from Kalam Town to Kanai village

5.7.12 Women's Participation in Income Generating Activities

Women are involved in several household and income generation activities, including:

- Employment as private and government school teachers, lady health visitors/ workers and traditional birth attendants.
- Poultry, cleaning cot, supervise hatching, feeding, and animal rearing.
- Other household chores include washing clothes, fetching water and firewood, cooking, child caring, cleaning and repairs of household items, participation in social obligations/ marriages and gathering.
- Agricultural and farming activities such as harvesting, picking of vegetables and drying fruits.
- Livestock rearing, collection of fodder, grazing, washing buffaloes, processing the milk products.
- Poultry, cleaning cot, supervise hatching, feeding and health care.
- Other households chores include washing clothes, fetching water and firewood, cooking, child caring, cleaning and repairs of household items, participation in social obligations/ marriages and gathering

5.7.13 Women Daily Activities

The women's participation in different activities was analyzed for a better understanding of the workload on women in various households, and according to the findings, all the local women responded that they are involved in household activities. These views were obtained from mix groups of women, including housewives. The women's daily activities, social obligations, business activities, employment and other activities given in **Table 5.20**.

Table 5.20: Women Participation in Household activities

Activities	No. of Households (Women Members)	%
The extent of women involvement		
Household activities	56	100.0
Child caring	54	96.4
Farming including vegetable growing & picking	23	41.1
Livestock rearing	17	30.4
Preparing fodder	44	78.6
Feeding animals	21	37.5
Veterinary care	14	25.0
Milking	32	57.1
Watering animals	29	51.8
Social obligations (marriage, and other functions)	41	73.2
Fetching of drinking water	32	57.1
Collecting fire/ fuel wood	8	14.3
Decisions are taken by women in your home		
Children issues	4	7.1
Education of children	6	10.7
Health issues	2	3.6
Marriages of children	5	8.9
Food and cooking	17	30.4

The women of the project area also contribute to income generation of their families through some woodwork and dressmaking. About 2% of women involved in wood carving and 6% of women are involved in dressmaking.

6 Climate Change and Other Risks

This chapter discusses the risks of climate change-related impacts, net greenhouse gas emissions from the Project and risk of earthquakes.

6.1 Climate Change Risks

During the last decade, substantial research is carried out to study the effects of long-term climate change on precipitation, air temperatures, and droughts in Pakistan. Some of the main conclusions of these studies (GCISC, 2009[19] , Planning Commission, 2009[20]) are:

- between 1980 and 2005 the frequency of heatwaves (T >40 °C) has been increased in north-western Pakistan. It is expected that there will be more frequent periods with extreme drought;
- based on predictions in scenarios of the International Panel on Climate Change (IPCC) estimates have been made by the Pakistan Meteorological Service of the increase in maximum daily temperatures, which ranges from 2.8 °C to 4.2 °C in the year 2080 for northern Pakistan;
- more heavy rainfall events during the monsoon season will occur over north-western Pakistan instead of over the north-east of the country. Some models calculate 25 percent more rainfall during monsoon. As a result, areas along the western rivers of the country (Indus and Kabul) will be more vulnerable to flood episodes similar to the one experienced during 2010;
- water availability might increase considerably (during monsoon or Kharif season) but not when it is required for agriculture (winter or rabi season); a shift has been observed in the rainfall pattern with monsoons starting 1-2 weeks earlier and winter rains confined towards February. The predictions of changes in precipitation, however, are much less certain than those in temperature. A general conclusion is that precipitation in the form of rainfall and snow is likely to increase in summer (2- 7 percent) and decrease (2-4 percent) in Northern Pakistan in the year 2080 (GCISC, 2009).

Other studies (World Bank[21], 2005, Rees and Collins, 2004[22]) have been concentrated on the effects of glacial melt, especially on the Hindu Kush-Karakorum or the Western part of the Himalaya. Major issues to be investigated are amongst others: the importance of the contribution of snow and glacial melt on the hydrology of the Indus; the observed changes in the extent of the glaciers; the effects of climate changes on the amount of melt-water.

From these studies, it has been concluded that glaciers in the Himalaya and Karakorum are receding faster than happens in any other part of the world. From digital terrain models and satellite observations, it might be concluded that the reduction of the thickness of ice in the Western Himalayan glaciers ranges between 0.50 to 0.90 m per year, although in some areas in the Karakorum an extension

[19] GCISC (2009): Ali, G., S. Hasson, and A.M. Khan, Climate Change: Implications and Adaptation of Water Resources in Pakistan, Research Report No.GCISC-RR-13, Global Change Impact Studies Centre, Islamabad.

[20] Planning Commission 2009, Pakistan's Climate Change Policies and Actions, Task Force on Climate Change, Planning Commission, Planning and Development Division, Government of Pakistan.

[21] World Bank 2005.Pakistan's Water Economy Running Dry

[22] Rees, G. and D. N. Collins (2004), An assessment of the Potential Impacts of Deglaciation on the Water Resources of the Himalaya, Technical Report, DFID KAR Project No. R7890: Snow and Glacier Aspects of Water Resources Management in the Himalayas (SAGAR MATHA), Centre for Ecology and Hydrology, Oxfordshire, UK

and increase of glaciers has been reported. A recent study[23] suggests that 60 percent of the discharge in the Indus catchment is fed by the melting of glaciers and snow. This is a very high percentage as compared to other major rivers originating in the Himalayas, such as Brahmaputra, Ganges and Yellow River. In a likely scenario of global warming based on IPCC predictions, the reduction of the share of melt-water in the Indus discharge has been estimated at 8.4 percent. However, this could be (over) compensated by an expected increase of precipitation in the downstream areas (in the NW of the country), which are under the influence of the monsoon.

The relation between climate change and hydrology is extremely complex. This is especially the case, since the high variability in data on climate and hydrology, requiring long time series and proper monitoring. Moreover, regional circumstances might vary considerably, especially in high mountain areas. This often leads to conflicting data. More studies and more reliable data should be collected in the coming years.

6.2 Net Greenhouse Gases Emission from the Project – Power Generation Facilities

Net greenhouse gas (GHG) emissions from the implementation of the Project are estimated using the World Bank "Guidance Note: Greenhouse Gases Accounting for Energy Investment Operations, Version 2.0, January 2015 (hereinafter "Guidance Note") and IPCC 2006 guidelines. The emissions from the Project and baseline emission of the nearest least-cost alternative (CCGT) estimated for over 50 years.

6.2.1 GHG Emissions from the Generation Component

Three sources of emissions are considered for accounting GHG from the Project. The sources and the estimates are given below.

6.2.1.1 Reservoir Emissions

When a river is dammed, the flow dynamics are changed, riverine sediment and organic material are trapped, and terrestrial ecosystems are flooded. This alters the previous cycle and fluxes of CO_2 and other GHGs within the reservoir area. The main contributions to emissions are decomposable parts of flooded soil and vegetation in terrestrial zones and removed sinks from cleared biomass growth. GHG emissions from new aquatic systems will occur during the full lifetime of the reservoir but will exponentially decrease as the flooded organic material is decomposed and as biochemical conditions change.

The Project will create a limited reservoir (0.2 square kilometers) and will not contribute to any reservoir emissions, and hence reservoir emissions from the Project can be assumed to be zero.

6.2.1.2 Emissions from Land Clearing for Civil Works

Construction of project infrastructures such as weir, tailrace, switchyard, and some other project facilities such as spoil disposal require permanent land clearing. Emissions from land clearing can be calculated as a one-time emission of CO_2 based on the available dry biomass carbon for the total cleared areas for construction. According to IPCC guidelines, a dry temperate climate has 100 tons/ha of dry biomass, of which average carbon content is 47 percent. Total land clearing emissions for 2 km^2 are 0.034 million tCO_2e.

[23] Immerzeel, W. W., L. P.vanBeek, and M. F.Bierkens (2010), Climate change will affect the Asian water towers, Science, 328, 1382– 1385.

6.2.1.3 Embodied (Life Cycle) emissions in construction materials

The construction of the Project requires a huge amount of concrete, steel, metals, and other electromechanical equipment. All of these materials have embodied emissions as a result of the energy used to produce them, meaning that the implementation of the Project creates some upstream emissions in the manufacture of the materials used. The Guidance Note recommended a mean value of 2.9 kg CO_2e/MWh per hydropower as a default factor if no other information is available. Total Embodied (Life Cycle) Emissions are 0.056 million tCO_2e.

6.2.2 Baseline Emissions

Two sources of emissions are considered for estimations of baseline emissions.

6.2.2.1 Baseline Generation Emissions.

These are GHG emissions resulting from the same amount of electricity generation using other alternate feasible energy sources. This feasible alternative should be realistic in terms of economic, technical, financial, legal, and regulatory aspects. The economic and least-cost analysis of the Project described CCGT is the most feasible alternative to the Project. Emission Factor for CCGT in Pakistan is 367.56 g CO_2/kWh. Total Baseline Generation Emissions for 50 years is 7.19 million tCO_2e.

6.2.2.2 Baseline Construction Emissions.

According to the 'Guidance Note', the default value for one-off emissions for thermal gas power is 503 kgCO2e/kW of installed capacity. The corresponding plant factor is 85 percent. For the installed capacity to produce 391GWh/year requires 50 MW of thermal gas power. Total baseline construction emissions are 0.03 million tCO2e. Therefore, the total baseline emissions from the above two sources are 7.21 million tCO2e.

6.2.3 Net Emissions

The net emissions (Project Emissions - Baseline Emissions from CCGT) of the Project are minus 7.12 million tons of CO_2 equivalent. A summary of the calculations is given in **Table 6.1**.

Table 6.1: Net GHG Emissions (tCO2) from T5HP – Power Generation Component

	Emission Type	Generation	Baseline (CCGT)	Net
1	Reservoir emissions	0		0
2	Generation Emission		7,185,798	-7,185,798
3	Land clearing	34,467		34,467
4	Embodied Emissions	56,695		56,695
5	Energy emissions in Construction (optional)	0	26,413	-26,413
	Total Emissions	91,162	7,212,211	-7,121,049

6.3 Net Greenhouse Gases Emission from Power Evacuation Facilities

Three sources of emissions are considered for accounting GHG from the power evacuation facilities. The sources and the estimates are given below, and emission calculations are given in **Table 6.2**.

6.3.1 GHG Emissions from Transmission Line

The losses in the transmission are estimated at 2%. The direct generation emissions associated with these losses (emission factor 0.6545 tCO_2/MWh) is estimated to be 0.15 million tCO_2e.

6.3.2 GHG Emissions from Land Clearing

Land clearing will be required at the tower locations (approximately tower will be required for every 300 m, and a clearance required for each tower is 10m X 10m), and emissions associated with the clearing are estimated to be 69 tCO_2e.

6.3.2.1 Sulfur hexafluoride fugitive emissions

Sulfur hexafluoride (SF6) is used in gas-insulated switchgear, gas circuit breakers, and (less frequently) in high-voltage, gas-insulated lines. SF6 may escape as fugitive emissions during the manufacturing, installation, use, maintenance, and disposal of this equipment. Sealed distribution equipment may not emit any SF6 during use, but transmission equipment often requires periodic refilling and hence has higher rates of fugitive emissions during use. The amount of SF6 emitted during operation, and decommissioning is related to the number and type of equipment used, as well as the maintenance and recycling procedures. SF6 emissions could occur in all transmission and distribution projects, depending on the type of equipment installed, refurbished, or maintained. Countries report SF6 emissions from the power sector in their national emissions inventories, and emissions factors from these inventories provide one way to estimate their magnitude (emission factor for Pakistan is 0.119 gSF6/MWh). SF6 emissions are estimated as 0.033 million tCO_2e.

6.3.2.2 Total Emissions from Power Evacuation

Embodied emissions and construction emissions have not been calculated since the information will be known only at the construction stage. The overall Project emissions from the above sources are estimated to be 0.154 million tCO_2e.

6.3.3 Baseline Emissions

The baseline (or alternative to the project intervention) is usually a project that provides the same level of service (for example, the same transmission capacity or reliability level) provided by the project being pursued. Since this will be a new transmission line, the other feasible alternatives are different routings. So, the emissions of this alternative would likely be very similar to those of the project.

6.3.4 Net Emissions

The net GHG emissions (Project Emissions - Baseline Emissions) of power evacuation are zero since this will be a new transmission line, and emissions from the project and baseline (alternative) will be the same.

Table 6.2: Net GHG Emissions (tCO2) from Power Evacuation Component

	Emission Type	Evacuation	Baseline	Net
1	Generation Emissions from losses in the project	153,546	153,546	0
2	Emissions from Land Clearing	69	69	0
3	SF6 Emissions	33,361	33,361	0
4	Embodied Emission (Optional)	0	0	0
5	Energy Emissions in Construction (Optional)	0	0	0
	Total Emissions	153,615	153,615	0

6.4 Risk of Earthquakes

The Project area is located in a part of Pakistan where earthquakes frequently occur, though usually, these are not of an exceptional magnitude. The project area is located in a tectonically active region affected by the continuing northward drifting of the Indian plate and its subduction below the southern flank of the Eurasian plate. The collision of the two plates began about 50 million years ago, and the full contact between them was completed about 40 million years ago. Yet the Indian plate keeps on slowly drifting northward.

The major regional faults related to the intercontinental collision and considered to be active and capable of generating earthquakes are Main Karakorum Fault (located 50 m away from the weir site), Main Mantle Thrust (located 50 km away from the weir site), and Kohistan Fault (located about 45 km from the weir site).

The most recent major earthquake in the area occurred on 8 October 2005, whose epicenter was near Ghori about 19 Km NE of Muzaffarabad (about 200 km from the weir site). The minimum moment magnitude (Mw) of the earthquake measured at this site was 7.6, and the hypocenter was located at a depth of 26 Km below the ground surface. The earthquake caused severe destruction in large areas of northern Pakistan and to a lesser degree, in northern Afghanistan and northern India. More than 73,000 people were killed through this earthquake and 450,000 people made homeless. The epicenter was located at a distance of about 200 km northeast from Tarbela.

The seismicity of the region was studied as part of the detailed design. The seismic accelerations used in the design of the Project are:

- The recommended horizontal Peak Ground Acceleration (PGA) associated with Operating Basis Earthquake (OBE) is 0.21g, which is associated with ground motion having a return period of 145 years.
- The recommended horizontal Peak Ground Acceleration (PGA) associated with Safety Evaluation Earthquake (SEE) is 0.49 g, which is associated with ground motion having a return period of 3,000 years. This PGA is used for the design of the weir.
- All the appurtenant structures at the weir, tunnel and powerhouse areas are recommended to be designed for PGA of 0.30g, which is associated with ground motion having a return period of 475 years.

A committee of an international panel of experts recruited by PEDO will review and approve the Project design. This will be done in accordance with the World Bank Policy OP 4.37 Safety of Dams. A network of instrumentation will be installed at the weir for continuous monitoring.

7 Potential Impacts and Risks and Their Mitigation

7.1 Overview of Impacts

The Project will be a true run-of-river project (operated as a baseload plant) with a limited reservoir area (50acres). The most direct and significant negative impacts of the project will be on aquatic ecology caused by the construction of a 21 m high (above river bed) weir and diversion of river for about 5.75 km for power generation, and acquisition of 200.14 acres/1601.49 kanals (157.44acres/63.716 hectares will be permanently and 42.7 acres/17.3 hectares will be temporarily). Out of total land needed for the project, 76.587 acres/189.255 hectares of permanent loss of private land owned 89 households, including 8 households who will be physically displaced. The adverse impacts associated with the construction are temporary in nature and will mainly include waste generation, dust pollution, occupational health, and safety risks and community exposure to work hazards. The overall positive impact of the project, which is the generation of 339 GWh renewable electricity with minimal carbon emission, will be experienced countrywide through the provision of enough energy to power the equivalent of about 116,000 homes per year in the country[24].

7.2 Impact Assessment Methodology

Potential environmental and social impacts were identified on the basis of a review of feasibility study reports, field visits, stakeholder consultations, and experiences from the construction of Dasu and Tarbela 4th Extension Hydropower Projects (World Bank funded hydropower projects in Pakistan). The significance of potential impacts was assessed using the criteria and methodology given below.

Impact Magnitude

The potential impacts of the project have been categorized as major, moderate, minor or minimal based on consideration of the parameters such as: i) duration of the impact; ii) the spatial extent of the impact; iii) reversibility; iv) likelihood; and v) legal standards and established professional criteria.

The magnitude of the potential impacts of the project has generally been identified according to the categories outlined in **Table 7.1**.

Table 7.1: Parameters for Determining Magnitude

Parameter	Major	Moderate	Minor	Minimal
Duration of the potential impact	Long term Beyond the life span of the project	Medium Term The lifespan of the project	Limited to the construction period	Temporary with no detectable potential impact
The spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond immediate project components, site boundaries or local area	Within project boundary	A specific location within the project component or site boundaries with no detectable potential impact
Reversibility of	The potential	Baseline	Baseline returns	Baseline remains

[24] The estimates are based on current per capita energy consumption 450 kwh per year, and the average household size in Pakistan (6.45 persons per household).

Parameter	Major	Moderate	Minor	Minimal
potential impacts	impact is effectively permanent, requiring considerable intervention to return to baseline	requires a year or so with some interventions to return to baseline	naturally or with limited intervention within a few months	constant
Legal standards and established professional criteria	Breaches national standards and or international guidelines/obligations	Complies with limits given in national standards but breaches international lender guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable
Likelihood of potential impacts occurring	Occurs under typical operating or construction conditions (Certain)	Occurs under worst-case (negative impact) or best case (positive impact) operating conditions (Likely)	Occurs under abnormal, exceptional or emergency conditions (occasional)	Unlikely to occur

Sensitivity of Receptor

The sensitivity of a receptor has been determined based on a review of the population (including proximity / numbers / vulnerability) and the presence of features on the site or the surrounding area. Each detailed assessment has defined sensitivity in relation to the topic. The criteria for determining receptor sensitivity of the Project's potential impacts are outlined in **Table 7.2**.

Table 7.2: Criteria for Determining Sensitivity

Sensitivity Determination	Definition
Very High	The vulnerable receptor with little or no capacity to absorb proposed changes or minimal opportunities for mitigation.
High	The vulnerable receptor with little or no capacity to absorb proposed changes or limited opportunities for mitigation.
Medium	The vulnerable receptor with some capacity to absorb proposed changes or moderate opportunities for mitigation
Low	The vulnerable receptor with good capacity to absorb proposed

Sensitivity Determination	Definition
	changes or/and good opportunities for mitigation

Assigning Significance

Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor have been determined and the significance of each potential impact established using the impact significance matrix shown in **Table 7.3**.

Table 7.3: Criteria for Determining Significance of Impacts

	Sensitivity of Receptors			
Magnitude of Impact	**Very High**	**High**	**Medium**	**Low**
Major	Critical	Major	Moderate	Minimal
Moderate	Major	Major	Moderate	Minimal
Minor	Moderate	Moderate	Minimal	Minimal
Minimal	Minimal	Minimal	Minimal	Minimal

7.3 Summary of Assessed Impacts

The project's potential impacts and their significance have been assessed using the methodology described in Section 7.2 above. A summary of these impacts and their significance are presented in **Table 7.4** along with the key mitigation measures. A detailed assessment of impacts and proposed mitigation measures are given in the subsequent sections. Environmental Code of Practices (ECPs) have been prepared to address all generic construction-related environmental and social risks and presented in **Annex 1**.

Table 7.4: Potential Impacts and their Significance

The impact of various activities	Sensitivity	Magnitude	Significance Prior to Mitigation	Key Mitigation and Enhancement Measure	Residual Significance
Environmental and Social Considerations in the Project Design					
1. Reduction of the reservoir area by building the left embankment	Very High	Major	Critical beneficial	About 17.25 acres of agricultural land and two houses are saved from the submergence by building an embankment on the left bank of the reservoir.	Critical beneficial
2. Impact on fish migration and aquatic ecology	Very High	Major	Critical adverse	A fish ladder is designed considering the requirements of snow carp, the indigenous fish species in the project area. Environmental flows are designed based on the requirement of snow carp and to maintain ecological connectivity.	Minimal adverse
3. Restoring the 2010 flood eroded areas and land reclamation through placing muck disposal	Very High	Major	Critical beneficial	Muck disposal areas are identified in the flood eroded areas. The restored lands will be handed over to the original owners	Critical beneficial
4. Development of tourism attractive facilities in the project area	High	Moderate	Major beneficial	Tourist-attraction facilities are in-built in the project design (parks near the reservoir area and deflected spillway) to provide additional recreation facilities to the tourists of Kalam hill station.	Major beneficial
Environmental impacts due to Project siting					
1. Generation of low carbon and environmentally friendly power generation. Supply of additional 88 MW (339 GWh) of electric power to the national grid of Pakistan	Very high	Major	Critical beneficial	Implementation of the ESMP and RAP to mitigate impacts associated with the construction of the project	Critical beneficial
2. Loss of natural vegetation (48 trees owned by the community and 636 forest trees) due to the land clearing under project footprints. Possible disturbance to Koklass and black bear pheasants.	Medium	Major	Moderate adverse	Compensation for the provincial forest department for replantation of trees in the same areas (at higher elevations, at a ratio of 10 new trees per each tree cut), and afforestation of degraded forest lands (in an area equal to the land affected by the project activities). Plantation of trees in the colony and around the reservoir area	Minimal adverse

The impact of various activities	Sensitivity	Magnitude	Significance Prior to Mitigation	Key Mitigation and Enhancement Measure	Residual Significance
				Supporting the provincial wildlife department for wildlife conservation in the project area and the Bhan game reserve. Detailed monitoring of impacts on flora and fauna during construction	
3. Inundation of 500 m existing road on the left bank and submergence of a footbridge and PVC water pipes	Very high	Major	Critical adverse	Realignment and construction of a 1.4 km new road at a higher elevation and relocation of a footbridge and the utilities Provision of water supply to the communities through tankers during the relocation of PVC water pipes	Minimal adverse
4. Greenhouse gases emissions from the proposed land clearing, construction, material life cycle, and power generation and transmission (0.24 million tons of emissions over the lifetime of the project)	Medium	Minor	Minimal adverse	Net greenhouse gases emissions are minus 7.12 million tons when compared to other feasible options for power generation and transmission	Moderate beneficial
Social impacts due to Project siting					
5. Acquisition of 157.44acres (1259 kanals) of land permanently from 87 households	Very high	Major	Critical adverse	Adequate compensation for affected households as per the entitlement matrix in the RAP. Implementation of income and livelihood restoration plan Implementation of a social development plan.	Minimal adverse
6. Impact on 11 acres of land due to construction for 2.75 km long transmission line (12 towers)	Medium	Moderate	Moderate adverse	Adequate compensation for affected households as per the entitlement matrix in the RAP One time compensation for the land under towers	Minimal adverse
7. Loss of livelihood due to the acquisition of 26 acres of agricultural land from 44 households	Very high	Major	Critical adverse	Adequate compensation as per RAP Implementation of income and livelihood restoration plan. Implementation of social development plan.	Minimal adverse
8. Relocation of 8 households	Very high	Moderate	Major adverse	Adequate compensation for affected households as per the entitlement matrix in the RAP	Minimal adverse
Environmental impacts and risks during construction					
9. Generation of about 0.8 to 1	Medium	Moderate	Moderate	Transport and disposal of spoils and designated muck disposal	Major

The impact of various activities	Sensitivity	Magnitude	Significance Prior to Mitigation	Key Mitigation and Enhancement Measure	Residual Significance
million cubic meters of spoils/muck (excess excavation) and their disposal			adverse	sites identified and approved for land reclamation Proper dumping and adequate compaction to avoid dust and release back to the river Handing over the reclaimed sites to the landowners Landscaping of the areas after completion of works	beneficial
10. Generation of construction waste including hazardous waste	High	Moderate	Major adverse	Containers of adequate size and numbers in place for collection of various types of wastes (metal, rubbers, used fuels, batteries, etc.) Procurement of services of a waste management contractor for transport and treatment of recyclable and hazardous waste	Minimal adverse
11. Generation of solid waste from campsites and offices (about 100 kg per day).	Very High	Moderate	Major adverse	Implementation of the waste management plan Segregation of solid waste into kitchen waste (organics), paper and plastic (recyclable) and garbage (non-recyclable). Placement of containers with adequate size and numbers. Organic waste will be treated through in-vessel composters Recyclable waste will be compressed through bailers and use services of the waste management contractor Disposal of the garbage at the designated disposal site	Minimal adverse
12. Wastewater discharges from the construction camps, sites, and batching plants	Medium	Moderate	Moderate adverse	Construction of wastewater treatment facilities at the campsite (e.g., septic tank and soak pit) and at the worksites (sedimentation tanks for batching plants and discharges from tunnels; and site drainage) Monitoring of wastewater quality to ensure compliance with NEQS	Minimal adverse
13. The potential risk of soil and water pollution by construction works	Medium	Moderate	Moderate adverse	Storage of fuels and chemical in contained facilities Availability of spill kits and trained personnel for immediate cleanup of any oil spills	Minimal adverse
14. Air and noise pollution from	Moderate	Medium	Moderate	Air and noise pollution control measures at the worksites and	Minimal

The impact of various activities	Sensitivity	Magnitude	Significance Prior to Mitigation	Key Mitigation and Enhancement Measure	Residual Significance
construction and traffic			adverse	regular monitoring of ambient and noise quality to ensure compliance with NEQS Compliance with NEQS on vehicle and machinery emissions	adverse
15. Sourcing of aggregates (about 0.59 million cubic meters) for concrete works	Medium	Moderate	Moderate adverse	Reuse of excavated material to the extent feasible Use of licensed quarry sites Source the material from the boulders from the eroded riverbanks in the proposed reservoir area (which are found to be suitable for aggregates).	Minimal
16. Impact on river habitat due to construction activities and drying of river section (about 590 m) between two cofferdams (for two years)	Medium	Moderate	Moderate adverse	Control of wastewater and sediment releases to the river Monitoring and relocation of trapped fish into the downstream waters	Minimal
17. Impacts from increased human activities on flora and fauna, including Bhan Community Game Reserve	High	Minimal	Minimal adverse	Limit the siting of any temporary facilities within the boundaries of the worksites. Use of non-wood fuel for cooking and heating Code of conduct for workers and employee's protection of flora and fauna and a ban on tree cutting and hunting. Any violation to code of conduct leads to strict punishment including termination of employment Awareness-raising to workers on the Bhan game reserve	Minimal adverse
Occupational Health and Safety Risks					
18. Occupational health and safety risks on workers due to hazards associated with the construction activities (instream, underground tunnels, mountain slopes, blasting and drilling, working on heights and trenches, cold weather, etc.)	High	Moderate	Moderate adverse	Development and implement occupational health and safety plan Regular site inspections and safety audits (OSHA) Regular training program for workers on occupational health safety (monthly training and daily toolbox talks) Incident investigation and reporting Conduct a 'job hazard analysis' at the new construction site to identify potential hazards and implement necessary control measures. Use of relevant personal protection equipment at all times	Minimal adverse

The impact of various activities	Sensitivity	Magnitude	Significance Prior to Mitigation	Key Mitigation and Enhancement Measure	Residual Significance
				Availability of firefighting, fully equipped ambulance, first-aid and rescue facilities at the site Adequate water supply and mobile toilets at the worksites	
19. Potential health risks due to inadequate facilities in the campsites (about 200 non-locals, including about 60 foreign workers live in construction camps)	High	Moderate	Moderate adverse	A construction camp will be built with all adequate facilities (safe drinking water and sanitation, kitchen, rest areas, recreation) for labor. Cleaning of the campsite on a daily basis. A medical clinic, with a medical doctor and attendants and preliminary staff, will be established at the camp The Contractor shall establish a mechanism to collect the complaints from the workers and address those complaints by the approved GRM plan	Minimal adverse
20. Employment generation for the local community	Very high	Moderate	Major beneficial	The hiring of the local community during construction works (about 300 workers on average regularly and about 500 during peak construction for five years) Implement a labor management plan Formal contracts to be signed with labor.	Major beneficial
21. Risk of child labor	Low	Moderate	Minimal adverse	No hiring of workers less than 18 years of age	Minimal adverse
Social Impacts and risks during construction					
22. Safety hazards due to increased traffic on local roads especially for children and elderly people	High	Moderate	Major adverse	Implement a traffic management plan (e.g., avoiding school hours, following sped limits, hiring licensed drivers, etc.) including awareness-raising and safety measures	Minimal adverse
23. Community exposure to work hazards	Very high	Moderate	Major adverse	Barricade the work areas (near the settlements) with hard fencing to prevent the entry of community in the construction areas. Placing adequate signboards and flagmen to divert the community away from the construction works. Community awareness programs on construction-related hazards, including awareness programs in schools	Minimal adverse

The impact of various activities	Sensitivity	Magnitude	Significance Prior to Mitigation	Key Mitigation and Enhancement Measure	Residual Significance
24. Dust from vehicular movement (20 to 30 trucks per day) on local roads and construction equipment	Very high	Moderate	Major adverse	Frequent sprinkling as per weather requirements of water on the local roads and worksites to control dust emissions Dust control measures at the worksites	Minimal adverse
25. Risk of damage to houses by blasting activities (through fly rock and vibration)	Moderate	Medium	Moderate adverse	Use of controlled blasting and placement of sandbags on the drill holes to prevent fly rock Minimum use of explosive blast instead of one single blast Adequate compensation for any affected structures	Minimal adverse
26. Impacts from labour influx and potential cultural conflicts between communities and workers	High	Moderate	Moderate adverse	The contractor's code of conduct shall cover a program to promote awareness to the construction workers on respecting the local community. Construction camps will be built in the designated areas, located away from the local settlements The Contractor's monthly training program will cover topics related to respectful attitude while interacting with the local community	Minimal adverse
27. Risk of gender-based violence (GBV), sexual exploitation and abuse (SEA), and sexual harassment (SH)	High	Minimal	Minimal adverse	The contractor's code of conduct shall cover clauses related to avoiding gender-based violence, sexual exploitation and abuse, and sexual harassment. The code of conduct will be translated into Urdu and disseminated. The code of conduct will be included in the worker's contract agreement, and any violation of the code of conduct will lead to termination of employment. The contractor's code of conduct shall cover a program to promote awareness to the construction workers on avoiding GBV, SEA, SH and the risk of spreading sexually transmitted diseases The Contractor's monthly training program will cover topics related to Code of Conduct such as sexual harassment particularly towards women and children, violence, including sexual and/or gender-based violence. The awareness activities will cover posting of CoC standards in public spaces in Urdu language; trainings and	Minimal adverse

The impact of various activities	Sensitivity	Magnitude	Significance Prior to Mitigation	Key Mitigation and Enhancement Measure	Residual Significance
				sensitization sessions, providing information on GRM, awareness on suspicious situations and signs of GBV and other related aspects. Measures to protect the privacy of women and girls by the contractor, sub-contractors and service providers	
Environmental and Social impacts during Operational stage					
1. Barrier effect on fish migration	High	Minimal	Minimal adverse	A fish ladder has already built into the design of the weir Sensors will be placed on the ladder and monitored to count the fish and to assess the effectiveness of the ladder	Minimal adverse
2. Reduced water flow between the weir and the tailrace during low flow season	Very High	Major	Critical adverse	Environmental flow requirements are assessed based on the requirements of snow carps. During extreme low flow season (December to February), when fish don't migrate and live in pools, an environmental flow of 2 m^3/s will be released. During the fish migration season (March/April and September/October) and other seasons, an environmental flow of 2.5 to 3.5 m^3/s will be released. Downstream monitoring and adjustment of flows if required	Minimal adverse
3. Risk of bird collision and electrocution from the transmission line	Medium	Minor	Minimal adverse	Insulation of exposed parts of the tower structure	Minimal adverse
4. Reduction of sediment load in the downstream water flows from the reservoir	Medium	Minor	Minimal adverse	Release of environmental flows and excess flows through sluices to release the sediments in the high flow season Regular flushing of sand traps during high flow season	Minimal adverse
5. Workers health and safety during routine operation and maintenance	High	Moderate	Moderate adverse	Implementation of OHS plan	Minimal adverse
6. Waste generation from the plant and staff colony	High	Moderate	Moderate adverse	Implement a waste management plan	Minimal adverse
7. Community health and safety	Very high	Minor	Moderate adverse	Complied with World Bank recognized standards on EMF through design considerations. Review of dam designs by an independent panel of experts	Minimal adverse
8. Improved livelihood opportunities	High	Moderate	Major	PEDO will provide preference to affected persons in	Minimal

The impact of various activities	Sensitivity	Magnitude	Significance Prior to Mitigation	Key Mitigation and Enhancement Measure	Residual Significance
from the development of tourist attractions and waste generation at tourist sites.			beneficial	establishing small businesses in designated tourist areas established at the project sites to improve their livelihood. PEDO establish and maintain waste and sanitation facilities at the tourist facilities at the project sites	adverse

7.4 Environmental Issues Mainstreamed in the Project Design

Environmental and social aspects have been considered in the planning and design of the Project facilities. These include:

- The weir height and potential power generation from the project are optimized to avoid the inundation of upstream Kanai and Utror villages.
- Construction of embankment (flood protection wall) on the left bank at the weir site has reduced the land acquisition by 17 acres (that could be submerged under reservoir).
- Muck disposal sites are selected in the areas that were eroded by the 2010 flood (before the flood, they were under agricultural use) and these sites will be reclaimed and can be used for agricultural purposes
- A fish ladder is designed based on the requirements of snow carps and included in the weir
- The project will be operated as a 'true run-of-river' for baseload power generation without any peaking operation
- Tourist-attraction facilities are in-built in the project design (hiking ways, deflected spillway, and parks)

7.5 Impacts from Project Siting

7.5.1 Environmental Impacts from project siting

7.5.1.1 Low Carbon Power generation and Economic Improvement in the Region

The Project would supply about 339 GWh of electric power annually to the national grid. This additional electric power supply would address the current energy crisis in the country by eliminating the load shedding and power cuts and would lead to economic growth and increased employment. The Project generates clean energy enough to power the equivalent of about 116,000 homes per year in the country[25]. The estimated greenhouse gases from the Project are minus 7.12 million tons.

7.5.1.2 Loss of Forest Vegetation

The proposed project facilities are located mainly within the river corridor; however some facilities on the right bank near the weir site for connecting channel, sand trap and tunnel inlet (13.86 acres) and powerhouse site (for powerhouse, surge shaft, access tunnel portal, access road from powerhouse to surge shaft) (48.5 acres) require cutting of some forest vegetation. It has been counted that about 636 wood trees would need to be cleared. The two forest patches affected by Project do not constitute natural habitats as they already under anthropogenic use for development settlements and grazing of their animals. All the affected trees are Cedar deodara (IUCN Status: Least Concern), which is a common and popular wood tree used for construction. In addition, the Project will also require cutting of 10 eucalyptus and 19 fruit trees (15 apples, 2 apricots, 1 peach, and 1 walnut) from the private properties.

Koklass pheasant (*Pucrasia macrolopha*; IUCN Status: Least Concern) is reported in the forests near the powerhouse site. This pheasant has a wide range of habitat and usually lives away from human settlements, and the proposed clearing of the forest will not have any impact since there are ample alternate and adjacent habitats to accommodate these pheasants. The only important species from the

[25] The estimates are based on current per capita energy consumption 450 kwh per year, and the average household size in Pakistan (6.45 persons per household).

conservation point of view, known to occur near the project sites, is the Asiatic Black Bear (IUCN Category: Vulnerable). The major activities under the proposed project that could affect the mammals are the construction works. However, the proposed construction activities will not affect the Black Bear population as the animal prefers to live in higher habitats away from human settlements. As the Bear is persecuted by humans due to damages to poultry, this animal avoids such a situation and keeps itself away from human settlements. Therefore, the project activities will not have any impact on the vastly distributed population of Black Bear around the project site. The project will not have any impact on the Bhan Valley Community Game Reserve since no project activities will be carried out in this valley, and the animal habitats are located about 15 to 20 km away deep inside the valley on the mountain tops. Hence, the significance of the vegetation clearance has been estimated as moderate.

Mitigation

PEDO will implement the following compensation and enhancement measures:

- The loss of natural vegetation from forests will be compensated through cash compensation to the Forest Department for the loss of trees and replantation of trees (a mandatory requirement of planting 10 new trees of indigenous species per each tree cut); and also support the forest department for afforestation of about 60 acres degraded forest land (in an area equal to the land affected by the project activities) in the similar ecological terrain.
- The project will also support the Wildlife Department in its efforts to promote wildlife conservation measures in the project area, including conservation measures in the Bhan Game Reserve.
- A budget of USD 600,000 has been allocated in the project budget for the above measures. Details of activities to be implemented under this budget will be worked out during the project implementation by the ESU staff of the PEDO in consultation with the forest and wildlife departments, and the final list of activities will be shared with the World Bank prior to their implementation.
- A tree plantation program will also be carried out in the proposed colony site.

With the above compensation and enhancement measures, the residual impacts of vegetation clearance have been assessed as minimal.

7.5.1.3 Formation of reservoir

The GKH reservoir would cover about 50 acres of the area (875 m long and 200-300 m width), which includes permanent flooding of about 18 acres of adjacent lands. Most of the lands to be submerged are covered with lands eroded by riverine floods and filled with boulders. About 300 m long local road on the left bank (from Kalam to Gabral) will be submerged under the reservoir and another 100 m long existing road will be affected by the footprints of the weir. A footbridge will be submerged in the proposed reservoir. The bridge was built by the local community and about 15 families are using this footbridge for collecting wood and access the grazing areas along with their livestock. A few PVC water pipes are also located on the riverbed of the proposed submergence area that are used to carry spring water from the right bank to the left bank for drinking purposes of a few households in Kanai village.

Mitigation

PEDO will implement the following mitigation measures:

- A new road of 1.4 km will be built to reroute the existing road adjacent to the weir and reservoir area

- The road built on the weir will be used for access to the right bank. The communities agreed to use the access road to be constructed over the weir, which will be ready before this bridge is submerged in the reservoir
- Relocate the affected PVC water pipes and re-instate the affected water supply facilities. The Contractor will manage to provide clean water to the affected households during the relocation of PVC water pipes through tankers at the accessible location to all affected communities, being within 30 minutes total round trip travel time as per United Nations definition of access to water.

With the above mitigation measures, the residual impacts of reservoir formation have been assessed as minimal.

7.5.2 Social Impacts from Project siting

7.5.2.1 Land acquisition and Resettlement

The development of project facilities will require the permanent acquisition of 157.44 acres/63.716 hectares (1259.57 kanals) of land, including 25.3 acres of agricultural land, 10 wood trees, 19 fruit trees, and 8 residential structures. The total households affected (AHs) by the permanent acquisition of land are 89 and the total affected people (APs) in these households are 743. Besides, the project will temporarily acquire 42.6 acres (347.58 kanals) of land, including 16 acres (37.89 kanals) of agricultural land, and the households affected by this acquisition are 82 and total affected population is 664. The proposed construction of a 2.75 km-long transmission line will also require the temporary land acquisition of 20 acres/8.1 hectare (160 kanals) for construction of 12 towers and right-of-way (30m). The total project-affected households are 171. The land acquisition will have a significant impact on the landowners and their livelihoods. A summary of the proposed impacts on land acquisition is given in **Table 7.5**.

Table 7.5: Summary of Resettlement Impacts

Sr. No.	Category of Impacts	Affected Land		AHs (Nos.)	APs (Nos.)	Remarks
		(Kanals)	(Hectares)			
A. Permanent Land Acquisition						
i)	Cultivated/Arable land	206.63	10.453	44	366	Permanent land acquisition
ii)	Barren (Un-cultivated land)	927.223	46.904	42	349	
iii)	Hilly (Un-cultivated land)	57.38	2.902	1	6	
v)	Cultivated/Arable land having residential structures	2.217	0.112	8	22	
vi)	Riverbed	66.11	3.344			
	Total	1,259.57	63.715	89	743	
Temporary Land Acquisition						
i)	Cultivated/Arable land	37.894	1.917	6	64	Land on a lease, which will be restored and returned to the landowners in its original condition.
ii)	Barren (non-cultivated land)	282.685	14.299	76	600	
iii)	Hilly (non-cultivated land)	-	-	-		
iv)	Residential land	-	-	-		
v)	Riverbed	21	1.062	-		
	Total	341.579	17.278	82	664	

Affected Cropped Area						
i)	Permanent impact	206.640	10.453	44	366	Affected cropped area
ii)	Temporary impact	126.852	6.411	16	64	Affected cropped area
	Total	333.492	16.864	60	-	
Affected Structures						
i)	Residential structures (Nos.)	8	-	8	22	Loss of residential structures
Affected Trees (Private)						
i)	Affected wood/ timber trees (Nos.)	10	-	4	32	
ii)	Affected fruit trees (Nos.)	19	-	4	32	

Mitigation

A Resettlement Action Plan (RAP) has been prepared to address and mitigate the impacts on the affected households. The objective of the plan is to improve or at least restore the income and livelihood conditions of the people to at least the pre-project level. The households affected will not only receive cash compensation for land and other assets at prevailing rates for full replacement cost but also additional assistance will be given for relocation and livelihood restoration. The RAP also includes programs to improve the general quality of life of people in the project area through a Social Development Plan involving social, community, health, and educational infrastructure development activities with a budget of USD 5 million. Overall, the RAP presents (a) socio-economic profile of the affected settlements; (b) type and extent of loss of assets; including land, structures, and trees; (c) principles and legal framework applicable for mitigation of these losses; (d) the entitlement matrix; (e) income and livelihood restoration program; (f) relocation and resettlement budget; (g) institutional framework for the implementation of the plan, including monitoring and evaluation. The total cost of resettlement, including implementation, is estimated at USD 25.173 million.

7.5.2.2 Livelihood impacts

The land acquisition will have an impact on the livelihood of the affected households, especially on 44 households who lose their agricultural land permanently (25.83 acres or 206.64 kanals) and on 19 households who lose their agricultural lands temporarily (15.857 acres or 126.85 kanals). In the project area, the suitable agricultural lands are available mainly along the river banks, and hence the loss of agricultural land will also affect their livelihoods. In total, 49 households (out of total 171 households) will have significant impact due to loss of residential structures (8 households), loss of more than 10% of their land-based income (33 households), loss of both productive land and house (one household), and tenants who lose more than 10 percent of their income (8 households). These vulnerable households also include households that fall below the poverty line[26].

Mitigation

- Compensation will be paid to the affected households for lost land, crops and fruit trees in accordance with RAP. Additional cash compensation will be paid to vulnerable households.
- Livelihood restoration measures will also be implemented in accordance with the RAP
- Provision of temporary employment in the construction works

With the above mitigation measures, the residual impacts on livelihood have been assessed as minimal.

[26] The income at the poverty line is Rs. 25,475/ month per household

7.5.2.3 Relocation of Eight Households

Eight (8) residential structures consisting of 68 sub-structures (i.e., living rooms, kitchens, animal sheds, washrooms, etc.) will be affected due to the construction of the powerhouse and associated components. These structures owned by eight households located in Chirat, Sher Kalay, and Rashnail. All of these households have built structures on their own lands. This will cause physical relocation of these eight (8) households.

Mitigation

Compensation will be paid to affected households in accordance with the RAP. It was confirmed that all of these households have a nearby place to relocate their structures after getting compensation for land and structures as per the entitlement matrix.

7.6 Environmental Impacts and Risks during Construction

7.6.1 Generation of spoils

Excavations for weir, sand trap, tunnels, powerhouse, and switchyard facilities generate huge quantities of excavated rock. It is estimated that the quantity of rock to be excavated will be 0.8 to 1.0 million m^3. Part of the excavated rock can be used as aggregate provided the fragmented rock meets the quality standards needed for the work. Disposal of remaining spoils requires designated land; otherwise, improper disposal of spoils will have an impact on the river environment.

Mitigation

The contractor will implement the following mitigation measures:

- Minimize the generation of spoils by recycling the excavated rock to the maximum extent possible by using them as the aggregate material in the concrete works, and filling of embankments and road works
- Transport and disposal of spoils and designated muck disposal sites
- Proper dumping and adequate compaction of soil/muck to avoid dust and release back to the river
- Some disposal sites have been identified on the eroded riverbanks, which were originally agricultural lands. These lands can be reclaimed through the placement of spoils and providing soil layer at the top. These sites will be handed over to the landowners. During consultations, local communities have also offered to use their lands for disposal of spoils, if additional land is required.
- Landscaping of the spoil sites, that were in the permanently acquired lands, after completion of works

With the above mitigation measures, the residual impacts have been assessed as minimal.

7.6.2 Generation of Construction and Hazardous Waste

The construction works generate large quantities of excess materials from construction sites (concrete, discarded material, etc.) and wastes from field camps and construction yards, including other debris. In addition, small quantities of hazardous waste will also be generated mainly from the vehicle maintenance activities (liquid fuels; lubricants, hydraulic oils; chemicals, such as anti-freeze; contaminated soil; spillage control materials used to absorb oil and chemical spillages; machine/engine filter cartridges; oily rags, spent filters, contaminated soil, etc.). It is imperative that such waste is responsibly disposed to avoid adverse environmental and human health impacts.

Mitigation

The following mitigation measures will be implemented:

- Guidelines for the management of wastes, including solid and hazardous wastes, are given in ECPs (See ECP1 on Waste Management and ECP 2 on Fuels and Hazardous Substances Management in **Annex 1** for detailed mitigation measures). Before commencing the construction activities, the contractor will be required to prepare a Waste Management Plan and submit it to the PMO for their review and approval.
- The contractor will place containers of adequate size and numbers in place for the collection of various types of wastes (metal, rubbers, used fuels, batteries, etc.) from the worksites, and transport these wastes regularly to a centralized facility.
- The contractor will procure the services of a waste management contractor for transport and treatment of hazardous waste, and management of recyclable waste.
- For disposal of inorganic construction waste, the contractor will develop a waste disposal site or place them in the spoil disposal areas.

With the above mitigation measures, the residual impacts have been assessed as minimal.

7.6.3 Generation of Solid Waste

Solid waste will be generated from the construction camps and offices, which include food waste, paper and plastic, and garbage. About 200 workers live in the construction camp and the average solid waste generation per worker is 0.5kg per day. Thus, the total quantity of waste generated from the camps will be 100 kg per day. Most of these wastes will be food waste. There are no municipal waste disposal sites in the project area. If these wastes are not properly managed, they may harm the environment and health of workers and nearby communities.

Mitigation

The following mitigation measures will be implemented by the contractor:

- Before commencing the construction activities, the contractor will be required to prepare a Waste Management Plan and submit it to the PMO for their review and approval.
- Collection and segregation of solid waste into kitchen waste (organics), paper and plastic (recyclable) and garbage (non-recyclable). Three kinds of waste bins (with different colours) with adequate numbers and capacities will be placed at the campsite (kitchen, offices, rooms) for the segregation of the waste at source.
- Organic waste will be treated through in-vessel composters and the final compost will be given to the local communities to use in the agricultural lands.
- Procure the services of waste management contractors for the collection and management of recyclable waste. Recyclable waste will be compressed through bailers to minimize the volume of waste to be stored and transported.
- Develop a waste disposal site for disposal of garbage.

With the above mitigation measures, the residual impacts have been assessed as minimal.

7.6.4 Wastewater Discharges from Construction Sites

The wastewater discharges from the batching plants contain high sediment loads and high pH value. Although the groundwater is not encountered in the test boreholes drilled along the tunnel alignment, there is a possibility groundwater may ingress through joint planes and discontinuities, creating dripping and moist conditions in some stretches of the tunnel. The discharges from the tunnel may contain high

in suspended sediments and can have pH significantly different from receiving surface water bodies. These discharges will impact the aquatic environment if they are discharged without any prior treatment. The groundwater located within the river bed would be affected by the wastewater discharges. Other wastewater discharges from the construction sites include sanitary effluents from workers camp, and vehicle and machinery washing facilities.

Mitigation

The following mitigation measures will be implemented:

- Sedimentation ponds, of adequate size and capacity, will be built for the treatment of discharges from the batching plants and the tunnels to allow the sediments to settle. Final discharges from the sedimentation ponds shall comply with NEQS for wastewater discharges into the rivers. Frequently monitor the pH values and If the pH values high, add online buffering solutions to settlement ponds for control of pH. The settled sediments will be periodically removed and will be disposed of at the designated spoil disposal sites.
- Construction of wastewater treatment facilities at the campsite (e.g., septic tank and soak pit) and site drainage)
- The contractor will be required to take appropriate measures to avoid and contain any spillage and pollution of the water
- Quarterly monitoring of wastewater quality to ensure compliance with NEQS

With the above mitigation measures, the residual impacts have been assessed as minimal.

7.6.5 Risk of Soil and water pollution from Construction Works

During construction, there is a high risk of accidental spills and leakages from fuel and oil tanks, vehicles, machinery and stored chemicals that are used in construction areas, yards, batching plants, worker camps, and storage sites. Earthworks for site preparation and foundation during rainy periods may carry the sediment load to the river. Other potential sources of soil and, surface water and groundwater pollution are improper storage and handling of materials, including hazardous materials, discharges from the construction sites and material storages, lack of proper drainage facilities, spillage of fuels, erosion from material stockpiles, etc.

Mitigation

The following mitigation measures will be carried out by the contractor to minimize soil and water pollution.

- Storage of fuels and chemicals in contained facilities and take appropriate measures to avoid and contain any spillage
- confine the contaminants immediately after such accidental spillage and cleanup of oil spills using spill kits.
- Collect contaminated soils, treat and dispose of them as a hazardous waste
- Topsoil from cultivated lands in the construction areas to be stripped and stockpiled where practical for later use for restoration of spoil disposal sites.
- Temporary stockpiles to be protected from erosion.
- Additional mitigation measures are given in ECP 3: Fuels and Hazardous Goods Management, ECP 3: Water Resources Management, ECP 5: Soil Quality Management, and ECP 7: Erosion and Sediment Control.

With the above mitigation measures, the residual impacts have been assessed as minimal.

7.6.6 Air and Noise Pollution from Construction

During construction, air and noise emissions from the construction activities will cause temporary nuisances to the residents of the nearby villages. The nearest residences are located about 900 from the weir site, where most of the construction works will be carried out. Major sources of air and noise pollution are drilling and blasting activities, excavations, emissions from construction-related traffic and equipment. The construction activities will also generate airborne dust and particulate matter. The dust raised from the above activities will have impacts on crops, animals and public health.

Mitigation

The following mitigation measures will be implemented;

- Construction equipment and vehicles will be well maintained so that emissions are minimal and comply with emission standards of NEQS.
- Crushing and batching and asphalt plants will be located a minimum 500 m away from residential areas and will have appropriate dust/emission suppression mechanisms such as wet scrubbers
- Dust generation from construction sites would be restricted as much as possible, and water sprinkling would be carried out throughout the construction period.
- Construction activities near the settlements will be limited to daytime only
- High noise-producing equipment will be provided with mufflers or acoustic enclosures.
- Blasting methods should be selected to minimize dust and fly rock emissions.
- Implement the additional mitigation measures provided in ECPs to address air and noise quality impacts (see ECPs 10 and 11 in **Annex 1** for air and noise quality management).
-
- A GRM will be put in place to receive complaints from the public on various aspects of environmental issues, including noise pollution. These grievances will be addressed by the contractor by adopting the necessary measures.
- Quarterly air and noise quality monitoring will be carried out in the project area to ensure compliance with NEQS on ambient air and noise quality.

With the above mitigation measures, the residual impacts have been assessed as minimal.

7.6.7 Impacts from Quarry and Borrow Activities

About 0.59 million m^3 of aggregates (0.29 million m^3 fine aggregates and 0.3 million m^3 coarse aggregates) will be required for construction activities. Improper siting and extraction of these construction materials will have significant impacts on the physical and biological environment on the quarry and borrow areas.

Mitigation Measures

The following mitigation measures will be implemented:

- The contractor shall use the designated quarry sites recommended by the PEDO or government-approved quarry sites for the procurement of aggregates.
- Reuse of excavated material from the construction sites to the extent feasible
- Source the material from the surface boulders from the eroded riverbanks in the proposed reservoir area (which are found to be suitable for aggregates).

- Although the material is widely available, the quarrying/mining activities will be limited to fewer areas to reduce the area of extent affected by quarrying activities. If any mining activities are to be carried outside the project area, they should be not be located in any sensitive areas.
- Maintain setbacks (which could include placement of berms) between sediment extraction areas and the low flow channels in order to reduce the low flow season impacts. These would include that excavations are set back at least 5 m from the main low flow channel and minimizing the activities that release fine sediment to the river.
- Maintain a buffer zone of 5 to 10m between the low flow channel and the mining operations to minimise the downstream impacts and limit the excavation activities to the low flow season.
- In addition, Implement the generic measures and best practices on quarry areas development and operation that are given in ECP 9 (**Annex 1**) and World Bank Group EHS Guidelines for Construction Materials Extraction

With the above mitigation measures, the residual impacts have been assessed as minimal.

7.6.8 Impact on River Habitat due to Instream Construction Activities

At the weir site, cofferdams will be placed on upstream and downstream of the work areas to keep the riverbed dry for about 590 m length (for about two years) to facilitate the construction of the weir. Aquatic biological production will be eliminated from approximately 590 m of stream length, part of which (the weir footprint) will be removed for the life of the weir. Pre-construction and construction activities have the potential to adversely affect aquatic biota by the release of high concentrations of sediment during the construction of cofferdams, use of explosives and accidental spillage of fuels. Sediment concentrations above natural levels can cause mortality of biota directly; for fish, damaged gills and sediment clogging of gill chambers eventually lead to death. A surface channel will be built to divert the river water from upstream of the cofferdam to downstream of the cofferdam, and hence no impacts on fish movement are anticipated.

Mitigation

The following mitigation measures will be implemented:

- The open diversion channel shall be inspected regularly to ensure the safe passage of fish.
- If any fish is stranded in the dry river bed, it shall be relocated to the downstream
- Control of wastewater and sediment releases to river particularly in the section between cofferdams
- Prevent the release of silt, sediment, sediment-laden water, raw concrete, concrete leachate, or any other deleterious substances into the River.
- Ensure equipment and machinery are in good operating condition (power washed), free of leaks, excess oil and lubricants, and grease.
- Machinery leaking fuel, lubricants, hydraulic fluids, or solvents shall not work within the river.
- Keep a spill containment kit readily accessible onsite in the event of a release of a deleterious substance to the environment. Train onsite staff in its use.
- Regular monitoring of the aquatic habitat and fish species during the construction activities

With the above mitigation measures, the residual impacts have been assessed as minimal.

7.6.9 Impact on Flora and Fauna

Wildlife, including mammals, reptiles, and birds, are likely to be affected by construction through disturbance (presence of people, artificial lighting and noise), injury, or death owing to construction

works (including trapping in deep excavations) and increased traffic. The significance of the impact has been assessed as Medium. Project construction activities will have no impact on the Bhan Game Reserve.

Mitigation

The following mitigation measures will be implemented:

- The contractor's code of conduct for workers will include conditions on the protection of flora and fauna and ban on cutting of trees and ban on hunting and poaching of wildlife. Employees found violating would be subject to strict actions including fines and termination of employment.
- Awareness-raising to workers on the protection of flora and fauna, including the awareness on the conservation value of the Bhan Valley Community Game Reserve
- The dense vegetation will only be cleared once it has been established that any individuals present have fled. Before and during vegetation clearance or tree felling, any animals found will be removed and released to a safe place. There should be no burning of natural vegetation. The borrow animals, if found during excavation, shall also be transported to a safe place.
- Use of non-wood fuel for cooking and heating
- Artificial lighting used on construction sites and camps at night will be shaded and directed downwards to avoid light spillage and disturbance to nocturnal birds, bats, and other wildlife.
- No organic waste will be disposed of in the open places
- PEDO will commission a study for the additional baseline data collection on flora and fauna and regular monitoring of the construction impacts on flora and fauna.

With the above mitigation measures, the residual impacts have been assessed as minimal.

7.7 Occupational Health and Safety Risks during Construction

7.7.1 Occupational Safety Risks in Construction

Some of the Occupational Health and Safety risks which are likely to arise during the construction phase are typical to many large construction sites, which include: exposure to physical hazards from use of heavy equipment including cranes; working at height and electrical equipment; trip and fall hazards; exposure to dust, noise and vibrations; falling objects; exposure to hazardous materials; and exposure to electrical hazards from the use of tools and machinery. Key construction activities with potential OHS hazards in the project are working in the river, underground tunnels, and on mountain slopes. The major risks associated with instream construction and work on slopes include the risk of drowning in the river and the risk of fall from slopes. The major risks associated with tunneling works are depletion of oxygen from poor ventilation and exposure to excessive heat and fumes, which can lead to acute or long-term health problems, the release of toxic gases, fumes and vapors, and release of dust and silica from drilling and blasting activities.

Mitigation

The following mitigation measures will be implemented:

- Each contractor will be required to prepare, obtain approval of, and implement an occupational health and safety (OHS) plan. These plans will be prepared in compliance with the World Bank Group's EHSGs, International Tunnel Association, ECPs in Annex 1, GoKP regulations on Factory Act 2013, Industrial Relations Act 2013, and Workers Compensation Act 2013. If these guidelines cannot address any specific aspect of OHS, international good practices such as OSHA and ILO

will be applied. OHS Plan should contain general guidance for all identified hazards under each work activities, and site-specific OHS hazard and risks during construction, and control and preventive Measures proposed by the Contractor. The Plan shall be reviewed and updated if there any changes in the construction methodologies.

- OHS Plan should contain general guidance for all identified hazards under each work activities and they should be presented in three discrete headings, (a) Contractor's Standards on the identified hazard management, (b) Expected Site-specific OHS hazard and risks during construction, and (c) Control and Preventive Measures proposed by the Contractor.
- The OHS plan will be reviewed and approved the Construction Supervision Consultant and the World Bank
- Conduct a 'job hazard analysis' at the new construction site to identify potential hazards that may arise from the proposed works or working conditions to the project workers and implement necessary control measures. The job hazard analysis should be part of the contractor's method statements, which will be reviewed and approved by the OHS Specialists of the supervision consultants. The specialists will also visit the construction sites, prior to the start of construction, to ensure the control measures are in place.
- Regular site inspections and safety audits by the construction supervision team, both by the OHS specialists and the site engineers. Since the site engineers will present at the worksites all the time, they will be trained by their OHS team on monitoring safety aspects of the construction works.
- Regular training program for workers on occupational health safety (monthly training and daily toolbox talks). Special attention will be focused on safety training for workers to prevent and restrict accidents and on the knowledge of how to deal with emergencies.
- Incident investigation and reporting, including a complete record of accidents and near misses, will be maintained.
- In order to protect all project personnel and visitors, the Contractor will provide personal protective equipment (PPE) for workers, such as safety boots, helmets, masks, gloves, body harness, protective clothing, goggles, fully face eye shields and ear protection. The contractor will also provide training to workers on how to use them and maintain in a sanitary and reliable condition and replace the damaged ones immediately with the new one.
- Availability of firefighting, ambulance, medical and rescue facilities at the site for implementation of an emergency response plan
- Adequate water supply and mobile toilets, medical and first aid care facilities at the worksites
- Contractors will have dedicated and qualified staff for ensuring compliance with the OHS Plan
- Awareness-raising material will be used including posters, signage, booklets, and others at the worksites
- A complete record of accidents and near misses will be maintained.
- First aid facilities will be made available at the worksites and in the camps. The contractors will engage qualified first aider(s).
- Implement the mitigation measures and emergency response plans given in ECP 18: Worker Health and Safety, ECP 19: Tunneling and Underground Construction Works, and ECP 20: Instream Construction Works.

With the above mitigation measures, the residual impacts have been assessed as minimal.

7.7.2 Occupational Health Risks in Construction

Potential health issues on workers are associated with the use of temporary accommodation sites include those relating to sanitation, disease, fire, cultural alienation, sleeping space, quality and quantity of food, personal safety and security, temperature control and recreation, amongst others.

Mitigation

The following mitigation measures will be implemented:

- The contractor will develop and implement a camp management plan
- The construction camp will be built with all adequate facilities (safe drinking water and sanitation, kitchen, rest areas, etc.) including entertainment facilities so that there will be minimal interaction between them and local communities
- A medical clinic, with a medical doctor and attendants, will be established at the campsite. Regular health checkups of the workers will be carried out.
- The Contractor shall establish a mechanism to collect the complaints from the workers and address those complaints by the approved GRM plan

With the above mitigation measures, the residual impacts have been assessed as minimal.

7.8 Social Impacts and Risks during Construction

7.8.1 Safety Hazards due to Increased Traffic

The construction activities can potentially impact the residents of settlements along Kalam-Gabral Road, particularly the movement and safety of school children at Ashuran. About 20 to 30 construction vehicles travel on this road on a daily basis for the transport of material such as steel and cement. Due to increased use of trucks and other vehicles on the narrow roads in the project area, pedestrians, particularly elderly people and children will be more exposed to dangerous situations, which may lead to traffic accidents.

Mitigation

- The contractor will develop and implement a traffic management plan with adequate measures such as avoiding school hours, following speed limits, hiring licensed drivers, etc.). The plan will be implemented with the aim of ensuring access to residential areas and preventing unsafe situations, especially near schools, housing areas, construction areas
- Road signage will be fixed at appropriate locations to reduce safety hazards associated with project-related vehicular traffic.
- Liaison with traffic police will be maintained
- Project drivers will be trained in defensive driving.
- Ensure that all construction vehicles observe speed limits on the construction sites and on public roads
- Provide adequate signage, barriers, and flag persons for traffic control.

With the above mitigation measures, the residual impacts have been assessed as minimal.

7.8.2 Community Exposure to Work Hazards

Communities will be exposed to construction-related hazards due to excavation, heavy vehicular movements, and blasting activities. These risks will be more at the construction works located close to the existing road and settlement (near the proposed colony and access roads)

Mitigation

The following mitigation measures will be implemented:

- Barricade the work areas with hard fencing to prevent the entry of community in the construction areas.
- Placing of adequate signboards and flagmen to divert the community away from the construction works.
- Implementation of traffic management plan near the blasting sites
- Community awareness programs on construction-related hazards, including awareness programs in schools Construction activities such as blasting and excavation, particularly at the borrow areas, may pose safety risks to the nearby population.
- Ambulance and first aid medical facilities will be made available at the worksite.

With the above mitigation measures, the residual impacts have been assessed as minimal.

7.8.3 Dust from Local Roads and Construction Activities

The construction activities, particularly earthworks and blasting activities, will generate airborne dust and particulate matter. In addition, vehicular movement along the local gravel road will also generate a lot of road dust. The dust raised from the above activities will have impacts on crops, animals and public health. The generation of dust will be a major issue in the construction.

Mitigation

Following measures will be implemented

- Dust generation from construction sites will be restricted as much as possible and water sprinkling will be carried out as appropriate, especially at those places where earthmoving, excavation will be carried out.
- Frequent sprinkling of water on the local roads and worksites to control dust emissions. The contractor has to mobilise adequate water sprinkling trucks.
- A GRM will be put in place to receive and address complaints from the public on various aspects of environmental issues, including dust pollution.

With the above mitigation measures, the residual impacts have been assessed as minimal.

7.8.4 Risk of Damages from Blasting Activities

The construction of the Project has the potential to generate significant noise and vibrations from blasting and drilling activities. Vibration from blasting is a major source of concern if any structures and trees are located within close proximity to the blasting locations. The vibrations may cause damages to the structures and trees.

Mitigation

Following measures will be implemented

- Use of controlled blasting and placement of sandbags on the boreholes to prevent fly rock
- Adequate compensation for any affected structures. Prior to the start of the construction works, particularly near the blasting sites, all nearby residential structures will be photographed.
- A GRM will be put in place to receive complaints from the public on various aspects of environmental issues, including noise pollution. These grievances will be addressed by the

contractor by adopting the necessary pollution control measures. Continued consultations with the affected communities will be carried out during the construction phase.

With the above mitigation measures, the residual impacts have been assessed as minimal.

7.8.5 Employment Opportunities in Construction Activities

About 200 skilled and 300 unskilled workers will be required during construction on a continuous basis for about five years. During the peak construction period, the requirement of unskilled labour will be about 500 to 600. The project offers good opportunities for local residents to apply for employment as unskilled and skilled construction workers. The local communities during the stakeholder consultations have shown great interest to work in the construction activities. The contractor will be recommended to employ local workers and technicians to the extent possible. It is also a common practice in other hydropower projects in KP that the contractors hire local communities for all unskilled works. In addition to maintaining good relations with the local communities, maximizing local employment may also be cost-effective since engaging the workforce from other parts of the Country could be costlier. All these new opportunities for work for local residents could boost employment and improve the social and economic position of the population for a short time. This will be a major and significant positive impact of the project.

Mitigation

The contractors will be required to formulate a labour management policy to ensure equitable availability of employment opportunities to all communities within the project area, particularly the project affected persons.

The contractor will adopt the following Labor-Management Guidelines while preparing the labour management policy:

- encourage to engage local workers/laborers with the same terms and condition of outside workers/laborers;
- integrating provisions to redress labour related grievances in the Grievance Redress Mechanism (GRM) which should be well known to the laborers/workers and accessible;
- prohibition of child labor;
- no engagement of forced and bonded labor;
- provision of a safe and healthy working environment to workers; and
- taking steps to prevent accidents, injury, and disease and appropriate treatment for those suffering from occupational injuries/diseases; and encourage for insurance facility for workers.

7.8.6 Impacts from Labour Influx

For the proposed project activities, the average labour requirement per day is 500. Unskilled workers will be mainly hired locally; however, the skilled works will be brought by the contractor from other parts of Pakistan or abroad. It is estimated that about 200 migrant workers work in this project. labor influx may lead to negative impacts on the host community. Pre-existing social issues in the host community can easily be exacerbated by the influx of labor. The potential risks associated with labour influx are social tension arise between the local community and the construction workers, which may be related to differences due to competition for local resources, increase the rate of crimes and/or a perception of insecurity by the local community, increased burden on and competition for public service provision, and influx of people may bring communicable diseases to the project area, including sexually transmitted diseases (STDs), or the incoming workers may be exposed to diseases to which they have low resistance.

Mitigation

The following mitigation measures will be implemented:

- This situation will be addressed by an awareness campaign implemented at the beginning of the construction phase. The Contractors will be aware of the possibility and risks of miscommunications between local residents and workers, which easily could lead to conflicts. This will be prevented by raising awareness and implementing a Code of Conduct for the workers. The Contractor shall develop a Worker Code of Conduct to govern the behavior of workers on-site, in camps, and in local communities.
- The awareness campaign will also be aimed at the risk of interaction between the resident population and the construction workforce, including the spreading of sexually transmitted diseases such as HIV/AIDS.
- The contractor will prepare a labour influx management plan prior to construction works for approval of PEDO.
- The contractor's code of conduct shall cover the program to promote awareness to the construction workers on respecting the local community.
- Construction camps will be built in the designated areas, located away from the local settlements
- The contractor will ensure local water usage will not be affected by the project water usage by the project or compete with water requirements of the local community
- The Contractor's monthly training program will cover topics related to respectful attitude while interacting with the local community

With the above mitigation measures, the residual impacts have been assessed as minimal.

7.8.7 Risk of Gender-Based Violence

During consultations with the women on Gender-Based Violence (GBV)/Sexual Exploitation and Abuse (SEA)/Sexual Harassment (SH), the women reported that domestic violence is not common in the project area except for a few exceptional cases, but no one reports it as for them this is a not socially acceptable matter. No rape cases have been reported in the past years. Women visit relatives and family friends of their own tribe within or outside of their villages. Women also go out for shopping. However, as the markets are on an average of 4.5 km away from the villages, the women are accompanied by either an elderly woman or a male member of the family or a male child. Some women travel for up to 30 minutes, 3-4 times a day to collect water from nearby springs for drinking, cooking and cleaning and washing purposes. They also help the male members of their families in agriculture fields, which are generally next to their homes. However, women go in pairs and do not travel alone. Women always accompany the male members of the households to the hospitals located in Kalam town and Mingora city. Women rarely go out for the purchase of grocery items and grocery shopping is mostly done by the male members of the family. The girls of better-off and middle-income households are allowed to go out to get an education while in lower-income households they are not allowed to go out without a male member of the household accompanying them.

The interaction between the Project construction labor force and the communities is expected to be limited, particularly with women due to the conservative culture in the region. The current level of GBV/SEA risk is quite low in the Project, and the likelihood of GBV/SEA risk from the proposed project is also not expected significant due to the employment of local labour in construction works and a only skilled workers will be hired from outside. The risk assessment has been made based on the country and legal context, gender norms and beliefs, and national capacity to respond. In addition, several project-

specific factors including project location, type of infrastructure to be constructed, accessibility of women for consultations, poverty levels, accessibility for the supervision of project and others were also considered for determining the risk levels.

Proactive/Preventive Measures

Commensurate with this risk level and also to be proactive, the Project has proposed several proactive measures as below:

- Inclusion of clause on GBV/SEA/SH behavior obligations in the employment contracts of all employees and construction workers aimed at strengthening measures to address and prevent GBV/SEA/SH in the workplace and construction areas.
- Translation of code of conduct (CO) into Urdu and dissemination of the principles laid out in CoC and the consequences (warnings, penalties, termination and legal actions) of its breach to all employees and workers.
- Awareness training of PEDO, CSC, contractor, sub-contractor and service providers staff to sensitize them about GBV, SEA, and SH, and their responsibilities to prevent
- Posting of CoC standards in public spaces at contractor's work camps and living areas, and village information centers and public places of adjoining/neighboring communities in the Urdu language
- Raising awareness that GBV is prohibited
- Awareness to explain suspicious situations and the signs of GBV/SEA/SH;
- Provide information on the use of GRM to report cases of GBV/SEA/SH, Code of Conduct breaches and assist victims of SEA, if signs of SEA are identified/a victim approaches them to complain about SEA;
- Awareness to communities, particularly women, and male and female children to understand risks of SEA and SH and the roles and responsibilities of parties involved in project implementation on SEA and SH prevention, processes for reporting incidents of project-related SEA/SH, and the corresponding accountability structures.
- Strengthen the Contractors' obligations and capacity to public health and safety risks and ensure contractor supervision capacity to monitor the mitigation of these risks.
- Preparing code of conduct for PEDO, PMO, Contractors, Sub-contractors and service providers (such as security agencies, catering, transport, or any other services) on GBV/SEA prevention and by integrating these measures/clauses in bidding documents.
- Proactive GBV/SEA prevention measures will be put in place, such as GBV/SEA related training to sensitize workers and local population along the project implementation area and ensuring that GRM for the project will also take care of GBV related issues if any.
- There will be adequate mechanisms in place to protect the local vulnerable population, especially women and minors from risks associated with the influx of workers (harassment, underage sex). This mechanism will ensure the sensitization and enforcement of code-of-conduct by the Contractor employees and workers and all other parties that are involved in the project implementation.
- Additionally, the Contractor will employ their skilled staff and apply unskilled construction labor from the local population as far as possible to minimize an influx of outsiders into the communities.
- The PMO will ensure compliance with the GoKP Act and policy and WB requirements related to GBV/SEA.
- The third-party monitoring agency of the project will also cover the monitoring of GBV/SEA prevention measures.

- Measures for receiving, reviewing and acting as appropriate on GBV/SEA concerns at the project management level.
- Documentation and reporting of prevention and response in the progress reports of the project.

7.9 Environmental and Social impacts during Operational stage

7.9.1 Barrier Effect on Fish Migration

By constructing the weir in the Gabral River, a barrier in the river will be created, which will impair the ecological connectivity in the river, including the migration of snow carps. The snow carp production in the Gabral River within the project area is low, the main reasons being the introduction of brown trout. No other long-distance migratory fishes are present in the project that could be affected by the dam. There is also a risk that fish may pass through the tunnels and injured by the turbines.

Mitigation

The following mitigation and compensation measures will be implemented:

- A Fish ladder has already built into the design of the dam. The fish ladder is designed based on the requirements of snow carps and details of the fish ladder are given in Section 3.3.
- Water will be released continuously through the fish ladder at all times
- Sensors and underwater video cameras will be placed on the ladder and monitored to count the fish and to assess the effectiveness of the ladder
- Installation of trash rack at the intake to prevent the fish from entering water intakes and protect the fish against entrapment
- Regular removal of deposited sediments from the ladder
- Monitor the effectiveness of the fish ladder and take adaptive measures to improve the performance of the fish ladder
- Supporting the fisheries department for upgrading their snow carp hatchery at Nagoha Shamozai, and annually releasing the fish on both upstream and downstream of the weir
- A budget of USD 200,000 has been allocated in the project budget for the above measures. Details of activities to be implemented under this budget will be worked out during the project implementation by the ESU staff of the PEDO in consultation with the fisheries departments, and the final list of activities will be shared with the World Bank prior to their implementation

With the above mitigation measures, the residual impacts have been assessed as minimal.

7.9.2 Reduced Water Flow Between Weir and the Tailrace

The river-reach between the weir-axis to the tailrace discharge point (dewatered section) is about 5.75 km long (**Figure 7.2**). From last week of May to mid-August, when the average river flow is higher than 65 m3/s (the flow required to run all turbines), the excess water will be discharged through the under sluices/spillways thus maintaining about 47 m^3/s of flow in June, 56 m^3/s of flow in July and 20 m^3/s of flow in August in dewater section. However, from September to May, when the average flow is less than 65m^3/s, and during this period, if all water will be diverted to the powerhouse, there will be no release water to the downstream of the weir. A tributary Bhan Khwar river joins the Gabral in this reach (about 4.5 km downstream of the weir). The average discharges of Bhan Khwar during low flow season varies from 1.5 to 8 m^3/s during low flow season, which indicates that there will be minimal impact on the flows downstream of the Bhan Khwar. The reduced water inflow in this river section between weir and confluence with Bhan Khwar (4.5 km length) can potentially cause significant impacts on the aquatic fauna and overall ecology of the river in this reach during September to May if all flows are directed to

the powerhouse. Due to the low reservoir capacity (1.08 million m^3), there will be no changes in the water quality of the reservoir. The reduced river flows may also contribute to the degradation of downstream fish habitats due to its reduced capacity of flushing of sediments deposited on the spawning areas.

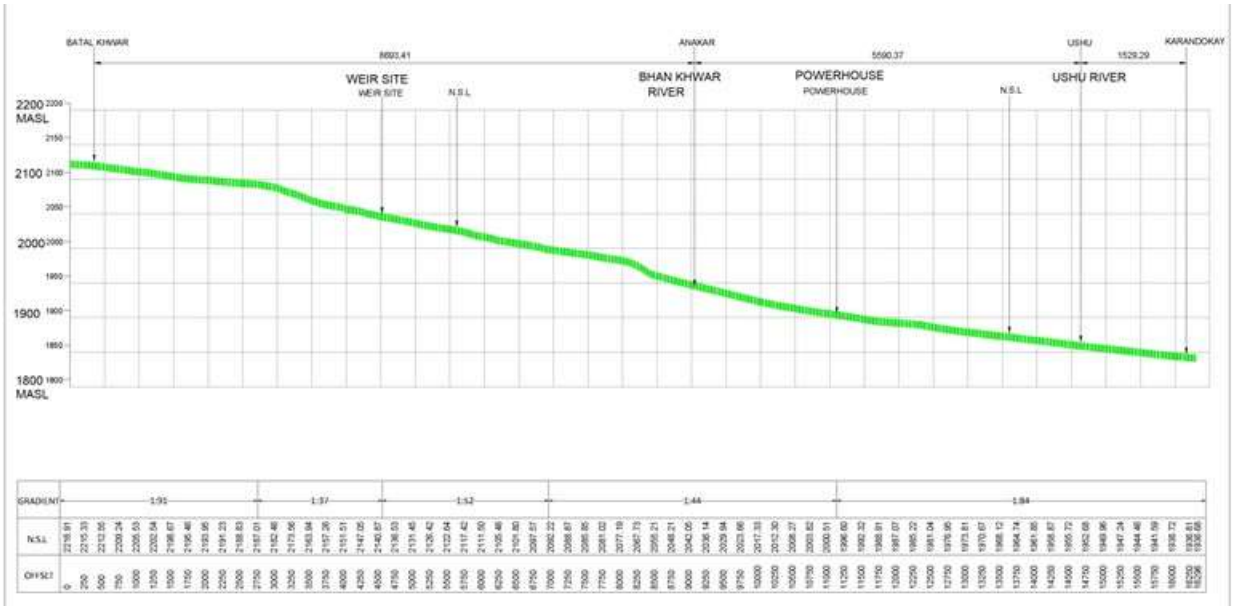

Figure 7.1: River Profile and Water Levels on the Downstream of the weir site

Need for Environmental Flow: Environmental flows are the water that is released into the river, for the specific purpose of managing the condition of that ecosystem. Generally, requirements of environmental flows are assessed based on the impact of specific ecosystem components such as aquatic animals, flood plains, river sand, estuaries, groundwater aquifers, recreational and cultural features, irrigation and drinking, etc. There is no human use of water (e.g., drinking, irrigation, cultural use, etc.) in the river section between dam and tailrace. All the villages in the project area depend on springs for drinking water and irrigation requirements. The only ecosystem that is likely to be affected in this river section due to reduced flows is the migration of snow carps and its habitat. Maintaining an environmental flow downstream of the weir could mitigate potential impacts on this habitat of snow carps. A comprehensive monitoring program will be in place during the O&M to regularly monitor the release of environmental flows and downstream impacts, and the environmental flows will be increased to mitigate any additional impacts are noticed.

Mitigation

A hydraulic modeling study was conducted to assess adequate flows to meet the requirements of snow carps (depth, flow, and velocities) in the downstream of the weir. A typical cross-section of the river on the downstream of the weir and the results of the modeling are given in **Figure 7.2**. A flow of 2.33 to 3.06 m^3/s will maintain the adequate depths (0.4 to 0.5) and velocities (1 to 1.1 m/s) to support the winter habitat of snow carps (see Section 5.3.3 for snow carp habitat requirements). An environmental flow of 2.5 to 3.5 m^3/s from weir is considered in the design during the migratory season of snow carp (March and April, and September and October), and a flow of 2 m^3/s is considered during extreme low flow season November to February when the snow carps do not migrate and live in pools.

With the above mitigation measures and compensatory measures described in the above section, the residual impacts have been assessed as minimal.

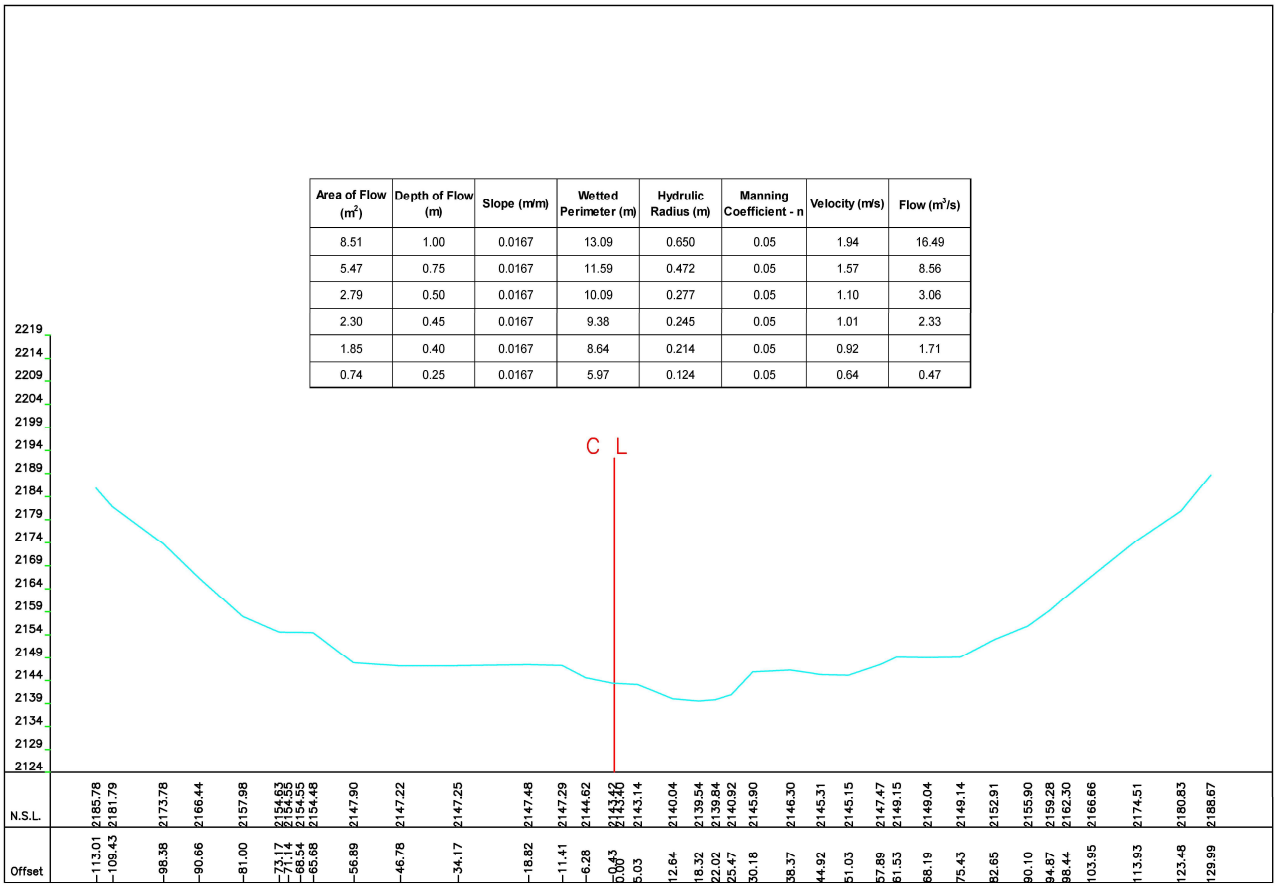

Figure 7.2: River Cross Section at the Downstream of the Weir and Results of Hydraulic Modeling

7.9.3 Risk of Bird Collision and Electrocution

The length of the proposed 220 kV transmission line in the project is 2.75 km. There are no staging areas for the migratory birds in the project, and birds continue to fly over the River without descending down, and hence there no bird collision is also expected. There also will be no electrocution risk for the large birds due to wider space between two vertical conductors (about 6m) since the maximum wingspan of the birds is generally within 3m. However, closely spaced exposed equipment, such as jumper wires on transformers, poses an electrocution risk to small birds.

Mitigation

The exposed coverings and parts of the transmission line towers will be insulated to avoid any electrocution of birds.

7.9.4 Impact on Downstream Sediment Load

The Gabral River carries about 126,4932 tons of sediment load annually, in which about 86% of the load is carried during five months of high flow season (May to September), and only 14% of the load is carried during seven months of the low flow season (October to April). After the construction of the weir, the sediment will be trapped behind the weir if there will be no flushing of the sediments from the reservoir. Even with the regular sediment flushing, the life of the reservoir is estimated at about 40 years. Hence the reservoir operations are designed with regular flushing of sediments through under sluices and from the sandtrap during high flow season. Hence the sediment concentrations in the downstream waters of the weir will be maintained during high flow season. However, during the low flow season, the sediment concentrations will be reduced due to the lack of flushing operations. The impacts associated with low sediment concentrations in the low flow season is minimal since the river generally carries the low sediment load during low flow season, and there is no existing mining industry for the extraction of river sediment material on the downstream of the weir.

Mitigation

PEDO will routinely carry out the following activities during O&M for sediment management:

- Sediments will be flushed from the reservoir through under sluices during high flow season
- Sediments from sandtraps will be flushed regularly during high flow season
- Environmental flows will be released through under sluices to allow some sediment flows during low flow season as well

7.9.5 Workers Health and Safety during O&M

The potential OHS risks associated with the O&M stage of hydropower plants are (i) exposure to higher levels electric and magnetic fields (EMF) than the general public because of working in proximity to electric power generators, equipment, and connecting high-voltage transmission lines, and (ii) exposure to high noise levels from the turbines and generators. The noise pollution will not be significant since the turbines and generators will be located in enclosed building structures for protection against the elements, thus significantly attenuating noise pollution. Workers of the transmission line may be exposed to occupational hazards from contact with live power lines during maintenance and operation activities.

Mitigation

The following mitigation measures will be implemented

Occupational EMF exposure will be prevented or minimized by preparing and implementing an EMF safety program that includes the following components:

- Identify potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities.
- Train workers in the identification of occupational EMF levels and hazards
- Establish and identify safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure and limiting access to properly trained workers.
- Implement action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed by international organizations such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The recommended EMF exposure levels by ICNIRP (also referred in WB EHSGs) are 10 kV/m for electrical field and 1000 µT for magnetic field

- Personal exposure monitoring equipment will be set to warn of exposure levels that are below occupational exposure reference levels (for example, 50 percent).
- Implement actions to minimize occupational exposure, which include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible, or using shielding materials
- Workers always use personal noise protective gear when working in high noise areas (typically areas with noise levels greater than 85 dBA).
- Transmission line workers will be provided with adequate PPEs and training on the safe use of equipment

7.9.6 Waste Management

The potential sources of waste during operation are domestic solid waste from the staff colony and offices, and hazardous wastes such as turbine and transformer oil, and maintenance materials or chemicals (such as paints, solvents). Nonhazardous wastes may include office waste, packing materials, and domestic waste from workers and work camps.

Mitigation

PEDO will implement a waste management plan for collection and disposal of organic waste, recyclables, garbage and hazardous waste following the principles give in ECPs 1 and 2 on waste management and hazardous waste management

7.9.7 Community Health and safety during O&M

The potential risks to the community will be the exposure to electrical and magnetic fields (EMF) from the transmission line. The recommended limits (by ICNIRP, which are endorsed by the World Bank) of community exposure to EMF are 5 kV/m for the electrical field and 200 µT for the magnetic field.

Other major community risks associated with hydropower projects during operation are dam failures due to different reasons ranging from seepage, piping (internal erosion), insufficient freeboard, liquefication due to earthquakes, etc.

Mitigation

Exposure to EMF levels from the proposed transmission will be well below the recommended levels by ICNIRP. The EMF exposure levels within 10 m from the center of the transmission line alignment are estimated as 2.72 kV/m for the electrical field (standard is 5 kV/m) and 8.9 µT for the magnetic field (the standard is 200). Beyond the 10m from the center of the transmission lines, the EMF levels will start to decrease.

To address the potential risks associated with the dam failure, the PEDO will appoint a team of the international and independent panel of experts to review the proposed designs. The panel includes experts in the dam, tunnel and geology, and hydrology, hydraulic structures, and sediment management. PEDO will install an instrumentation network to monitor the behavior of the weir, its foundations, and its abutments. In addition, PEDO will carry out a dam break analysis and prepare an emergency response plan for approval of the World Bank.

7.9.8 Impacts from the Tourist Facilities around the Project Facilities

The Project site is located near the Kalam town, which is a major tourism hub in the region. Due to the tourism potential in the project area, tourist facilities will be provided near the project sites. These include the development of parks and viewpoints near the weir site and walking tracks near the

powerhouse. These facilities will act as an added attraction to the tourists and may attract more tourists to the Kalam. The overall impacts of the proposed tourist attractions around the weir sites are expected to be positive due to its contribution to the livelihood of the local communities and tourism industry in the region. There would be increased employment and business opportunities for the local communities. The adverse impacts associated with the tourist facilities may include the generation of solid waste, poor maintenance of public toilets, and inadequate housekeeping. Although tourism is not new to this area, there could be some adverse potential social impacts associated with tourists visiting the project sites such as social-cultural conflicts with local communities and the privacy of local women.

Mitigation

PEDO will provide preference to affected persons in establishing small businesses in designated eco-tourism spots. It will help affected households to formalize their small businesses and benefit from the promotion of local tourism.

PEDO will make concerted efforts in collaboration with the Department of Culture, Sports, Tourism and Youth Affairs (DoT) to promote responsible/eco-tourism to be socially, economically and environmentally responsible for avoiding impacts on the local socio-cultural situation and environment of the area around the weir.

The information communication material will be displayed at the tourist spots to promote responsible tourism.

The tourist facilities include waste collection bins and public toilets (separately for men and women), which will be maintained regularly by PEDO. The solid waste management system adopted for the PEDO colony and offices will be used for the collection, storage, transportation and disposal of solid waste from the tourist facilities.

8 Cumulative Impact Assessment

The potential cumulative impacts of all planned hydropower projects in the Swat River basin, in the context of the Gabral Kalam hydropower project, are discussed in this chapter.

8.1 Hydropower Development in the Swat River Basin

8.1.1 Overview of the Swat River

The Swat River is a perennial river in the northern region of KP, and its source is in the Hindukush Mountains and fed by the glacial waters. The river commences in the Kalam Valley of Swat Kohistan with the confluence of two main tributaries Ushu and Gabral and runs through mountainous terrain and narrow gorge up to Baghdheri. The average width in this reach is around 30-40 meters. Then the river enters in plain areas of Swat Valley; its average width is 400 meters in the extreme south of the valley, and it is a meandering river and receives the drainage of the entire Swat Valley. The river flows southwards and then westwards; once again, it enters a narrow gorge and joins by the Panjkora River at Qalangi. The river then flows southwestward into the Peshawar Plains and joins the Kabul River at Charsadda after a 320-kilometer course. Kabul river then joins Indus River at Attock (Punjab) below the Tarbela reservoir. The Swat River basin comprises all the areas drained by Swat River and its tributaries, and the total catchment area is 14,000 km^2.

8.1.2 The Proposed Hydropower Projects

The Hydropower potential of the Swat River Basin was studied under the "Hydropower development Master plan for Northern Areas of Khyber Pakhtunkhwa," which was carried out during 1990-1995 by PEDO and German Agency Technical Corporation. The hydropower projects identified by the study are given in **Table 8.1**.

Table 8.1: A Summary Hydropower Development in the Swat River Basin

Main River	Proposed HPPs on Main Rivers	Proposed HPPs on Tributaries	Existing HPPs on Canals
Gabral	• Chota Jabbar – 90 MW • Gabral Utrol – 50 MW • Gabral Kalam – 88 MW (Total : 183 MW)	• Swati – 8 MW • Batal Khwar – 8 MW • Bhan Khwar – 25 MW (Total: 41 MW)	
Ushu	• Javaid – 45 MW • Artistic – 55 MW • Gorkin Matiltan – 84 MW (*in construction)* • Ushu II – 20 MW (Total : 204 MW)	Kalam – 3 MW (Total: 3 MW)	
Kalam	• Kalam Asrit – 197 MW • Asrit Kedam – 215 MW • Madyan – 157 MW • Munda – 800 MW (*in construction*) (Total: 1369 MW)	• Choken Khwar – 12 MW • Kedam Khwar – 17 MW • Barel Dare – 9 MW • Daral – 36 MW (*existing*) • Kalkot-Barikot-Patrak – 47 MW • Patrak – Shringal – 22 MW (Total: 143 MW)	• Jaban – 22 MW • Dargal – 20 MW • Malakand III – 81 MW
Total	**1,756 MW**	**193 MW**	**123 MW**

A total of 24 hydropower projects are planned in the Swat Basin, with a total estimated hydropower potential of 2072 MW. Of these, 11 are located on the Swat, Gabral, and Ushu Rivers (total capacity 1,756 MW), and 9 are located on the tributaries (total capacity 193 MW).

In general, each project located on the main rivers (Swat, Gabral, and Ushu) has a capacity of more than 45 MW (except one project), and each project located on the tributaries has a capacity of less than 25 MW (except two projects). All these projects are runoff river projects except Munda (Mohmand) Dam Hydropower (the most downstream project in the Swat River), which involves storage (1600 million cubic meters) for power generation and irrigation.

8.1.3 Locations of Hydropower Projects

Locations of the hydropower projects in the Swat River Basin are given in **Figure 8.1**, and the current status of each of these hydropower projects is given in **Table 8.2**. Of the planned 24 projects, four are existing (160 MW), two are under construction (884 MW), and 18 are proposed (1028 MW). As seen in this table, out of the proposed 18 projects, feasibility studies are completed for only 3 projects and details of the other 15 projects are not available. Hence, a quantitative assessment of cumulative impacts could not be carried out in this study.

Among the four existing projects, three are located on the Upper Swat Canal, an irrigation offtake from the Swat River, and one is located on the tributary, Daral Khwar.

Among the two projects under construction, one is located on the Ushu (Gorkin-Matiltan) and the other one on the Swat (Munda).

Table 8.2: List of the Hydropower Projects in the Swat River Basin

Sr. No	Project	MW	Location	District	Tributary	Status	Client
1	Daral	36.6	35 12` 10.13" N 72 32` 35.78"E	Swat	Daral Khwar	Completed	PEDO
2	Gorkin Matiltan	84	35 31` 1.61" N 72 37` 35.78"E	Swat	Ushu	Under Construction	PEDO
3	Gabral Kalam	88	35 30` 21.83" N 72 31` 22.47"E	Swat	Gabral	Under the Feasibility stage (FS)	PEDO
4	Kalam Asrit	197	35 21` 44.67" N 72 36` 10.97"E	Swat	Swat	Under FS Stage	PEDO
5	Asrit Kedam	215	35 15.9`N 72 35.9`E	Swat	Swat	Under FS stage	PEDO/Private
6	Madyan	157	35 9` 0.26"N 72 32`0.65"E	Swat	Swat	FS completed	PEDO/Private
7	Kedam Khwar	17.1	35 13` 36.79"N 72 34`12.31E	Swat	Kedam Khwar	Identified	PEDO/Private
8	Chokel Khwar	12	35 9` 47.37"N 72 7` 5.37"E	Swat	Chokel Khwar	Identified	PEDO/Private
9	Batal Khwar HPP	8	35 29` 32.62" N 72 27`26.96"E	Swat	Batal Khwar	Identified	PEDO
10	Baral Derra	9	35 14`25.16"N 72 34` 50.28"E	Swat	Garnai Khwar	Under FS stage	PEDO/Private
11	Ban Khwar	25	35 31`20.37"N 72 33`35.75"E	Swat	Ban Khwar	Under FS stage	PEDO/Private
12	Gabral Utror	50	35 29`48.79"N	Swat	Gabral	Under FS stage	PEDO/Private

Sr. No	Project	MW	Location	District	Tributary	Status	Client
			72 29`5.72”E				
13	Artistic 2	55	35 34`34.36”N 72 40`35.73”E	Swat	Ushu	Under FS stage	PEDO/Private
14	Chota Jabba	50	35 32`8.41”N 72 24`49.05”E	Swat	Gabral	Identified	PEDO/Private
15	Javaid Power	45	35 38` 57.63”N 72 40`46.37” E	Swat	Ushu	Identified	PEDO/Private
16	Ushu II	20	35 28`46.87”N 72 35` 39.56’ E	Swat	Ushu	Identified	PEDO/Private
17	Swati	8	35 31`32.79”N 72 24` 43.92”E	Swat	Tributary of Gabral	Identified	PEDO/Private
18	Kalam	3	35 29` 59.63” N 72 36` 12.92”E	Swat	Tributary of Ushu	Identified	PEDO/Private
19	Patrak Shringal	22	35 19’16.81”N 72 2’37.32” E	Dir	Panjkora River	FS completed	PEDO
20	Kalkot-Barikot- Patrak HPP	47	35^{o}24’7.52”N 72^{o} 10’25.69”E	Dir	Panjkora River	FS completed	PEDO
21	Malakand III	81	34°30’29.42”N 71°54’37.32”E	Malakand	Upper Swat canal	Completed	PEDO
22	Jaban	22	34°33’26.80”N 71°55’54.14”E	Malakand	Upper Swat canal	Completed	WAPDA
23	Dargai	20	34° 31’ 7.77” N 71° 55’ 8.11” E	Malakand	Upper Swat canal	Completed	WAPDA
24	Mohmand/ Munda	800	34°21’11.49”N 71°31’ 58.72” E	Mohmand	Swat	Under construction	WAPDA
Potential of Swat River Basin		2071.7					

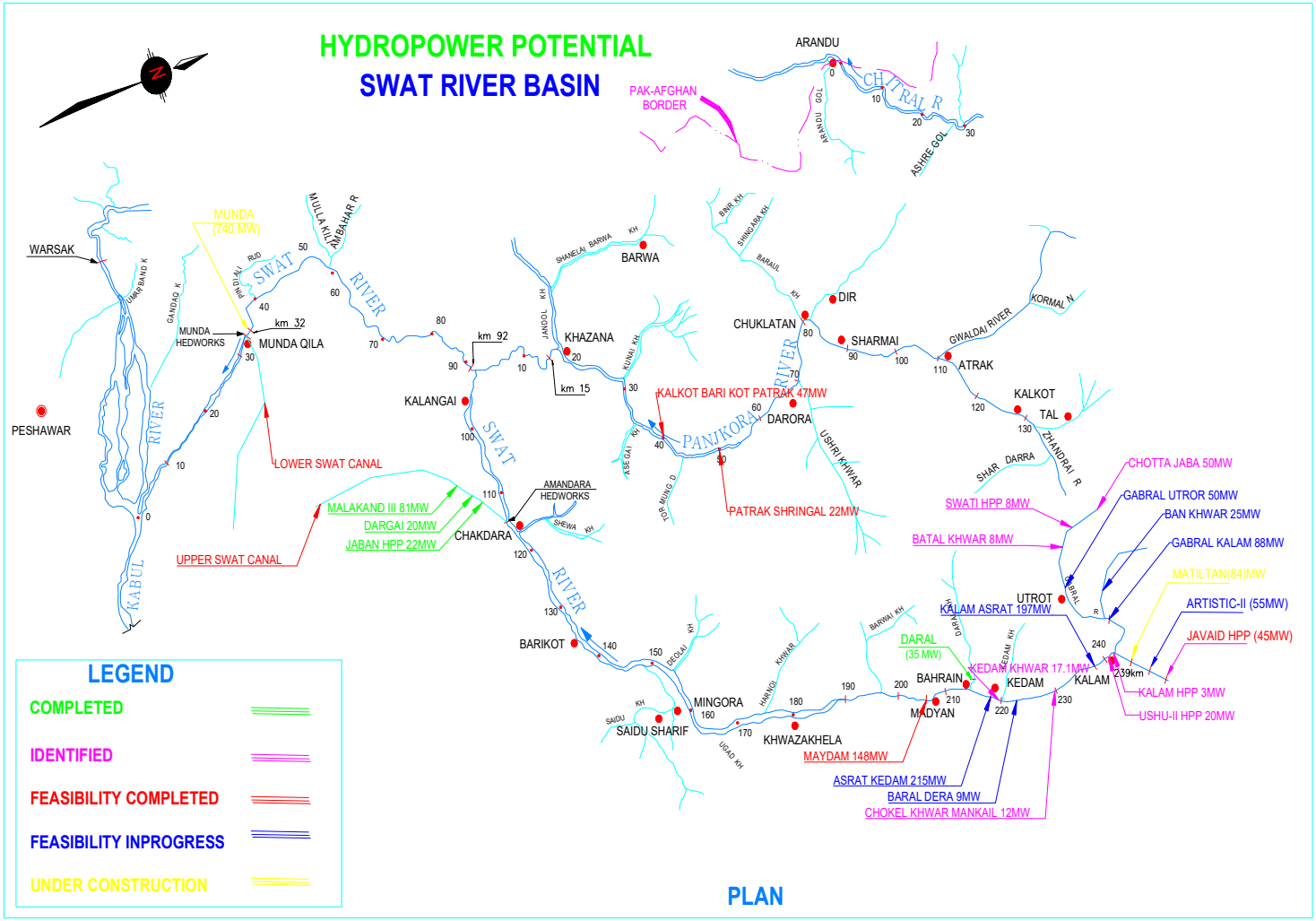

Figure 8.1: Locations of the Potential Hydropower Projects in the Swat Basin

8.1.4 Schematic View of Hydropower Development in the Swat River Basin

A schematic drawing (without scale) showing the locations of the existing, under construction and proposed hydropower projects are also shown in **Figure 8.2** for an easy reference for the discussion given in this chapter.

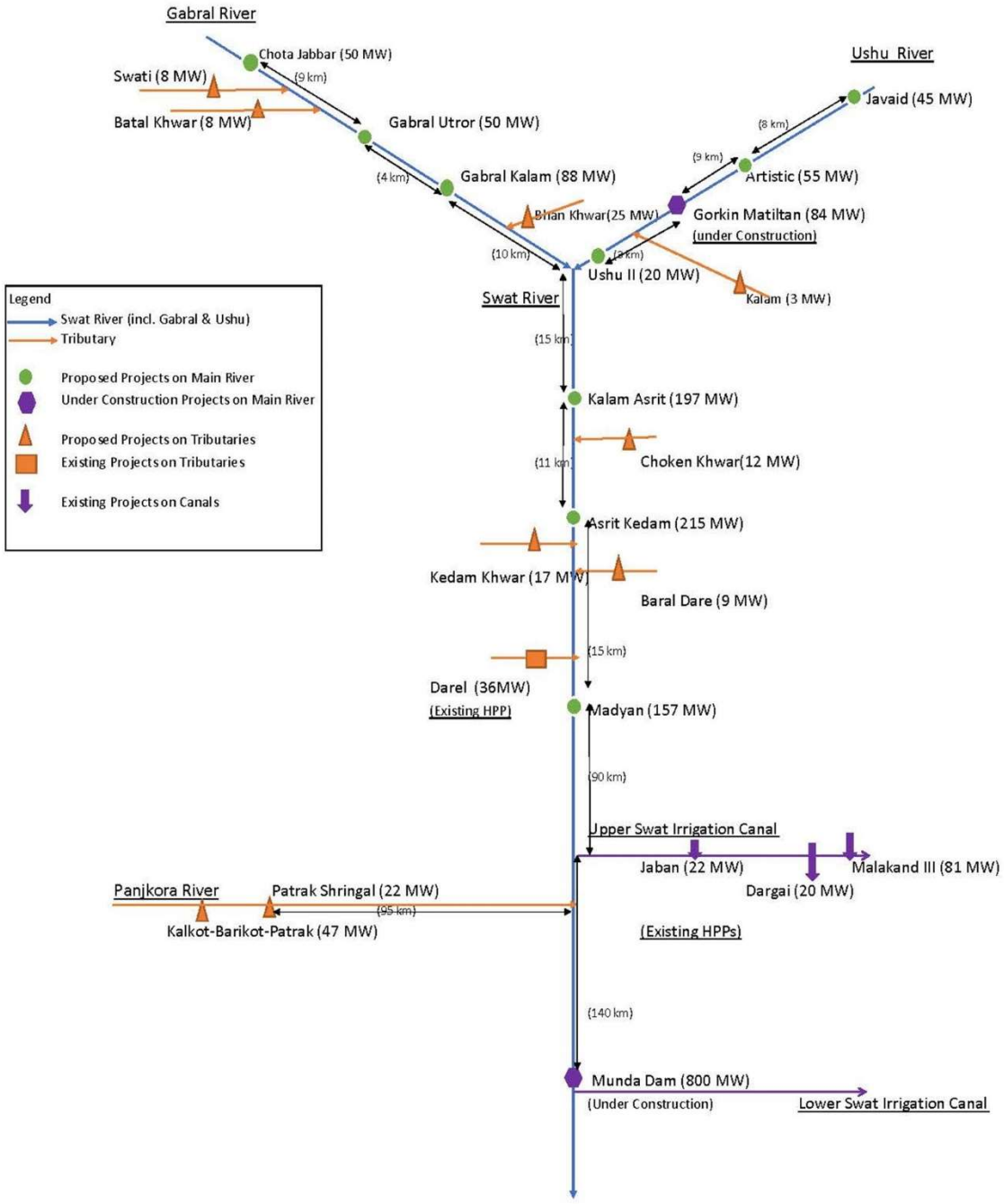

Figure 8.2: A Schematic View of Hydropower Development in the Swat River Basin

8.2 Study Boundaries and VECs

The spatial boundary considered for this cumulative impact assessment (CIA) is the whole Swat River Basin, and the temporal boundary has been taken up till the next 20 years as proposed projects will be expected to be completed by 2040. Four valued environmental components (VECs) have been studied for the CIA study and they are (i) river flows, (ii) terrestrial ecology, (iii) aquatic ecology and (iv) socioeconomic environment.

8.2.1 VEC 1: River Flows

8.2.1.1 Baseline

The main source of water flows in the Swat basin is the melting of snow and glaciers, and to some extent, by summer rains and monsoons. Annual precipitation over the entire basin is between 375 mm to 1250 mm. The river flows of the Swat at Kalam (upper reaches) and Chakdara (in the middle reaches where irrigation releases start from the river) are given in **Table 8.3**. At Kalam gauging station, the catchment area is 2020 km^2, and at Chakdara, the catchment area is 5770 km^2.

Table 8.3: River Flow data of Swat River at Kalam and Chakdara gauging stations

Month	**Swat River at Kalam m^3/s, (1961-2010)** (10 km downstream of GKH Weir Site)	**Swat River at Chakdara m^3/s, (1999-2007)** (140 km downstream of GKH Weir Site)
January	14.93	59.23
February	13.696	76.23
March	16.876	141.83
April	47.973	231.40
May	128.61	348.98
June	242.3	420.47
July	251.44	408.85
August	165.85	287
September	78.656	161.50
October	35.033	92.82
November	22.49	74.31
December	17.43	61.29

Irrigation Releases

The Swat River flows through mountainous terrain up to Madyan, and hence there are no irrigation requirements from the river. Once the river reaches the plain areas near Chakdara, there is extensive use of agriculture requiring irrigation releases from the Swat.

The most direct use of river flows of the Swat is from its two irrigation projects, the Upper Swat Canal and the Lower Swat Canal. The Amanda headworks near Chakdara releases water to the Upper Swat Canal, and the headworks near the Munda releases water to the Lower Swat Canal.

The Upper Swat Canal was completed in the year 1918, and it irrigates about 121,400 ha of lands of Charsadda, Swabi and Mardan areas in KP. A section of the canal carries water to the foot of Malakand hills, where a 3.5 km long Benton tunnel pierces the Malakand hills and releases water into the Daragai nullah. A cascade of three dams, Jaban, Dargai and Malakand III, are constructed on the canal.

The Lower Swat Canal flows in the Mardan district of the Peshawar Valley. It was commissioned in 1885 and was built as a typical British run-off-the river system, taking its waters from the Swat River.

The volume of water diverted to the Upper Swat and Lower Swat Canals from the Swat River is given in **Table 8.4.**

Table 8.4: Mean Monthly Water uptakes through Canals from Swat Rive

Months	Upper Swat Canal (1999-2007), m^3/s	Lower Swat Canal (1999-2007), m^3/s
January	19.29	1.81
February	28.94	3.81
March	43.54	26.29
April	66.22	39.43
May	69.97	44.40
June	74.36	45.85
July	70.26	40.70
August	60.45	38.13
September	61.41	41.29
October	51.78	33.31
November	42.07	25.85
December	35.74	21.89

8.2.1.2 Cumulative Impacts

Among the existing and proposed hydropower projects, Munda (Mohmand) dam is a storage project and located below the two irrigation canals and this dam will have no impact on the upstream irrigation system. All others are run-of-river projects. If these projects run on peaking operations due to storage of water for about 18 to 20 hours and then release the water for 4 to 6 hours for peaking operations, there will be a significant cumulative impact on the downstream irrigation projects. However, if they run on baseload operation, there will not be any impact on downstream irrigation projects.

The potential cumulative impacts associated with both baseload and peaking operations of all hydropower projects are explained in **Table 8.5**. The potential reductions in water flow at the Chakdara and irrigation flow to the Upper Swat Canal are given in this table if all hydropower projects store water for 18 hours and release it in 6 hours for peaking operations. The potential cumulative impacts are summarized below:

- If all the projects operated for baseload power generation, the river flows at Chakdara will remain the same as a baseline, and there will be no reduction in the irrigation releases to the Upper Swat Canal (see columns iii and iv of Table 8.5), and also there will be no reduction in the Lower Swat Canal.
- If all the projects store water for 18 hours for peaking operation, there will be a reduction of 75% of river flows at Chakdara during the 18-hour storage period (see column v of Table 8.5). This will, in turn, reduce the available irrigation flows to the Upper Swat Canal mainly from September to April and hence will significantly affect agriculture in Rabi season. The reduction of flows in the Upper Swat Canal is estimated to be about 34 to 57% from September to December (see the last column of Table 8.5). Although all the water from the projects will be released in the 6-hour window, it will not meet the requirement of all farmers. Presently, there

is a well-established *warbandi*[27] system under the Upper Swat Canal which operate on the basis of proportional flow distribution. In this system, each and every landowner has a fixed time during the day for his turn of irrigation water whereas the turn of one farmer is normally repeated after 7 days. Storing of water behind the dams for 18 hours means that the farmers having their turn during this 18-hour period will be suffered by 34 to 57% shortage of water, whereas the others will get additional water in 6 hours. This is a sensitive issue and any holding of water in the reservoirs for peaking operations will cause conflict among the farmers. The impacts will be similar for the Lower Swat Canal irrigation releases also.

- The incremental contribution of GKH to the overall cumulative impacts (If water is stored for 18 hours for peaking operations) will be a reduction of 15-25% of flows in Swat River at Chakdara from September to December, which in turn will reduce the irrigation releases to the Upper Swat Canal. However, GKH will not contribute to any reductions to the Lower Swat Canal due to the joining of the Panjkora river at 15 km downstream of the Chakdara and the river flows of Panjkora could meet the requirements of the Lower Swat Canal.

Table 8.5: Cumulative Impacts of Peaking Operations on River Flows and Irrigation Releases

Month	Baseline Flows at Chakdara (1997-2007)		Baseload operations - Cumulative Impacts on River Flows at Chakdara (Recommended Option)		Peaking Operation - Cumulative Impacts on River Flows at Chakdara during storage for 18 hours		
	Available River Flows (m3/s) (i)	Irrigation Releases to Upper Swat Canal (m^3/s) (ii)	Available River Flows (m^3/s) (iii)	Reduction in Irrigation Releases to Upper Swat Canal (m^3/s) (iv)	Available Swat River Flows (m^3/s) (v)	Reduction in Irrigation Releases to Upper Swat Canal (m^3/s) (vi)	Percentage Reduction in Irrigation Flows (vii)
January	59.23	19.29	59.23	0	14.81	4.48	23.24
February	76.23	28.94	76.23	0	19.06	9.88	34.15
March	141.83	43.54	141.83	0	35.46	8.08	18.56
April	231.4	66.22	231.4	0	57.85	8.37	12.64
May	348.98	69.97	348.98	0	87.25	0.00	0.00
June	420.47	74.36	420.47	0	105.12	0.00	0.00
July	408.85	70.26	408.85	0	102.21	0.00	0.00
August	287	60.45	287	0	71.75	0.00	0.00
September	161.5	61.41	161.5	0	40.38	21.04	34.25
October	92.82	51.78	92.82	0	23.21	28.58	55.19
November	74.31	42.07	74.31	0	18.58	23.49	55.84
December	61.29	35.74	61.29	0	15.32	20.42	57.13

Individually each hydropower project will also have localized impacts on its dewatered sections between the weir and tailrace. If there are any water uses (irrigation, drinking, etc.) during these stretches, they

[27] Warabandi system of water distribution is followed for canal irrigation system. The term Warabandi is originated from two vernacular words 'Wara' and 'bandi'. The meaning of wara is 'turn' and bandi means 'fixation'. Taken together, the term Warabandi means rotation of water supply according to a fixed schedule. "Warabandi is a system of equitable water distribution by turns according to a predetermined schedule specifying the day, time and duration of supply to each irrigation in proportion to holdings in the outlet command".

will be affected if all the water is diverted for power generation without releasing any environmental flows. Since most of the projects are located on a hilly terrain, there is not much irrigation demand from the rivers due to presence of limited agricultural areas around the project sites, and the irrigation requirements are generally met from the springs (in GKH project area, the springs are used for irrigation, and there is no direct use of river water either for irrigation and drinking). Among all proposed projects, only Madyan has agricultural lands in its dewatered section (about 12 km section between the weir and tailrace), which could be affected if there are no environmental flow releases to meet the requirements of irrigation.

8.2.1.3 Actions to Address Cumulative Impacts

PEDO will take the following actions to avoid any impacts on the river flows and irrigation releases:

- All hydropower projects in the Swat River basin will be operated for baseload power generation since the peaking operations will affect the irrigation system downstream.
- All water uses (irrigation, drinking, and other uses) in the dewatered sections of each hydropower project will be assessed, and environmental flows will be released to meet these requirements
- Regularly monitor whether the released environmental flows meet the requirements the water uses and adjust the environmental flows if needed.

8.2.2 VEC 2: Terrestrial Ecology

8.2.2.1 Baseline Terrestrial Ecology

The Swat River basin can be divided into eight ecological zones considering the climatic variability along with the biodiversity and the land-use patterns. These zones are as follows:

- **The sub-tropical humid zone**: this zone is predominantly the lowlands of the valley with characteristic short winters and extended summers. The indicator species are *Bauhinia variegate, Phoenix spp., Reptonia buxifolia,* and *Nannorrhops ritchiana.*
- **The sub-tropical dry zone**: this zone covers most of the Swat Valley with the altitudinal range of 600 to 1000 m. The indicator species of this zone are *Acacia modesta* and *Olea ferruginea.*
- **The humid-temperate zone**: the altitudinal range of this zone is from 1000 to 1500 m with hot and humid summer, especially in June and July. The native tree species of this zone are *Pinus roxburghii* and *Quercus incana.*
- **The dry temperate zone**: the altitudinal range of this zone is from 1500 to 2000 m with extended cold winter and petite summer. The common indicator species of the zone are *Pinus wallichiana* and *Quercus dilatate.*
- **The dry (cool) temperate zone (Coniferous habitat)**: this is the most densely forested zone of the valley, ranging from 2000 to 2700 m altitudinally with Abies pindrow and Picea smithiana as the common indicator species.
- **The subalpine zone**: this zone is normally covered by snow for practically half of the year with an altitudinal range of 2700 to 3200 m. The indicator species of this zone are Betula utilis and Quercus semecarpifolia.
- **The alpine zone**: The altitudinal range of this zone is from 3200 to 4700 m with characteristic species, including mosses and ferns. This zone also has meadows and grassy slopes.
- **The cold deserts**: these are the highest points of the valley with an altitudinal range of 4700 to 6000 m above sea level. This zone is permanently covered with snow and lacks obvious macro-flora.

It is obvious that these dissimilar ecological zones deliver micro-climates and habitats to a wide variety of flora and fauna. They key biodiversity of the Swat basin is briefly described below:

Mammals. Pakistan hosts more than 190 species of mammals. The diverse habitats of the basin are home to a variety of wild animals, including snow leopard, Markhor, musk deer, Himalayan black bear, and Himalayan ibex. Other animals include Himalayan lynx, brown bear, grey wolf, striped hyena. According to the secondary data, 70 species have been reported from the Swat region with four Threatened species. The Threatened species include Common leopard (*Panthera pardus*), Snow leopard (*Uncia uncia*), Asiatic black bear (*Ursus thibetanus*) and Markhor (*Capra falconeri*).

Herpetofauna. Amphibians are represented in the Swat valley by anurans, i.e., frogs and toads whereas; reptiles are represented by *lacertilians* (lizards) and *serpents* (snakes). Amphibians and reptiles are very important animals of the Swat basin ecosystem system since they act as biological indicators.

Pheasants. Pheasants are usually considered as game birds. Four species are reported, including Chukar Partridge *(Alectoris chukar*), Black francolin *(Francolinus francolinus*), Koklass Pheasant (*Pucrasia macrolopha*) and Himalayan Monal pheasant (*Lophophorus impejanus*) in the region. None of these species is "Threatened" according to IUCN Red List of Threatened Species yet these are the most favored species among hunters as well as bird lovers. These species occupy vast habitats in northern areas in KP, Gilgit Baltistan and Azad Jammu Kashmir and some plane areas in Punjab and even being hunted in thousands each year their populations are stable. Therefore, the hydropower projects in the Swat region would not have any significant impact on pheasants.

Waterfowl. A number of waterfowl visit the Swat region each year during southward migration in September and spend the winter season in warm waters in the south. Some of the waterfowls during migration land in the region but only for one or two days using the wetlands as a staging area. If they find some food, they stay otherwise fly away. Swat falls into a colder region and most of the wetlands in Swat during the winter season have no attraction for the birds looking for warm waters in the south. Therefore, there will not be any kind of negative impact of hydropower projects in the Swat region.

Forests. The Swat basin is rich in forest resources and forestry products. The forest vegetation mainly includes Deodar, Blue pine, Chilgoza Pine and Spruce.

Protected Areas. There are some protected areas exist in the Swat valley, and all of them are game reserves (none of them are in the IUCN protected area category). The community game reserves close to the project sites are Bhan Valley Community Game Reserve (near the Bhan Khwar Project) and Mankial Community Game Reserve (near the Chokel Khwar project). The nearest key biodiversity area (located outside the basin) is Duber Valley, an Important Bird Area.

Current Threats. The existing threats on flora and fauna in the basin are mainly due to over-exploitation, mismanagement, and loss of natural habitats because of anthropogenic activities. Rapid human population growth is increasing the pressure on the basin's natural resources. Increased poverty has forced rural people to exploit biodiversity at unsustainable rates. Factors like deforestation, overgrazing, soil erosion, are posing major threats to the remaining biodiversity. With the current trends, the continuing loss of forest habitat, with its associated fauna and flora, will have severe impacts on the natural ecosystems.

8.2.2.2 Cumulative Impacts

The potential cumulative impacts of all hydropower projects include loss of forests, natural habitats and habitat degradation by the footprints of proposed facilities associated with hydropower projects. The terrestrial ecology of each hydropower project and potential cumulative impacts are given in **Table 8.6**.

Table 8.6: Terrestrial Ecological Conditions of Hydropower Projects and Cumulative Impacts

Ecoregion	Projects on Main River	Projects on Tributaries	Forest Cover near the project sites	Community Game Reserves near the projects	Cumulative Impacts on Terrestrial Ecology
Dry/cold temperate (2000 to 2700 masl)	All projects on Gabral and Ushu: • Chota Jabbar • Gabral Utror • Gabral Kalam • Javaid • Artistic • Gorkin-Matiltan • Ushu II	All tributaries of Gabral and Ushu: • Swati • Batal Khwar • Bhan Khwar • Kalam	The most upstream projects (Chota Jabbar on Gabral and Javaid on Ushu) have little forest cover and other project sites have medium to high forest cover	Bhan Valley Community Game Reserve (25,000 ha). Bhan Khwar project is located in this game reserve)	• Cutting of forest trees • Degradation of forest habitats • Soil erosion and increased sedimentation • Improved access to remote high mountain areas • Impact on wildlife habitats
Dry temperate (1500 to 2000 masl)	On the Swat River • Kalam – Asrit • Asrit - Kedam	• Chokel Khwar • Kedam Khwar • Baral Dare • Kalkot Barikot Patrak • Patrak Shringal	The forest cover is medium to high near these sites	Manikal Community Game Reserve (13063 ha) is located near Choke Khwar	• Cutting of forest trees • Degradation of forest habitats • Soil erosion and increased sedimentation • Improved access to remote high mountain areas • Impact on wildlife habitats
Humid temperate (1000 to 1500 masl)	• Madyan	• Daral	The forest cover is very limited near these sites	No game reserves near these sites	• Cutting of forest trees
Subtropical humid zone (less than 600 masl)	• Munda (Mohammad)	Projects on Upper Swat Canal: • Jaban • Dargai • Malakand III	No forest cover. The land use is mainly agriculture		• Clearing of natural vegetation

A summary of the key ecological features of the project sites and potential cumulative impacts are discussed below:

- All hydropower projects on the Gabral and Ushu and their tributaries (7 on main rivers and 4 on tributaries) are located in the dry/cold temperate zone with elevations ranging from 2000 to 2700 masl. These mountain slopes near the project sites are covered with medium to high forest cover (except two most upstream projects – Chota Jabbar on Gabral and Javaid on Ushu, which have little forest cover). The development of these projects require forest cutting and hence may impact the wildlife habitats. The clearing of forest areas will lead to indirect impacts such as soil erosion and increased sediment flows to the river from the stormwater runoff.
- Two hydropower projects on the Swat and five hydropower projects on its tributaries are located in the dry temperate zone with elevations ranging from 1500 to 2000 masl. The mountain slopes near these project sites are also covered with medium to high forest cover. The development of these projects also requires tree cutting which leads to similar impacts described above, but the impacts on wildlife habitats are expected to be lower than the upstream projects on the Gabral and Ushu rivers.
- According to a study based on satellite image processing[28], the dense forest cover in the Swat district reduced from 178,933 ha in 1992 to 108,054 ha in 2011, which amounts to about 3,730 ha annually over the 19 years. The areas covered by settlements, barren soils and rocky areas have shown a significant increase during this period. Though exact forest land to be affected by the above proposed 18 projects (between the elevations 1500 to 2700 masl), it is roughly estimated that about 900 ha of forest land will be affected by all the projects, and this equals to about one percent of the total forest cover in the district.
- The impacts on wildlife due to the forest clearance will be mostly felt on amphibians and reptiles due to their very restricted home range. The impacts on the mammals and birds are unknown at this stage due to the losses associated with habitat loss. The mammals and birds generally have a very vast home range, and there is a chance that when there is some disturbance in their habitat, they move to adjacent similar habitats, and when the disturbance is over, they retreat back in their native habitats.
- Two of the proposed projects are located close to the community game reserves. The Bhan Khwar project site is located in the Bhan Valley Game Reserve, and Chokel Khwar is located near the Manikal Community Game Reserve.
- Bhan Khwar is the tributary of the Gabral River. The alpine and subalpine habitats of the Bhan Khwar catchment area provide a rich habitat of 21 mammals, including threatened species of snow leopard, and black bear. The entire 25,000 of the Bhan Khwar catchment area was declared as Bhan Valley Community Game Reserve on June 25, 2005. The proposed hydropower project is located in the lower reaches of the Bhan Valley Game Reserve, and the project activities may impact the ongoing conservation activities due to the improved access into the valley through the project roads. Manikal Community Game Reserve (13,063 ha) could also be affected by improved access.
- The incremental impacts of the GKH to the cumulative impacts are mainly due to the clearing of forest trees, while the positive impacts would be significant due to its support to the forest

[28] Sajid Ali, Wajid Ali, Salman Khan, Abdullah Khan, Zia Ur Rahman and Arshad Iqbal. Forest cover change and carbon stock assessment in Swat valley using remote sensing and geographical information systems. Pure and Applied Biology. http://dx.doi.org/10.19045/bspab.2017.60089

department for afforestation and wildlife department for wildlife conservation with a proposed budget of USD 0.6 million.

8.2.2.3 Actions to Address Cumulative Impacts

PEDO will take the following actions to minimize and compensate for the impacts on terrestrial ecology:

- Environmental assessments will be carried out for all proposed projects in accordance with the World Bank safeguard policies and guidelines, in addition to the national and provincial regulatory requirements. In accordance with KP EPA requirements, the hydropower projects less than 50 MW require an Initial Environmental Examination (a limited ESIA), but PEDO will conduct a detailed ESIA for these projects also in accordance with the World Bank guidelines.
- Detailed ecological baseline studies will be carried out as part of the ESIA studies and develop adequate mitigation plans to address all potential impacts on the ecological environment.
- While designing the Bhan Khwar and Chokel Khwar hydropower projects, the Impacts on the game reserve will be minimized by avoiding the sensitive wildlife habitats and optimizing the design of the project facilities with minimum footprints.
- Compensation and enhancement measures to address impacts associated with forest clearance and habitat degradation by tree plantation, afforestation of degraded forest habitats and wildlife conservation programs will be taken up in all the project sites by supporting the forest and wildlife departments.
- The Environmental and Social Unit of the PEDO will closely work with relevant stakeholders (forest and wildlife departments) and staff of proposed hydropower projects to ensure the impacts associated with each hydropower project are minimized.

8.2.3 VEC 3: Aquatic Ecology

8.2.3.1 Baseline Aquatic Ecology

The aquatic ecosystem in the Swat basin can be classified as (i) cold water ecosystem and (ii) semi cold-water ecosystem. The fish diversity of the rivers in the basin depends on the respective ecosystem.

Cold Water Ecosystem. Upper part of River swat from Baghdheri and upward have water temperature seldom raising above 12°C; therefore cold water fish species like *Salmo trutta fario* (Brown trout), *Onchorhynchus mykiss* (Rainbow trout), *Schixothorax plagiostomus* (Snow carp), *Schizothorax esocinus* (Chunr), *Schizothorax labiatus* (Bota), *Racoma labiat, Glyptothorax* species are found. None of these species listed in the IUCN red-listed category. All hydropower projects in the Swat River basin (except the Munda and the projects on the Upper Swat Canal) are located in the cold-water ecosystem and the *Schixothorax plagiostomus* (snow carp) is the most common species. The snow carp is an indigenous fish species of the Himalayan region and widely distributed in the cold waters of Pakistan, Nepal, and India.

Semi Cold-Water Ecosystem. The lower reaches of the Swat River, starting from the downstream of the confluence with the Panjkora river, exhibits this ecosystem. Munda Dam and hydropower projects in the Upper Swat Canal are located in this ecosystem. The Swat River before the confluence with the Kabul represents an ideal habitat for aquatic fauna, especially the fish due to plenty of food availability like macroinvertebrates, freshwater mussels, algae, and several other species of aquatic flora. During floods, both the Rivers bring down a variety of organic matter acting as fertilizer increasing phytoplanktons and zooplanktons population hence providing a rich baseline for a rich food Chain in the River. This results in a wide variety of fish populations downstream. Micro-invertebrate species recorded in these waters include Planaria, Leech, Caddis fly, Mayfly, Stonefly, Dragonfly, Dames fly, Water strider, Chironomous, Water beetles and Water scorpions. These macro-invertebrates contribute a lot to the food chain and hence an integral part of the ecosystem. About 38 fish species reported in this ecosystem belonging to

six orders, nine families and 24 genera. Cyprinidae was recorded to be the richest family represented by 20 species, Nemachilidae by four, Sisoridae by six, Chanidae and Schilbidae by two species each and Mastacembilidae, Schilidae, Belonidae and Chandidae by single species each. Mahseer (tor putitora) is an endangered and commercially important fish species in this ecosystem.

Currents threats to Aquatic Ecosystems. The riverine ecosystem in the Swat basin, particularly near the towns (e.g., Mingora. Saidu Sharif, Madyan, etc.), is affected by the release of untreated municipal sewerage along with disposal of solid waste into the river. The waste from all the settlements located along the river, particularly near the tourist areas (e.g., Kalam and Bahrain) is also being thrown directly into the river. Other major impacts on the aquatic ecosystem are the mining activities in the adjoining hills, particularly marble production in Mingora, Barikot and Batkhela areas, which releases high sediment loads and heavy metals into the river. It is observed that the populations of *Schizothorax plagiostomus, Cyprinus carpio,* and *Tor putitora* have decreased during the last two decades due to several factors including pollution and over-exploitation.

8.2.3.2 Cumulative Impacts

General impacts of hydropower dams on the aquatic environment, and their relevance to the hydropower development in the Swat River basin, and overall cumulative impacts are given in **Table 8.7**. The potential cumulative impacts are summarized below:

- **Habitat destruction**. Construction of dams causes habitat destruction in both feeding and breeding grounds, which leads to biodiversity loss. Dams block the natural flow of water, reducing water discharge in the downstream. Flowing water is vital as it cleans interstitial spaces of pebbles, gravel, and boulders and prepares spawning substrate for fish. In the absence of water flow after diversion, the spawning ground is covered by sediment that limits fish recruitment. Snow carps are reported to be affected by the destruction of their spawning beds[29]. These impacts are significant in the dewatered sections (between the dam and tailrace) of the hydropower projects. About 20% of the main stem of the Swat River (including Gabral and Ushu) will only have environmental flows that will be released from all hydropower projects.
- **Obstacles in Fish Migration**. The snow carps migrate upstream and downstream in response to water temperature (See Section 5.3.3.2). The proposed hydropower development will construct a series of physical barriers and such structures prevent fish species from reaching their traditional areas of spawning and feeding, leading to changes in the composition of upstream and downstream species. The Munda dam will have the most significant impacts since it will be a reservoir project with a 215 m high dam and completely stops the fish migration between the Swat River and the Kabul River, including the migration of mahseer.
- **Fish Injury**. Mortality resulting from fish passage through hydraulic turbines or over spillways during downstream migration is unavoidable. Bottom feeders such as snow carp and mahseer. maybe pulled in the intake and killed by the hydropower turbines. Even riverine fish adapted to fast current may be affected.

[29] T.K. Shrestha (2019). Conservation and Management of Fishes in the Large Himalayan Rivers of Nepal (https://www.researchgate.net/publication/266862560_Conservation_and_Management_of_Fishes_in_the_Large_Himalayan_Rivers_of_Nepal.)

Table 8.7: Overall Impacts of the Swat Hydropower Development on Aquatic Environment

Direct Impact	Indirect Impact	Secondary Impact	Cumulative	Relevance to the Swat Basin Development
Conversion of a lotic into a lentic pond ecosystem	Habitat destruction (in both feeding and breeding grounds due to reduction of water discharges on the downstream of the dams)	• Eutrophication of reservoir • Effect of exotic and invasive fish species • Emission of methane from the reservoir • Effect on food chain • Effect on fish health	Loss of movement path, blockage in inter-connected pathways of migratory fish in the rivers, extinction of fish species	The height of proposed hydropower projects is generally less than 25 m (above riverbed) with limited reservoir area, and hence impacts associated with water quality changes are not expected to be significant.
The downstream riverine environment from the dam will be converted into a dry stretch	• Low flow • Habitat destruction • Destruction of spawning bed impacts on fish breeding • Obstruction of fish migration	• River aggradation • Increase inshore erosion • Change in water quality		The aquatic environment of about 20% of the main Swat River (including Gabral and Ushu) will be affected by dewatered sections between dam and tailrace and will have environmental flows that will be released from all hydropower projects. About 10% of the Panjkora River will be affected by dewatered sections and will have environmental flows that will be released from all hydropower projects.
Fish migration will be obstructed	Impact on fish breeding	Decrease in fish population		Snow carp's migration and its population will be affected. Mahseer migration is affected by the Munda dam

Source: see footnote[30] for the source of first four columns

[30] D.E. McAllister, J.F. Craig, N. David Source: D.E. McAllister, J.F. Craig, N. Davidson, S. Delany, and M. Seddon. 2001. Biodiversity Impact of Large Dams, Background Paper No. 1, Prepared for IUCN/UNEP/WCD

A recent study of the Asian Development Bank[31] has assessed potential impacts of the dams on the snow carp and mahseer species in Nepal rivers, and made the following recommendations based on the review of successful mitigation measures adopted in the Southeast Asia and South Asia regions:

- Projects can take various mitigation measures to facilitate fish movement across dams (such as providing fish ladder, fish passage, natural fish bypass channel, etc.) or
- Compensatory measures to maintain fish population such as (i) breeding fish in hatcheries and annually releasing them upstream and downstream of the dam to maintain their populations, (ii) improvement of spawning grounds, and (iii) catch and haul arrangement.

The study also assessed the effectiveness of environmental mitigation measures adopted in the operation of eight dam projects in Nepal. Despite the implementation of many mitigation measures, the fish population is found to be reduced in Kali Gandaki and Babar irrigation project. The main reasons are found to be lack of adequate monitoring and compliance on the environmental flow releases, limited budget for the operation of hatcheries, and non-maintenance of the fish ladders (removal of silt deposits).

The potential cumulative impacts all hydropower projects on the aquatic environment of Swat River will be minimized and compensated by the construction of fish ladders, the release of environmental flows to meet the requirement of fish habitats in the dewatered sections, and the release of native fish species into the rivers through fish hatcheries. Some hatcheries along the banks of River Swat have already been established by the KP Fisheries Department, one for Mahseer at Chakdara, one for Snow carps at Nagoha Shamozai, and one for brown trout at Madyan. All these hatcheries are functional, but these facilities are needed to be upgraded to be more efficient and productive.

8.2.3.3 Actions to Address Cumulative Impacts

PEDO will take the following actions to minimize and compensate for the impacts on aquatic ecology:

- Fish ladders will be built into the design of weirs to facilitate the movement and migration of fish on both upstream and downstream of the reservoir.
- Ensure year-round functionality of the fish ladder by always releasing the water and removing the sediment deposits in the ladder
- Fish movement and migration through the fish ladders will be monitored regularly to assess their adequacy (using sensors and underwater video cameras) and modify the designs if needed.
- Documentation of effectiveness fish ladder operation in the GKH to improve the fish ladder designs for other future hydropower projects
- Installation of appropriate screen devices at the intake to divert the fish from entering water intakes and protect the fish against entrapment.
- Ecological flows will be assessed based on the requirements of all water users (fish, riparian habitats, drinking, irrigation, tourism, cultural, etc.) in the dewatered sections (river-reach between the weir and tailrace) of the projects. The power generation of the projects will be optimized based on the requirements of environmental flows.
- Monitor the quality of the water from the reservoir and flows from under sluices
- The Environmental and Social Unit of the PEDO will closely work with the fisheries department to foster a mechanism to augment their fish hatcheries for the breeding of snow carp and mahseer and annually releasing them upstream and downstream of the weirs to maintain their population.

[31] Asian Development Bank, 2018. Impact of Dams on Fish in the Rivers of Nepal

8.2.4 Socio-economic Environment

8.2.4.1 Baseline Condition

Most of the population in the Swat basin live in rural areas, which are located extremely in remote terrain with no development intervention except in a few towns. The national-level labor force level in KP is low and was reported to be 35.42% in (2017-18). The most recent Labor Force Survey indicates a notable unemployment rate of 7.16% for KP when compared with the national level of 5.79%. Health care facilities are very limited in KP with 277 hospitals, 911 dispensaries, 132 maternity and childcare facilities, and 22,154 beds in all hospitals and dispensaries. There are very limited paved roads connecting the villages. In some villages, local access is usually through walking trails in the mountain range.

8.2.4.2 Cumulative Impacts

The cumulative impacts of the proposed construction of hydropower projects on the socio-economic environment will be employment generation and infrastructure development in rural areas, where most of the projects are located. The proposed infrastructure developments, including the development of electrification, water supply, and educational and health facilities by each project, are expected to lead to significant improvement of the socio-economic conditions in the project area. The local communities will be directly benefitted by the employment opportunities in both construction and operational activities, and also will be indirectly benefitted by the employment and business opportunities due to improved access to the nearby towns and markets. The potential employment opportunities at the project sites will also attract skilled workers from other areas of Pakistan. The influx of outside workers may have some impact on the local population. Potential cumulative impacts associated with employment generation and labor influx, and induced impacts from infrastructure development are further discussed below.

Employment. During the construction period, each proposed project will employ about 500 skilled and unskilled persons continuously for about four to five years. The employment opportunities will be increased during the peak construction period. In the near term, the demand for local goods such as construction materials and supply of food and other services for the project and workforce will temporarily increase. Hence, there will be a significant positive impact on local employment and the economy during the construction period. During operation, after the project is completed, each hydropower project will employ about 50 people, and some of these opportunities will go to the local communities.

Labor Influx. The overall labor requirement of proposed hydropower development projects will be about 10000[32], which provides employment opportunities for skilled and unskilled labor, and will attract an influx of migrant labor from inside and outside of Pakistan as the local market has limited capacity in terms of the skilled labor force. Out of the expected labor requirements, 25% (2500) will be migrant labors (of which 50% will be foreigners and 50% Pakistanis but outside of the Project area). About 75% of the labor (7500) will be local labor. The influx of labor into the project site area for a period of four to five years may increase the risk of social tensions between the local community and the construction workers. Construction workers are predominantly younger males. Those who are away from home on the construction job are typically separated from their family and act outside their normal sphere of

[32] Approximate labour requirement for each project will be 500, and for total 20 projects would be 10000. About 25% of the labour will be skilled and consists of mostly outsiders and foreigners and remaining 75% would be locals. During peak Construction period, the requirement of local labor may increase upto 10,000 to 12,000.

social control. This can lead to inappropriate and behavior, such as sexual harassment of women and girls, exploitative sexual relations, and illicit relations with the local community.

The incremental impacts of the Gabral Kalam hydropower project to the overall cumulative impacts are expected to be significant on local employment, but not on labor influx due to the inclusion of adequate measures to address risks with labor influx. In addition, a social development plan (with a provision of USD 5 million) is included project budget to implement community-based social infrastructure projects such as water supply and sanitation schemes, education, and health facilities and access roads.

8.2.4.3 Induced Impacts

The proposed infrastructure for hydropower development including electrification in the project areas may trigger induced developments such as urbanization, communication, business, tourism, industrialization, etc. These induced developments will have both positive and negative impacts. The positive impacts are improved socio-economic conditions in the region through employment generation and poverty reduction. The adverse impacts are air and noise pollution due to construction activities and increase in traffic levels, generation of more solid waste due to improved living standards, consequent health impacts due to pollution, clearance of forest resources and loss of biodiversity, and land acquisition and resettlement for the induced developments.

Most of the adverse impacts associated with induced development can be minimized by interventions of local government and regulatory agencies such as revenue and planning departments, environmental protection agencies, and forest department and wildlife departments in approval of planning of these developments and overseeing of their implementation.

8.2.4.4 Actions to Address Cumulative Impacts

PEDO will take the following actions to address the impacts on the socio-economic environment:

- Preference will be given to the local population in construction activities. The local communities will be hired to the maximum extent for skilled, semi-skilled and unskilled labor. The contractors will be required to implement a skill development program for the local population prior to their employment.
- A Social Development Plan will be implemented at all projects' areas, similar to the plan proposed for GKH. Various community-led infrastructure projects such as electrification, water supply and sanitation, education and health facilities, and access roads will be implemented under each project.
- The impacts on labor influx will be mitigated by maximizing the use of the local communities in employment and implementing a code of conduct and labor influx management plan.

8.3 A Summary of All Actions to Address Cumulative Impacts

A summary of all actions, to address the overall cumulative impacts of the proposed hydropower development in the Swat basin, are given below.

- Environmental assessments will be carried out for all proposed projects in accordance with the World Bank safeguard policies and guidelines, in addition to the national and provincial regulatory requirements.
- Detailed ecological baseline studies will be carried out as part of the ESIA studies and develop adequate mitigation plans to address all potential impacts on the ecological environment.
- Fish ladders will be built into the design of weirs to facilitate the movement and migration of fish on both upstream and downstream of the reservoir. Fish movement and migration through

the fish ladders will be monitored to assess their adequacy and modify the designs if needed. Installation of appropriate screen devices at the intake to divert the fish from entering water intakes and protect the fish against entrapment.

- Ecological flows will be assessed based on the requirements of all water users (fish, riparian habitats, drinking, irrigation, tourism, cultural, etc.) in the dewatered sections (river-reach between the weir and tailrace) of the projects. The power generation of the projects will be optimized based on the requirements of environmental flows. Regularly monitor whether the released environmental flows meet the requirements the water uses and adjust the environmental flows if needed.
- Impacts on the community game reserves and natural habitats will be minimized by avoiding the sensitive wildlife habitats and optimizing the design of the project facilities with minimum footprints.
- Tree plantation and wildlife conservation programs will be taken up in all the project sites by supporting the forest and wildlife departments.
- All hydropower projects in the Swat River basin will be operated for baseload power generation since the peaking operations will affect the irrigation system downstream.
- Maximizing the use of local skilled, semi-skilled and unskilled labor from the local communities for all project-related employment and implementing a code of conduct and labor influx management plan for the outside workers.
- A Social Development Plan will be implemented at all projects' areas, similar to the plan proposed for GKH. Various community-led infrastructure projects such as electrification, water supply and sanitation, education and health facilities, and access roads will be implemented under each project.
- The Environmental and Social Unit of the PEDO will closely work with relevant stakeholders (forest, wildlife, and fisheries departments of the province) and staff of proposed hydropower projects to ensure the impacts associated with each hydropower project are minimized. PEDO will also work closely with the fisheries department to foster a mechanism to augment their fish hatcheries for the breeding of snow carp and mahseer and annually releasing them upstream and downstream of the weirs to maintain their population.
- Importantly, the PEDO will conduct a comprehensive cumulative impact assessment study to better understand the environmental and social impacts and opportunities for hydropower development in the Swat River basin, consistent with the principles of sustainability. The study will be carried out in conjunction with Component B of the parent Program (KPHREDP). The component involves the preparation of a long-term integrated plan for the development of renewable energy and hydropower resources in the province, and sequencing of the investment program over 10 years, 20 years and 30 years periods considering priorities. The terms of reference (ToR) for the proposed cumulative impact assessment study is given in **Annex 5**.

9 Environmental and Social Management Plan

This chapter describes the proposed institutional mechanism, mitigation and monitoring plans for management of environmental, social, safety and health issues of the Project, and inclusion of mitigation and monitoring measures in contractors bidding documents

9.1 Objectives of ESMP

The basic objective of the ESMP is to manage the adverse impacts of project interventions in a way, which minimizes the adverse impact on the environment and people of the project area. The specific objectives of the ESMP are to:

- Facilitate the implementation of the mitigation measures identified during the present ESIA and discussed earlier in the document;
- Draw responsibilities for PEDO, contractors, consultants, and other members of the Project Team for the environmental and social management of the Project;
- 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;
- Implement environmental training programs for the implementation staff.

9.2 Institutional Arrangements for ESMP Implementation

The Institutional arrangements for the implementation of ESMP are given in **Figure 9.1**.

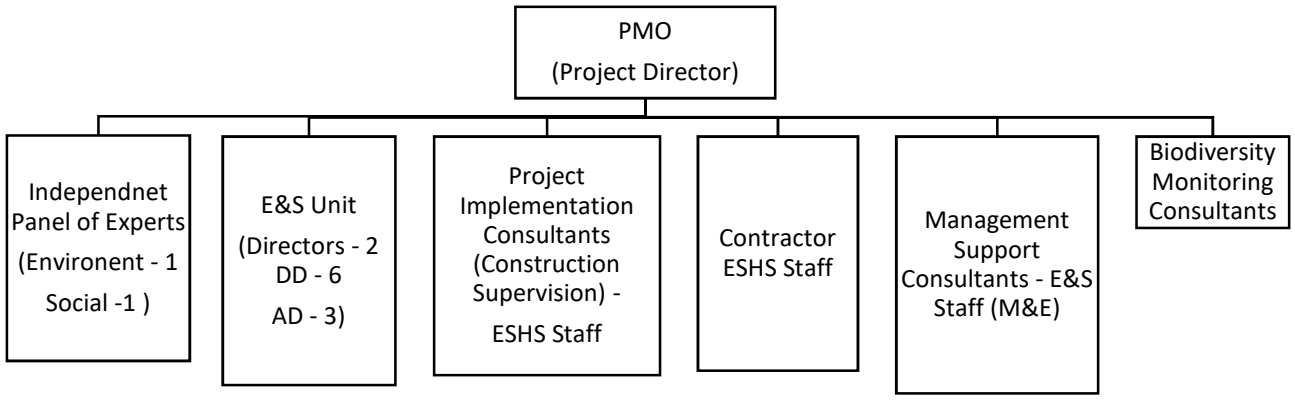

Figure 9.1: Organogram for Environmental and Social Management of the Project

9.2.1 Project Management Office

Pakhtunkhwa Energy Development Organisation (PEDO) is the implementing agency of the Project. PEDO will establish a Project Management Office (PMO) to monitor and coordinate all project implementation activities. PMO would be responsible for all aspects of project implementation, including technical, operational, financial management, and overseeing the implementation of ESMP.

PEDO has an existing 'Environmental and Social Unit (ESU),' for the management of environmental and social impacts of the Program. PEDO will depute these specialists to PMO to ensure the effective implementation of ESMP.

Details of environmental and social staff associated with various consultants and contractors to be engaged under the Program are summarized below:

- **Environmental and Social Staff in the PEDO/PMO.** The Environmental and Social Unit (ESU) of PMO includes the following staff:
    - Two Directors (one for the environment and one for social)
    - Three Deputy Directors (one each for the environment, OHS, Social Development)
    - Six Assistant Directors (two per each Deputy Director)

The PMO is headed by the Project Director. The responsibilities of the environmental and social staff of ESU are:

(i) supervising, facilitating and coordinating the implementation of environmental and social plans including ESMP and RAP;
(ii) inclusion of ESMP in the contract documents and preparation of relevant specifications and conditions, and review the bidding documents
(iii) ensuring that contractors follow KP EPA regulations, World Bank Safeguard Policies, and other requirements mentioned in the ESMP and RAP;
(iv) identifying any issues of non-compliance and report them;
(v) suggesting mechanisms to link contractor performance in relation to the ESMP to the timing of financial payments, incentives or penalties;
(vi) interacting with stakeholders for their concerns about the construction activities, (vii) development of local area development programs, and
(vii) prepare quarterly monitoring reports on ESMP implementation.

9.2.2 Project Implementation Consultant or Construction Supervision Consultants (CSC).

The Project Implementation Consultants (PIC) will act as Construction Supervision Consultants (CSC). The CSC will be responsible for supervising the contractors for the implementation of ESMP. For this purpose, the CSC will appoint dedicated environmental, social, health and safety (ESHS) staff to ensure the implementation of environmental and social management plans during the project. They will supervise the contractor for the ESMP implementation, particularly the mitigation measures. They will also be responsible for implementing the monitoring of the effects of these measures.

CSC will have the following environmental and social safeguard staff:

- Environmental specialist
- Occupational Health and Safety Specialist
- Ecologist
- Social Specialists
- Environmental, Social, and Health & Safety (ESHS) Inspectors (six staff)

The ESHS staff of CSC will closely supervise the construction works to ensure that all environmental commitments are incorporated into the construction activities and work processes. Specific responsibilities of these staff include:

- Supervising and supporting contractors in achieving their responsibilities as outlined in the ESMP

- Review and approve the Contractor's site-specific plans on ESMP and OHS implementation
- Regular safety audits at the worksites;
- Issuing non-compliance notices to the contractors
- Providing input, advice, and approval on activity-specific work plans relating to ESMP
- Supervising the implementation of activity-specific work plans
- Regularly reviewing and assessing ESHS risks throughout the construction phase;
- Identifying and preparing environmental induction and training materials;
- conducting ESHS trainings;
- Assist PMO in addressing and resolving ESHS complaints and grievances
- Responding to environmental incidents as required;
- Managing compliance reporting as it relates to the Project, and preparing monthly ESMP compliance reports; and
- Liaise with PMO for effective environmental and social management at the site;

9.2.3 Management Support Consultant (MSC)

The Management Support Consultants (MSC) support in project management and carrying out day to day activities of PEDO. Support various departments of PEDO in operation of various functions; Oversee Budgetary and financial Management; Prepare and assist in implementing Quality Control and Quality Assurance Plan; Contractual advice, variation orders, and settlement of disputes claims; Support in Implementation of the safeguard plans. MSC will also carry out independent monitoring of the implementation of ESMP. The MSC will have environmental and social experts and shall carry out intermittent third-party monitoring of the project. MSC will also carry out annual third-party auditing of ESMP and make further modifications if required.

9.2.4 Planning Consultant

The Planning Consultant will work for the overall Program (not for the GKH) to develop a Comprehensive Plan for Hydropower and Energy Systems in KP through (i) Assessment and Appraisal of potential hydropower and alternative renewable energy sites in KP, and preparation of a long-term integrated plan for development of renewable energy and hydropower resources in the province, and (ii) Sequencing of the investment program over 10 years, 20 years and 30 years periods considering priorities, objective agreed criteria, demands and implementation constraints, etc. and electricity price for the generators and consumers. The Consultant will also carry out feasibility studies for some priority subprojects.

9.2.5 Contractor

The contractor is also required to appoint the following environmental staff for the implementation of ESMP in the field, particularly the mitigation measures.

The contractor will develop various plans directed towards health, safety, the environment and social issues (discussed in Section 9.5.2) and get them approved by the CSC,PMO and the World Bank. The contractor will also be responsible for communicating with and training of its staff in the ESHS aspects before the commencement of the physical works on site. The contractor's ESHS team will include the following team members:

- ESHS Manager
- Environmental Officer

- OHS Officer
- Social Officer
- ESHS Site Supervisors (one supervisor at each site)

9.3 Environmental Approvals and Permits Required for Project Implementation

Environmental clearances and permits required during the implementation of the Project are given in **Table 9.1**. PEDO and its Contractor will obtain these approvals from the relevant government departments during implementations.

Table 9.1: Environmental Approvals and Permits Required during Implementation of the Project

#	Details of Approval and Permits	Issuing Authority	Requirements	Responsible Agency	Timing
1	**Environmental Approval** for the overall construction of the Project	KP EPA	Submission of this ESIA	PEDO	Prior to Construction of the Project
2	**Environmental Approval** for establishing crusher plants	KP EPA	Submission of IEE Application	Contractor	During the construction phase
		Forest Department	Submission of Request	Contractor	During the construction phase
		Industries Department	Submission of Request with layout and location maps	Contractor	During the construction phase
		Mines and Mineral Department	Submission of Request	Contractor	During the construction phase
3	**Permit** for storage of blasting material	Deputy Commissioner of District	Submission of a request with the location map of the explosive store	Contractor	During the construction phase
4	**Permit** for the transport of blasting material	Chief Inspector of Explosives	Submission of a request along with a recommendation letter from the Employer	Contractor	During the construction phase
5	**Permit** for cutting of forest trees	Forest Department	Submission of a request	PEDO	During the construction phase
6	**Permit** for the use of quarry and excavated material	Mines and Mineral Department	Submission of a request with the location map of the quarry area	PEDO will sign the lease agreement and handover it to the contractor	During the construction phase
7	Batching Plant	KP-EPA	NOC is not required for establishing a batching plant, but the project has to inform EPA about the facility with a surety that all mitigation measures to control pollution will be adopted.	Contractor	During the construction phase
8	**Environmental Approval** for the operation of the Project	KP EPA	Submission of a compliance report on the implementation of	PEDO	After completion of the Construction and prior to

#	Details of Approval and Permits	Issuing Authority	Requirements	Responsible Agency	Timing
			conditions and recommendations given in the Environmental Approval for construction.		operation

9.4 Inclusion of ESMP in contract documents

In order to make the Contractors fully aware of the implications of the ESMP and responsible for ensuring compliance, technical specifications in the tender documents will include compliance with mitigation measures proposed in ESMP. The Contractor will be made accountable through contract documents for the obligations regarding the environmental and social components of the project.

PMO will include the following Environmental, Social, Health and Safety (ESHS) Conditions in the bidding documents:

- Past performance of the Contractor on ESHS aspects including sexual exploitation and abuse and gender-based violence;
- ESHS Staff with the Contractor;
- Performance Security;
- Mitigation measures to address construction impacts;
- Payments for implementation of ESHS measures;
- Code of conduct of Contractor's Personnel;
- Management Strategies and Implementation Plans (MSIP) to manage the ESHS Risks.

Each of the above conditions is elaborated in **Table 9.2**.

Table 9.2: ESHS Conditions in the Bidding Documents

Condition	The rationale for the inclusion of this Condition in the Contract	Specifications to be included in the Bidding Documents	Responsibility	
			Bidders	PMO
1. Past performance of the Contractor on ESHS is one of the eligibility criteria for the shortlisting process	The contractor's past performance on compliance with ESHS is an indicator of the contractor's commitment and capability for implementation of the ESMP	The Bidder shall "declare any civil work contracts that have been suspended or terminated and/or performance security called by an employer for reasons related to the non-compliance of any environmental, or social (including sexual exploitation and abuse (SEA) and gender-based violence (GBV) or health or safety requirements or safeguard in the past five years."	Bidder to make the Declaration	PMO use this information to seek further information or clarifications in carrying out its due diligence
2. Contractor shall propose adequate ESHS staff in his team	The Contractor's staff should include an ESHS Manager who is responsible for the implementation of all mitigation measures on ESHS risks and compliance with ESMP	The bidder shall propose adequate ESHS staff, which shall include at a minimum an ESHS Manager, an Environmental Officer, an OHS Officer, and a Social Officer with adequate ESHS Site Supervisors (one supervisor at each site) The Bidder shall provide details of the proposed ESHS Manager, including	The bidder to submit the CV of the proposed ESHS Manager	PMO will review and approve

Condition	The rationale for the inclusion of this Condition in the Contract	Specifications to be included in the Bidding Documents	Responsibility	
			Bidders	PMO
	with the following support staff (i) Environmental Officer, (ii) OHS Officer, (III) Social Officer, and (iv) adequate ESHS Site Supervisors	academic qualifications and work experience. The ESHS Manager should have a minimum bachelor's degree in engineering or a master's degree in sciences related to environmental management. The Specialist should have 10 years of experience working on monitoring and managing ESHS risks related to hydropower projects.		
3. Contractor shall submit ESHS Performance Security for compliance with ESHS obligations	The Contractor should have a financial implication if he could not comply with ESHS requirements. Hence performance security will be collected from the contractor	The Bidder shall submit the ESHS Performance Security in the form of a "demand guarantee" in the amount of one percent (3%) of the Contract Amount.	The bidder will submit a Performance Security	
4. Implement Mitigation Measures to Address Construction-Related Impacts given in ESMP	The mitigation measures to address potential ESHS risks and impacts should be included in the bidding documents. The contractor shall be made responsible for the implementation of the mitigation measures through the necessary conditions in the contract.	PMO will include **Table 9.1** (on environmental permits), **Table 9.3** (measures during pre-construction), **Table 9.4** (measures during construction), **Table 9.5** (monitoring measures during construction) and ECPs (**Annex 1**) of the ESMP in the General Specifications of the Bidding Document, and the reference to these tables will be provided in the Conditions of the Contract as follows: • The Contractor shall implement the mitigation and monitoring measures given in the ESMP to address ESHS risks associated with the construction works. The Consultant shall refer to the ESIA of the Project, which is available on the PEDO website for further guidance. • The Contractor shall comply with the World Bank Group's General Environmental Health and Safety Guidelines and Environmental Code of Practices (**Annex 1**)		PMO will include this condition in the bidding document
5. Payments for implementation of ESHS Mitigation and Monitoring	BOQs on ESHS implementation are included in the Bidding Documents	The budget will be allotted for the preparation and implementation of C-ESMP (including OHS plans), and monitoring plans. The items given in the ESMP budget will be included in the BOQ, and the bidder shall quote the	Bidder will quote for the ESHS Management	PMO will include this in the general specifications of the bid document

Condition	The rationale for the inclusion of this Condition in the Contract	Specifications to be included in the Bidding Documents	Responsibility	
			Bidders	PMO
Measures		amount against these items.		
6. Code of Conduct for Contractor's Personnel	All workers hired by the Contractor should sign a code of conduct to ensure compliance with ESHS obligations of the Contract	The Bidder shall submit the Code of Conduct that will apply to the Contractor's employees and subcontractors. The Code of Conduct will state that the workers will comply with the following ESHS requirements: • Wearing of Personal Protective Equipment (PPE's) in the workplace at all times • Non-discrimination in dealing with the local community by race, ethnicity, gender, religion, disability, sexual orientation, gender identity, social, or health status • Respectful attitude while interacting with the local community • Prohibit sexual harassment particularly towards women and children • Prohibit violence, including sexual and/ or gender-based violence • Respecting the reasonable work instructions • Protection and Proposer use of the property • Awareness raising, communication and dissemination of information campaigns for employees, workers and communities residing in AOI on SEA, SH and GRM.	Bidder shall submit code of Conduct with the bid documents	
7. Contractor's Management Strategies and Implementation Plans (MSIP) to manage the ESHS Risk	The Contractor proposal should include his understanding of the ESHS requirements of the project and the proposed strategies to manage the ESHS risks	The Bidder shall submit Management Strategies and Implementation Plans (MSIP) to manage the following key ESHS risks: • Strategy for the protection of workers and community from the construction-related hazards inside the terminal • Pollution prevention (wastewater, air and noise emissions) and management • A waste management plan for proper collection and disposal of waste • Traffic management plan to ensure the safety of local communities from	The bidder will submit MSIP along with the Bid Documents	

Condition	The rationale for the inclusion of this Condition in the Contract	Specifications to be included in the Bidding Documents	Responsibility	
			Bidders	PMO
		construction traffic • Hazardous material management plan safe storage and handling • Strategy to address labor influx impacts on the local communities • Gender-based violence and sexual exploitation and abuse prevention and response action plan • Emergency response plan and early warning system The Contractor shall be subsequently required to submit (before mobilisation) Contractor's Environment and Social Management Plan (C-ESMP) by the above strategies and Condition 4 of this Table.		

9.5 Environmental and Social Management During Construction

9.5.1 Environmental Codes of Practices

The ECPs will provide guidelines for best-operating practices and environmental management guidelines to be followed by the contractors for sustainable management of all environmental issues. These ECPs have been prepared based on the experiences in the construction of hydropower projects, including World Bank-funded hydropower projects in Pakistan and also in conformity with the WBG EHSGs and Good International Industry Practice. The ECPs are presented in **Annex 1** and will be included in the bidding documents (**item 4 of Table 9.1**) to ensure their implementation.

The list of ECPs prepared for the Project is given below.

- ECP 1: Waste Management
- ECP 2: Fuels and Hazardous Goods Management
- ECP 3: Water Resources Management
- ECP 4: Drainage Management
- ECP 5: Soil Quality Management
- ECP 6: Erosion and Sediment Control
- ECP 7: Topsoil Management
- ECP 8: Topography and Landscaping
- ECP 9: Quarry Areas Development and Operation
- ECP 10: Air Quality Management
- ECP 11: Noise and Vibration Management
- ECP 12: Protection of Flora
- ECP 13: Protection of Fauna
- ECP 14: Protection of Fish
- ECP 15: Road Transport and Road Traffic Management
- ECP 16: Labour Influx Management and Construction Camp Management

- ECP 17: Cultural and Religious Issues
- ECP 18: Workers Health and Safety
- ECP 19: Tunneling and Underground Construction Works
- ECP 20: Instream Construction Works (Diversion, Coffer Dam and Dam Construction)

9.5.2 Pre-construction Stage Mitigation Plans

Pre-construction stage will mainly include the mobilisation of the contractor and finalisation of the following conditions/documentation by the Contractor:

- Contractor's Environmental and Social Management Plan (C-ESMP) with site-specific management plans;
- Labour Management Procedures to be followed for hiring and management of labour;
- The mobilisation of ESHS Specialists

Each of the above conditions is elaborated in **Table 9.3**.

Table 9.3: ESHS Conditions in the Pre-Construction Stage

Condition	The rationale for the inclusion of this Condition	Description of the Condition	Responsibility	
			Implementation	Supervision
1. Preparation of Contractor's Environmental and Social Management Plan (C-ESMP)	The Contractor shall submit site-specific management plans to address ESHS risks following the ESMP requirements and MSIP proposed in the bid documents.	The Contractor to submit for approval and subsequently implement their Environment and Social Management Plan (C-ESMP). The C-ESMP should be submitted prior to the commencement of construction works, and no construction activities will be carried out under the project until approval of the C-ESMP. The C-ESMP will include the following site-specific management plans on: • Occupational health and safety management plan • Community health and safety management plan • Camp management plan • Waste management plan • Wastewater discharges management plan • Air and noise emissions management plan • Hazardous material management and spill control plan • Water supply and sanitation management at the worksites and workers' accommodations • Management of labour influx and facilities for the foreign workers • Labour recruitment procedures	Contractor	PMO, CSC

Condition	The rationale for the inclusion of this Condition	Description of the Condition	Responsibility	
			Implementation	Supervision
		and labour management • Traffic management plan • Training plan for ESHS risks including HIV/AIDS, sexual exploitation and abuse, and gender-based violence • Emergency Response Plan • Grievance Redress Mechanism • Demobilization plan after completion of works		
2. Mobilisation of ESHS Specialists	The ESHS Specialists should be mobilised during pre-construction for preparation of C-ESMP	The Contractor shall submit the CVs of following ESHS Specialists for PMO review and approval, and mobilise them • ESHS Manager • Environmental Officer • OHS Officer • Social Officer The ESHS Specialists should be present at the site throughout the construction period.	Contractor	PMO, CSC
3. Environmental approvals and permits during constructions	Government permits are required for carrying out some activities (see **Table 9.1**)	Contractor shall obtain the necessary approvals and permits for establishing crushing and batching plants, and storage and transport of blasting material	Contractor	PMO, CSC
4. The hiring of Construction Labour	Hiring procedure for construction workers including the signing of code of conduct	The procedures will include terms and conditions of employment, including hours of work, wages, overtime, compensation and benefits, holidays, leaves, and so on. The procedures will set out measures to prevent and address harassment, intimidation and/or exploitation. All workers shall sign the code of conduct (see Item 6 of Table 9.2) and they will be terminated from employment if not complied with the code of conduct.	Contractor	PMO, CSO
5. Construction camp and storage facilities	The contractor will need areas for setting up camp and storage areas.	Contractor shall set up camp and storage facilities within sites approved by the PMO with the adequate facilities	Contractor	PMO

9.5.3 Construction Stage Mitigation Plans

Detailed mitigation plans for construction stage impacts have been prepared on the basis of the detailed impact assessment covered under Chapter 7 and presented in **Table 9.4**. These plans are project-specific, and to the extent possible, site-specific, however, contractors will be required to carry out further detailing of the key aspects, to prepare site-specific management plans as part of C-ESMP for review and approval of PMO.

Table 9.4: ESHS Impacts and Risks in Construction and Mitigation Measures

(**Note**: PMO will include this Table in the Contract Specifications of the Bidding Documents)

Impact	Mitigation Measures	Generic Mitigation Measures	Responsibility	
			Implementation	Supervision
1. Generation of spoils (excess excavation) and their disposal	• Minimize the generation of spoils by reusing the excavated rock to the maximum extent possible by using them as the aggregate material in the concrete works, and filling of embankments and road works • Transport and disposal of spoils and designated muck disposal sites • Proper dumping and adequate compaction to avoid dust and release back to the river • Some disposal sites have been identified on the eroded riverbanks, which were originally agricultural lands. These lands can be reclaimed through the placement of spoils and providing soil layer at the top. These sites will be handed over to the landowners. During consultations, local communities have also offered to use their lands for disposal of spoils, if additional land is required. • Landscaping of the spoil sites, that were in the permanently acquired lands, after completion of works	Implement measures in the following ECPs: ECP 1 ECP 5 ECP 6 ECP 10	Contractor	PMO CSC
2. Generation of construction waste including hazardous waste	• Before commencing the construction activities, the contractor will be required to prepare a Waste Management Plan and submit it to the PMO for their review and approval. • The contractor will place containers of adequate size and numbers in place for the collection of various types of wastes (metal, rubbers, used fuels, batteries, etc.) from the worksites, and transport these wastes regularly to a centralized facility. • The contractor will procure the services of a waste management contractor for transport and treatment of hazardous waste, and management of recyclable waste. • For disposal of inorganic construction waste, the contractor will develop a waste management site or place them in the spoil disposal areas.	Implement measures in the following ECPS: ECP1 ECP 2	Contractor	PMO CSC
3. Generation of solid	• Before commencing the construction activities, the contractor will be	Implement	Contractor	PMO

Impact	Mitigation Measures	Generic Mitigation Measures	Responsibility	
			Implementation	Supervision
waste from worker's campsites and offices	required to prepare a Waste Management Plan and submit it to the PMO for their review and approval. • Collection and segregation of solid waste into kitchen waste (organics), paper, and plastic (recyclable) and garbage (non-recyclable). Three kinds of waste bins (with different colours) with adequate numbers and capacities will be placed at the campsite (kitchen, offices, rooms) for the segregation of the waste at source. • Organic waste will be treated through in-vessel composters and the compost will be given to the local communities to use in the agricultural lands. • Procure the services of waste management contractors for the collection and management of recyclable waste. Recyclable waste will be compressed through bailers to minimize the volume of waste to be stored and transported. • Develop a waste disposal site for disposal of garbage.	measures in the following ECPs: ECP 1 ECP 16		CSC
4. Wastewater discharges from the construction camps, sites, and batching plants	• Sedimentation ponds, of adequate size and capacity, will be built for the treatment of discharges from the batching plants and the tunnels to allow the sediments to settle. Final discharges from the sedimentation ponds shall comply with NEQS for wastewater discharges into the rivers. Frequently monitor the pH values and If the pH values high, add online buffering solutions to settlement ponds for control of pH. The settled sediments will be periodically removed and will be disposed of at the designated spoil disposal sites. • Construction of wastewater treatment facilities at the campsite (e.g., septic tank and soak pit) and site drainage • The contractor will be required to take appropriate measures to avoid and contain any spillage and pollution of the water • The contractor will prepare and implement a Pollution Prevention Plan prior to the start of the work. • Quarterly monitoring of wastewater quality to ensure compliance with NEQS	Implement measures in the following ECPs: ECP 3 ECP 4 ECP 16	Contractor	PMO CSC

Impact	Mitigation Measures	Generic Mitigation Measures	Responsibility	
			Implementation	Supervision
5. The risk of soil pollution by construction works	• Storage of fuels and chemicals in contained facilities and take appropriate measures to avoid and contain any spillage • confine the contaminants immediately after such accidental spillage and cleanup of oil spills using spill kits. • Collect contaminated soils, treat and dispose of them as a hazardous waste • Topsoil from cultivated lands in the construction areas to be stripped and stockpiled where practical for later use for restoration of spoil disposal sites. • Temporary stockpiles to be protected from erosion.	Implement measures in the following ECPs: ECP 5 ECP 6 ECP 7	Contractor	PMO CSC
6. Air and noise pollution from construction	• Construction equipment and vehicles will be well maintained so that emissions are minimal and comply with emission standards of NEQS. • Crushing and batching and asphalt plants will be located a minimum 500 m away from residential areas and will have appropriate dust/emission suppression mechanisms such as wet scrubbers • Dust generation from construction sites would be restricted as much as possible, and water sprinkling would be carried out through the construction period. • Construction activities near the settlements will be limited to daytime only • High noise-producing equipment will be provided with mufflers or acoustic enclosures. • Blasting methods should be selected to minimize dust and fly rock emissions. • Regular monitoring of air and noise quality to ensure compliance with NEQS on ambient air and noise quality • A quarterly air and noise quality monitoring will be carried out in the project area • A GRM will be put in place to receive complaints from the public on various aspects of environmental issues, including noise pollution. These grievances will be addressed by the contractor by adopting the necessary measures	Implement measures in the following ECPs: ECP 10 ECP 11	Contractor	PMO CSC
7. Sourcing of aggregates	• The contractor shall use the designated quarry sites recommended	Implement	Contractor	PMO

Impact	Mitigation Measures	Generic Mitigation Measures	Responsibility	
			Implementation	Supervision
for concrete works	by the PEDO or government-approved quarry sites for the procurement of aggregates. • Reuse of excavated material from the construction sites to the extent feasible • Source the material from the surface boulders from the eroded riverbanks in the proposed reservoir area (which are found to be suitable for aggregates) • Although the material is widely available, the quarrying/mining activities shall be limited to fewer areas to reduce the area of extent affected by quarrying activities. If any mining activities are to be carried outside the project area, they should be not be located in any sensitive areas. • Maintain setbacks (which could include placement of berms) between sediment extraction areas and the low flow channels in order to reduce the low flow season impacts. These would include that excavations are set back at least 5 m from the main low flow channel and minimizing the activities that release fine sediment to the river. • Maintain a buffer zone of 5 to 10m between the low flow channel and the mining operations to minimise the downstream impacts, and limit the excavation activities to the low flow season. • Implement the generic measures and best practices on quarry areas development and operation that are given in World Bank Group EHS Guidelines for Construction Materials Extraction	measures in the following ECPs: ECP 9		CSC
8. Impact on river habitat due to construction activities and drying of river section between two cofferdams	• The open diversion channel shall be inspected regularly to ensure the safe passage of fish. • If any fish is stranded in the dry riverbed, it shall be relocated to the downstream • Control of wastewater and sediment releases to river particularly in the section between cofferdams • Prevent the release of silt, sediment, sediment-laden water, raw concrete, concrete leachate, or any other deleterious substances into the River. • Ensure equipment and machinery are in good operating condition	Implement measures in the following ECPs: ECP 3 ECP 4 ECP 14	Contractor	PMO CSC

Impact	Mitigation Measures	Generic Mitigation Measures	Responsibility	
			Implementation	Supervision
	(power washed), free of leaks, excess oil and lubricants, and grease. • Machinery leaking fuel, lubricants, hydraulic fluids, or solvents shall not work within the river. • Keep a spill containment kit readily accessible onsite in the event of a release of a deleterious substance to the environment. Train onsite staff in its use. • Regular monitoring of the aquatic habitat and fish species during the construction activities			
9. Impacts on flora and fauna from construction activities	• The contractor's code of conduct for workers will include conditions on the protection of flora and fauna and ban on cutting of trees and ban on hunting and poaching of wildlife. Employees found violating would be subject to strict actions including fines and termination of employment. • Awareness-raising to workers on the protection of flora and fauna, including the awareness on the conservation value of the Bhan Valley Community Game Reserve • The dense vegetation will only be cleared once it has been established that any individuals present have fled. Before and during vegetation clearance or tree felling, any animals found will be removed and released to a safe place. There should be no burning of natural vegetation. The borrow animals, if found during excavation, shall also be transported to a safe place. • Use of non-wood fuel for cooking and heating • Artificial lighting used on construction sites and camps at night will be shaded and directed downwards to avoid light spillage and disturbance to nocturnal birds, bats, and other wildlife. • No organic waste will be disposed of in the open places	Implement measures in the following ECPs: ECP 12 ECP 13	Contractor	PMO CSC
10. Workers Safety risks	• The contractor will be required to prepare, obtain approval of, and implement an occupational health and safety (OHS) plan. These plans will be prepared in compliance with the World Bank Group's EHSGs, International Tunnel Association, ECPs in Annex 1, GoKP regulations on Factory Act 2013, Industrial Relations Act 2013, and Workers Compensation Act 2013. If these guidelines cannot address any specific aspect of OHS, international good practices such as	Implement measures in the following ECPs: ECP 18	Contractor	PMO CSC

Impact	Mitigation Measures	Generic Mitigation Measures	Responsibility	
			Implementation	Supervision
	OSHA and ILO will be applied. OHS Plan should contain general guidance for all identified hazards under each work activities, and site-specific OHS hazard and risks during construction, and control and preventive Measures proposed by the Contractor. • OHS Plan should contain general guidance for all identified hazards under each work activities and they should be presented in three discrete headings, (a) Contractor's Standards on the identified hazard management, (b) Expected Site-specific OHS hazard and risks during construction, and (c) Control and Preventive Measures proposed by the Contractor. • The OHS plan will be reviewed and approved the Construction Supervision Consultant and the World Bank • Conduct a 'job hazard analysis' at the new construction site to identify potential hazards that may arise from the proposed works or working conditions to the project workers and implement necessary control measures. The job hazard analysis should be part of the contractor's method statements, which will be reviewed and approved by the OHS Specialists of the supervision consultants. The specialists will also visit the construction sites, prior to the start of construction, to ensure the control measures are in place. • Regular site inspections and safety audits by the construction supervision team, both by the OHS specialists and the site engineers. Since the site engineers will present at the worksites all the time, they will be trained by their OHS team on monitoring safety aspects of the construction works. • Regular training program for workers on occupational health safety (monthly training and daily toolbox talks). Special attention will be focused on safety training for workers to prevent and restrict accidents and on the knowledge of how to deal with emergencies. • Incident investigation and reporting, including A complete record of accidents and near misses, will be maintained. • In order to protect all project personnel and visitors, the Contractor will provide personal protective equipment (PPE) for workers, such as safety boots, helmets, masks, gloves, protective clothing, goggles,	ECP 19 ECP 20		

Impact	Mitigation Measures	Generic Mitigation Measures	Responsibility	
			Implementation	Supervision
	fully face eye shields and ear protection. The contractor will also provide training to workers on how to use them and maintain in a sanitary and reliable condition and replace the damaged ones immediately with the new one. • Availability of firefighting, ambulance, medical and rescue facilities at the site for implementation of an emergency response plan • Adequate water supply and mobile toilets, medical and first aid care facilities at the worksites • Contractors will have dedicated and qualified staff for ensuring compliance with the OHS Plan • Awareness-raising material will be used including posters, signage, booklets, and others at the worksites • A complete record of accidents and near misses will be maintained. • First aid facilities will be made available at the worksites and in the camps. The contractors will engage qualified first aider(s).			
11. Occupational health risks in construction	• The contractor will develop and implement a camp management plan • The construction camp will be built with all adequate facilities (safe drinking water and sanitation, kitchen, rest areas, etc.) including entertainment facilities so that there will be minimal interaction between them and local communities • A medical clinic, with a medical doctor and attendants, will be established at the campsite. Regular health checkups of the workers will be carried out. • The Contractor shall establish a mechanism to collect the complaints from the workers and address those complaints by the approved GRM plan	Implement measures in the following ECPs: ECP 16 ECP 18 ECP 19 ECP 20	Contractor	PMO CSC
12. Safety hazards due to increased traffic especially for children and elderly people	• Traffic Management Plan (with adequate measures such as avoiding school hours, following sped limits, hiring licensed drivers, etc.) will be implemented with the aim of ensuring access to residential areas, and preventing unsafe situations, especially near schools, housing areas, construction areas • Road signage will be fixed at appropriate locations to reduce safety hazards associated with project-related vehicular traffic.	Implement measures in the following ECPs: ECP 15	Contractor	PMO CSC

Impact	Mitigation Measures	Generic Mitigation Measures	Responsibility	
			Implementation	Supervision
	• Liaison with traffic police will be maintained • Project drivers will be trained in defensive driving. • Ensure that all construction vehicles observe speed limits on the construction sites and on public roads • Provide adequate signage, barriers, and flag persons for traffic control.			
13. Community exposure to work hazards	• Barricade the work areas with hard fencing to prevent the entry of community in the construction areas located near the settlements. • Placing of adequate signboards and flagmen to divert the community away from the construction sites. • Implementation of traffic management plan near the blasting sites • Community awareness programs on construction-related hazards, including awareness programs in schools Construction activities such as blasting and excavation, particularly at the borrow areas, may pose safety risks to the nearby population. • Ambulance and first aid medical facilities will be made available at the worksite.	Implement measures in the following ECPs: ECP 15 ECP 16 ECP 17	Contractor	PMO CSC
14. Dust from vehicular movement on local roads and construction activities	• Dust generation from construction sites will be restricted as much as possible, and water sprinkling will be carried out as appropriate, especially at those places where earthmoving, excavation will be carried out. • Mobilisation of adequate water sprinkling trucks and a frequent sprinkling of water on the local roads and worksites to control dust emissions • A GRM will be put in place to receive and address complaints from the public on various aspects of environmental issues, including dust pollution.	Implement measures in the following ECPs: ECP 10	Contractor	PMO CSC
15. Risk of damage to houses by blasting activities (through fly rock and vibration)	• Use of controlled blasting and placement of sandbags on the boreholes to prevent fly rock • Adequate compensation for any affected structures. Prior to the start of the construction works, particularly near the blasting sites, all nearby residential structures will be photographed. • A GRM will be put in place to receive complaints from the public on	Implement measures in the following ECPs: ECP 11	Contractor	PMO CSC

Impact	Mitigation Measures	Generic Mitigation Measures	Responsibility	
			Implementation	Supervision
	various aspects of environmental issues, including noise pollution. These grievances will be addressed by the contractor by adopting the necessary pollution control measures. Continued consultations with the affected communities will be carried out during the construction phase.			
16. Employment opportunities in construction activities	• Encourage to engage local workers/laborers with the same terms and condition of outside workers/laborers • Children under 18 will not be employed in dangerous work. • No forced labor, which includes non-voluntary work extracted under threat of force or penalty. This covers indentured and bonded labor. • provision of a safe and healthy working environment to workers; • taking steps to prevent accidents, injury, and disease and appropriate treatment for those suffering from occupational injuries/diseases; and encourage for insurance facility for workers. • Working relationship: Working conditions and terms of employment will be clearly documented and communicated to employees and contracted workers. • Worker's Organizations: Ensure the provision of worker's rights to associate and bargain collectively. The contractor will comply with the KP laws and regulations. • Non-Discrimination and Equal Opportunity: The employment relationship will be based on the principle of equal opportunity and fair treatment, and will not discriminate in the contexts of hiring, compensation, working conditions, and terms of employment, access to training, promotion, termination, retirement, and discipline. • Local employment: Maintain inventory of the entire workforce (including names/national identify card numbers/ addresses etc.) and employment contracts and share with PIC and regularly update of the inventory; • Retrenchment: Develop a plan to mitigate the adverse impacts of retrenchment, if layoffs are expected to be significant. • Grievances: A grievance mechanism for workers. The mechanism will be transparent and well understood and should address concerns promptly at an appropriate level of management. The mechanism	Implement measures in the following ECPs: ECP 16	Contractor	PMO CSC

Impact	Mitigation Measures	Generic Mitigation Measures	Responsibility	
			Implementation	Supervision
	should not delay or impede other remedies available under law or in the context of existing arbitration procedures.			
17. Impacts from the influx of labor from the outside areas	• This situation will be addressed by an awareness campaign implemented at the beginning of the construction phase. The Contractors will be aware of the possibility and risks of miscommunications between local residents and workers, which easily could lead to conflicts. This will be prevented by raising awareness and implementing a Code of Conduct for the workers. The Contractor shall develop a Worker Code of Conduct to govern the behavior of workers on-site, in camps, and in local communities. • The awareness campaign will also be aimed at the risk of interaction between the resident population and the construction workforce, including the spreading of sexually transmitted diseases such as HIV/AIDS. • The contractor will prepare a labour influx management plan prior to construction works for approval of PEDO. • The contractor's code of conduct shall cover the program to promote awareness to the construction workers on respecting the local community. • Construction camps will be built in the designated areas, located away from the local settlements • The contractor will ensure local water usage will not be affected by the project water usage by the project or compete with water requirements of the local community • The Contractor will manage to provide clean water to the affected households during the relocation of PVC water pipes through tankers at the accessible location to all affected communities, being within 30 minutes total round trip travel time as per United Nations definition of access to water. • The Contractor's monthly training program will cover topics related to respectful attitude while interacting with the local community	Implement measures in the following ECPs: Implement measures in the following ECPs: ECP 16 ECP 17	Contractor	PMO CSC
18. Risk of gender-based violence GBV/Sexual Exploitation and Abuse	• Inclusion of clause on GBV/SEA behavior obligations in the employment contracts of all employees and construction workers aimed at strengthening measures to address and prevent GBV/SEA in	Implement measures in the following	Contractor	PMO CSC

Impact	Mitigation Measures	Generic Mitigation Measures	Responsibility	
			Implementation	Supervision
(SEA)/Sexual Harassment (SH)	the workplace and construction areas. • Translation of code of conduct into Urdu and dissemination of the principles laid out in CoC and the consequences (warnings, penalties, termination and legal actions) of its breach to all employees and workers • Awareness training to workers sub-contractor and service providers staff to sensitize them about GBV, SEA and SH, and their responsibilities to prevent • Posting of code of conduct in public spaces at contractor's work camps and living areas, and village information centers and public places of adjoining/neighboring communities in the Urdu language • Raising awareness that GBV is prohibited • Awareness to explain suspicious situations and the signs of GBV/SEA/SH; • Provide information on the use of GRM to report cases of GBV/SEA/SH, Code of Conduct breaches and assist victims of SEA, if signs of SEA are identified/a victim approaches them to complain about SEA; • Awareness to communities particularly women, and male and female children to understand risks of SEA and SH and the roles and responsibilities of parties involved in project implementation on SEA and SH prevention, processes for reporting incidents of project-related SEA/SH, and the corresponding accountability structures. • Strengthen the Contractors' obligations and capacity to public health and safety risks and ensure contractor supervision capacity to monitor the mitigation of these risks. • Preparing code of conduct for PEDO, PMO, Contractors, Sub-contractors and service providers (such as security agencies, catering, transport or any other services) on GBV/SEA prevention, and by integrating these measures/clauses in bidding documents. • Proactive GBV/SEA prevention measures will be put in place, such as GBV/SEA related training to sensitize workers and local population along the project implementation area and ensuring that GRM for the project will also take care of GBV related issues if any.	ECPs: ECP 16 ECP 17		

Impact	Mitigation Measures	Generic Mitigation Measures	Responsibility	
			Implementation	Supervision
	• There will be adequate mechanisms in place to protect the local vulnerable population, especially women and minors from risks associated with the influx of workers (harassment, underage sex). This mechanism will ensure the sensitization and enforcement of code-of-conduct by the Contractor employees and workers and all other parties that are involved in the project implementation. • Additionally, the Contractor will employ their skilled staff and apply unskilled construction labor from the local population as far as possible to minimize an influx of outsiders into the communities. • The third-party monitoring agency of the project will also cover the monitoring of GBV/SEA prevention measures. • Measures for receiving, reviewing and acting as appropriate on GBV/SEA concerns at the project management level. • PEDO will maintain an updated list of service providers as a part of the mapping exercise to assist potential victims (if any) for timely, safe and confidential support immediately after receiving a complaint from a victim including money for transportation, documentation fee and lodging if needed. • The identification information on the victim will not be stored in GRM. • Documentation and reporting of prevention and response in the progress reports of the project			
19 Chance finds during construction	Chance find procedures which will be used during this Project are as follows: • Stop the construction activities in the area of the chance find; • Delineate the discovered site or area; • Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a nightguard shall be present until the responsible local authorities and relevant Department of Archaeology take over; • Notify the supervisory Engineer who in turn will notify the responsible local authorities and relevant Department of Archaeology immediately (within 24 hours or less); • Responsible local authorities and relevant Department of Archaeology would be in charge of protecting and preserving the site		Contractor	PMO and CSC

Impact	Mitigation Measures	Generic Mitigation Measures	Responsibility	
			Implementation	Supervision
	before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archeologists (within 72 hours). The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historical, scientific or research, social and economic values; • Decisions on how to handle the finding shall be taken by the local authorities and the relevant Department of Archaeology. This could include changes in the layout (such as when finding an irremovable remain of cultural or archeological importance) conservation, preservation, restoration, and salvage; • Implementation for the authority decision concerning the management of the finding shall be communicated in writing by the relevant Department of Archaeology; and • Construction work could resume only after permission is given from the local authorities and relevant Department of Archaeology concerning the safeguard of the heritage.			

9.5.4 Construction Stage Monitoring Plans

The proposed monitoring plan to be carried out during the construction stage of the Project to ensure contractors are complying with the mitigation measures is given in **Table 9.5,** along with the monitoring indicators and frequency. CSC will be responsible for the supervision of the implementation of the plan. The total cost of monitoring has been estimated at USD 0.15 million.

Table 9.5: Effects Monitoring Plan During Construction

(**Note**: PMO will include this Table in the Contract Specifications of the Bidding Documents)

Parameter	Means of Monitoring	Location	Frequency	Responsibility	
				Implementation	Supervision
Topsoil storage	Visual inspection on stripping, storage and reuse of topsoil	Excavations	Monthly	Contractor	CSC, PMO
Erosion	Visual inspection of erosion prevention measures and the occurrence of erosion	All sites	Monthly	Contractor	CSC, PMO
Wastewater discharges from tunnels and batching plants, and campsites	Spot measurement for pH Visual inspection to ensure clear water leaving the site	Tunnel and batching plant discharges	Weekly	Contractor	CSC, PMO
	Sampling and analysis of wastewater discharges for the parameters given in NEQS	5 sites (including tunnel, batching, camp discharges)	Quarterly	Contractor	CSC, PMO
Surface water quality	Sampling and analysis of river water quality s for the parameters given in NEQS	5 sites in the river	Quarterly	Contractor	CSC, PMO
	Visual inspection of the presence of petroleum products.	All sites	Monthly	Contractor	CSC, PMO
Air Quality (dust)	Visual inspection to ensure good standard equipment is in use and dust suppression measures (spraying of waters) are in place.	All sites	Daily	Contractor	CSC, PMO
	Visual inspection to ensure dust suppression work plan is being implemented	All sites	Daily	Contractor	CSC, PMO
Air Quality in tunnels	Spot measurements for CO, O2, PM2.5, and hazardous gases, levels in the tunnels	In the tunnel	Daily	EU-CSC	PMO
Ambient Air Quality	Air quality monitoring for 24 hours for the	At 5 sites	Quarterly	Contractor	CSC, PMO

Parameter	Means of Monitoring	Location	Frequency	Responsibility	
				Implementation	Supervision
	parameters specified in NEQS				
Noise and vibration	24-hour noise monitoring (at/near construction sites, campsites, offices, colony, communities, quarry area, transportation routes)	At 5 sites	Quarterly	Contractor	CSC, PMO
Emissions from plant and equipment	Visual Inspection	All vehicles	Monthly	Contractor	CSC, PMO
Waste Management	Visual inspection on spoil disposal	At disposal sites	Monthly	Contractor	CSC, PMO
	Availability of dust bins at worksites and camp	At camp and work sites	Monthly	Contractor	CSC, PMO
	Collection and treatment of organic waste	At campsite	Monthly	Contractor	CSC, PMO
	Collection and treatment of recyclable and hazardous waste by the waste management contractor	At camp and work sites	Monthly	Contractor	CSC, PMO
Operation of quarry sites	Visual inspection of quarry sites	At quarry sites	Monthly	Contractor	CSC, PMO
Spills from hydrocarbon and chemical storage	Fuels are stored in contained facilities Availability of spill kits at the site Visual Inspection for leaks and spills	At fuel storage sites	Monthly	Contractor	CSC, PMO
Traffic Safety	Placement of traffic signs and traffic control personnel	Near the construction sites	Monthly	Contractor	CSC, PMO,
Local Roads	Visual inspection to ensure local roads are not damaged	Kalam-Gabral road	Monthly	Contractor	CSC, PMO,
Cultural and Sites	Visual observation for cultural sites	Along the local roads	Monthly	Contractor	CSC, PMO,
Drinking water and sanitation	Water quality analysis for drinking water parameters specified in NEQS	At the campsite	Quarterly	Contractor	CSC, PMO,
Safety of workers	Usage of Personal Protective equipment	All worksites	Daily	Contractor	CSC, PMO,
Labour engagement and GBV risks	Interaction with labours and review of GRM	All work sites	Monthly	Contractor	CSC, PMO
Reinstatement of Work Sites	Visual Inspection	All worksites	After completion of	Contractor	CSC, PMO,

Parameter	Means of Monitoring	Location	Frequency	Responsibility	
				Implementation	Supervision
			all works		

9.5.5 Reporting on ESMP Compliance

PMO and its Contractors will prepare periodic monitoring reports on the status of implementation of ESMP and will be submitted to World Bank for their review and feedback. Details of these reports and their content are given in **Table 9.6**.

Table 9.6: ESMP Monitoring and Compliance Reports

#	Title of the Report	Contents of the Report	Frequency of Report Preparation	Report to be prepared by
1	ESHS Monitoring Report	The compliance status of the Project with environmental and social mitigation and monitoring measures. Besides, the report also covers: • environmental incidents; • health and safety incidents, • health and safety supervision: • Usage of PPEs by workers • worker accommodations • Training conducted and workers participated • Workers grievances • Community grievances • Chance find (if any)	Monthly	Contractor
2	ESMP Monitoring Report	The compliance status of overall Project with ESMP requirements	Quarterly	PMO
3	Incident Reports	Incident investigation reports for all major incidents covering details of the incident, root cause analysis, and actions taken to address the future recurrence of this event	Initial investigation report within 24 hours Detailed Investigation Report within ten days	Contractor

9.6 Environmental and Social Management During Operation

9.6.1 O&M Stage Mitigation Plans

Detailed mitigation plans for operation and maintenance (O&M) stage impacts have been prepared on the basis of the detailed impact assessment covered under Chapter 7 and presented in **Table 9.7**. PMO's ESU staff will be responsible for implementing these measures.

Table 9.7: ESHS Impacts and Risks in O&M and Mitigation Measures

Impact	Mitigation Measures	Responsibility for implementation
1. Barrier effect on fish migration	• Sensors and underwater video cameras will be placed on the ladder and monitored to count the fish and to assess the effectiveness of the ladder. • Year-round release of water from fish ladders • Regular removal of sediments deposited on fish ladders • Compile the monthly data to share with the ESU • Installation of trash rack at the intake to prevent the fish from entering to the water conveyance system and tunnel • Monitor the effectiveness of fish ladder and take adaptive measures to improve the performance of the fish ladder • Supporting the fisheries department for upgrading of snow carp hatchery at Nagoha Shamozai and annually releasing the fish on both upstream and downstream of the weir.	PEDO O&M Staff PEDO ESU staff
2. Reduced water flow between weir and tailrace during low flow season	• Release of 2 m^3/s during extreme low flow season of December to February and 2.5 to 3.5 m^3/s during other seasons (including migratory fish season of March/April and September/October) of environmental flows.	PEDO O&M Staff
3. Impact on downstream sediment load	• Sediments will be flushed from the reservoir through under sluices during high flow season • Sediments from sandtraps will be flushed regularly during high flow season • Environmental flows will be released through under sluices to allow some sediment flows during low flow season as well	PEDO O&M Staff
4. workers health and safety due to noise and EMF exposure	• Prepare and implement an EMF safety program with the following components • Identify potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities. • Train workers in the identification of occupational EMF levels and hazards. • Establish and identify safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure and limiting access to properly trained workers.	PEDO O&M Staff

Impact	Mitigation Measures	Responsibility for implementation
	• Implement action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed by international organizations such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The recommended EMF exposure levels by ICNIRP are 10 kV/m for electrical field and 1000 µT for magnetic field • Personal exposure monitoring equipment will be set to warn of exposure levels that are below occupational exposure reference levels (for example, 50 percent). • Implement actions to minimize occupational exposure, which include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible, or using shielding materials • Workers always use personal noise protective gear when working in high noise areas (typically areas with noise levels greater than 85 dBA). • Transmission line workers will be provided with adequate PPEs and training on the safe use of equipment	
5. waste from the plant and colony including hazardous wastes	• implement a waste management plan for collection and disposal of organic waste, recyclables, garbage and hazardous waste following the principles give in ECPs 1 and 2 on waste management and hazardous waste management	PEDO O&M Staff
6. Community health and safety from exposure to EMF of transmission lines and risk of dam failure	• Measure EMF levels near the transmission line to comply with ICNIRP standards. • Dam design will be reviewed by the Independent Panel of Experts in the dam, tunnel and geology, and hydrology, hydraulic structures, and dam management • Install instrumentation network to monitor the behavior of weir, its foundation, and abutment. • Prepare an emergency response plan for dam -breaks prior to the operation of the project.	PEDO O&M Staff
7. Impacts from the tourist facilities	• PEDO will provide preference to affected persons in establishing small businesses in designated eco-tourism spots. It will help affected households to formalize their small businesses and benefit from the promotion of local tourism. • PEDO will make concerted efforts in collaboration with Department of Culture, Sports, Tourism and Youth Affairs (DoT) to promote responsible/eco-tourism to be socially, economically and environmentally responsible to avoid impacts on the local socio-cultural situation and environment of the area around the weir. • The information communication material will be displayed at the tourist spots to promote responsible tourism.	PEDO O&M Staff TCKP

Impact	Mitigation Measures	Responsibility for implementation
	• The tourist facilities include waste collection bins and public toilets, which will be maintained regularly by PEDO. The solid waste management system adopted for the PEDO colony and offices will be used for the collection, storage transportation and disposal of solid waste from the tourist facilities.	

9.6.2 O&M Stage Monitoring Plans

The proposed monitoring plan to be carried during the O&M stages of the Project is given in **Table 9.8** along with the monitoring indicators and frequency. PMO's ESU staff will be responsible for the implementation of the plan.

Table 9.8: Effects Monitoring Plan During O&M

Parameter	Means of Monitoring	Frequency	Responsibility	
			Implementation	Supervision
Downstream river flows	Measurements of discharges to the downstream	Monthly	PEDO O&M Staff	ESU
Fish counts	Data collection from sensors and monthly compilation of data	Monthly	PEDO O&M Staff	ESU
Fish catch surveys	Fish catch surveys to assess the use of ladder by the snow carps and brown trout	Monthly	PEDO O&M Staff	ESU
Waste	Collection and disposal of waste including hazardous waste	Monthly	PEDO O&M Staff	ESU
Dam Safety	Monitoring of data from dam safety equipment	Quarterly	PEDO O&M Staff	PEDO
EMF Exposure	Monitor EMF Levels in the powerhouse and switchyard	Continuous monitoring	PEDO O&M Staff	ESU
Water quality	Monitor water quality from the reservoir and on the fish ladders	Six-monthly	PEDO O&M Staff	ESU
Waste Management	Visual inspections to ensure the availability of waste collection bins at the tourist sites and regular waste collection and management	Continuous monitoring	PEDO O&M Staff	ESU

9.7 Capacity Building and Training

The environmental and social training will help to ensure that the requirements of the ESMP are clearly understood and followed by all project personnel. The competencies of the Consultant to be selected for capacity building training will include a thorough knowledge and experience of WB Environmental and Social Framework (ESF) and ESHGS guidelines. The trainings will be provided to different professional groups separately, such as managers, skilled personnel, unskilled labors, and camp staff. Capacity building will be aimed at strengthening the PMO staff in the field of environmental management and social development. Safeguard staff of PMO responsible for the supervision of environmental and social mitigation measures would be trained in environmental management,

environmental quality control, ecology, environmental awareness, labor and working conditions, and social development. The contractor will also be required to provide environmental and social trainings to its staff to ensure the effective implementation of the ESMP. A budget of USD 0.1 million has been earmarked for capacity building. The training plan shall include a program for the delivery of intermittent training to cover the subjects included in **Table 9.9**. Training should be carried out initially at the induction of staff and repeated throughout the project.

Table 9.9: Environmental and Social Training Programs

Contents	Participants	Trainer	Schedule
Environmental and social impacts of the Project and ESMP requirements of the Contractor; World Bank Group Environmental Health and Safety Guidelines. The contents for the second and subsequent training programs will cover topics related to the issues associated with on-going construction activities.	All the technical Staff of PMO, ESU, and relevant technical staff of PEDO who are involved in the management of environmental and social issues associated with routine operation and maintenance of the airport. Site Engineers of the PMC/Engineer.	ESHS staff of the CSC; and an external training agency who has a thorough knowledge of the WB safeguard policies and guidelines	During the initial stages of the Project implementation. The training will be repeated every six months.
Environmental and Social issues associated with the ongoing construction works; Workers' health and safety	Site Engineers of the Contractor, PMO, and the CSC	E&S staff of the CSC, PMO	On a monthly basis
Code of Conduct Occupational Health and Safety	Construction crew	Contractors ESHS Staff	Prior to the start of the construction activities and during the construction activities (To be repeated as needed.)

9.8 Audits and Annual Review of ESMP

Internal environmental safety audits will be held on a monthly basis with an objective to review the effectiveness of environmental and social management of the project. CSC, under the supervision of PMO, will carry out an annual review of the appropriateness and adequacy ESMP in the light of its own monitoring and supervision as well as on the basis of the third-party monitoring and audits discussed earlier. CSC will revise the ESMP in case substantial gaps and shortcomings are identified in these plans.

External third-party environmental audits will be held with an objective to review the effectiveness of environmental and social management of the project. It is proposed that MSC carry out these audits on a yearly basis. These audits would be used to re-examine the continued appropriateness of the ESMP and to provide advice on any updates required.

9.9 Gender Action Plan

The gender assessment of the project area is given in Section 5.5. The Gender Action Plan (GAP) for the Project is given in **Table 9.10**[33]. The internal monitoring of GAP implementation will be carried out by the social and gender staff of the CSC. A third party monitoring agency (TPMA) hired under RAP/ESIA implementation will be responsible for the external monitoring of the GAP.

Table 9.10: Gender Action Plan of the Project

#	Activities	Targets	Responsibility
1	Conduct public awareness campaigns on project benefits and encourage women to equally access development opportunities provided under the Project.	1.1 Project brochure in Urdu disseminated in villages of the project area of influence and within one month of the start of the Project and orientation to women in face-to-face meetings. 1.2 A documentary on the Project mitigation measures and benefits prepared in Pashto and Kohistani and shown to affected and beneficiary population in meetings and electronic media, among them 30% should be women. 1.3 Dissemination campaign to introduce project via local FM radio and local print media, minimum weekly basis for one month of the Project start.	PEDO, PMO - CSC and Third Party Monitoring Agency (TPMA)for monitoring
2	Socially and gender-inclusive consultations	2.1 Two broad-based socially and gender-inclusive participatory consultation workshops for relevant stakeholders on GAP objectives, one for male and one for female. 2.2 At least 25% of participants of stakeholder consultation activities are women. 2.3 Representation of women in consultation, participation and decision-making forums such as women-specific Affected Person Committee and Social Development Implementation Committee to voice their opinions, needs and preferences at a location and time that increases the possibility of women's participation, 20% of participants are women's representatives.	PMO, Project Director (PD), Social and Gender Staff of PMO (CSC and TPMA for monitoring)
3	Gender equality in compensation	3.1 compensation is paid to the one who owns the assets, if jointly owned by men and women, the amount is paid to both parties including resettlement and rehabilitation assistance. 3.2 Women having ownership of land and other fixed/affected assets receive compensation directly including resettlement and rehabilitation assistance. 3.3 Awareness raising in women about above provisions to ensure equality in gender rights in distribution of compensation and resettlement and rehabilitation assistance.	PMO, Project Director (PD), Social and Gender Staff of PMO (CSC and TPMA for monitoring)

[33] After development of implementation plan of Social Development Plan and detailed Livelihood Restoration and Improvement Plan, this Gender Action Plan will be updated within 6 months of start of project implementation

#	Activities	Targets	Responsibility
4	Women and men benefit equitably from the Livelihood Restoration Plan.	4.1 Minimum 80% vulnerable AHs provided training in improving existing skills or developing new income-generating skills either in on-farm or off-farm income-generating activities, among them 30% women trained in formal/informal skills (sewing, art and craft, veterinary, agri-processing, etc. as relevant) with microenterprise development training and financial support including marketing.	PEDO, PMO, Project Director (PD), Social and Gender Staff of PMO (CSC and TPMA for monitoring)
5	Social and gender-inclusive Social Development Plan (SDP)	5.1 Social Development Plan developed based on target population needs and priorities. 5.2 Installed water points/rehabilitation of existing water systems in all villages in the project area of influence, within 30 minutes round-trip travel time[34], will release women and children burden of fetching water, save time and improve their health; 5.3 At least one safe water connection at visible and accessible locations in community facilities, e.g. mosques, market area; 5.4 Safe and accessible water facilities for all girls' and boys' schools. 5.5 Conducted literacy campaigns to increase awareness of women and men to enrol the boys and girls in newly built schools under SDP. 5.6 Appoint at least one woman for Grievance Redress Mechanism (GRM) at the project site to address 100% women related complaints. 5.7 Monitor and evaluate the results of the implementation of the SDP by documenting successes, challenges, and lessons learned. 5.8 Recorded gender-disaggregated data by ethnicity, income, marginalized and vulnerable group against a set of socially inclusive and gender-sensitive indicators, monitored against baseline conditions and reported annually, focusing on improvements to the quality of life parameters.	PEDO, PMO, Project Director, Social and Gender Staff of PMO (CSC and TPMA for monitoring)
6	Women and girls visit the weir site with their families for recreation	6.1 Recreational area developed for families with sitting arrangement, water sports, and eateries; 6.2 Separate restrooms for women and men with a minimum of 6 toilets for women with clean running water and other personal hygiene facilities.	PMO, Project Director, Social and Gender Staff of PMO (CSC and TPMA for monitoring)
Institutional Strengthening, Project Management, and Monitoring and Evaluation			
7	Enhance the capacity of PEDO and PMO to include a gender	7.1 Evidence that equal employment opportunity policy and practices are implemented, at least 10% of female staff in PMO with equal salaries by following	PMO, Project Director, Social and Gender

[34] The United Nations definition of access to an improved water source being within 30 minutes total round-trip travel time

#	Activities	Targets	Responsibility
	perspective into program/project operations	GoKP fixed minimum quota for women employment; 7.2 Evidence of the type of incentives designed to recruit women, increase their capacity, and provide career development; 7.3 Social and Gender Specialist and female staff deployed in PMO and PIC to assist in GAP implementation and monitoring; 7.4 PMO and PEDO staff trained in job-related skills of which 10% are women; 7.5 Gender awareness and social inclusion training provided to 100% PMO and 50% management staff of PEDO for clarity in gender mainstreaming and social inclusion concepts, orientation on GAP targets, roles, and responsibilities, better planning, communication, coordination, implementation, documentation, monitoring and evaluation;	Staff of PMO (CSC and TPMA for monitoring)
8	Monitor satisfaction level of target beneficiaries	8.1 Conduct yearly satisfaction surveys of men and women project affected persons and beneficiaries of SDP including accessibility, quality, quantity, reliability, affordability, operations and maintenance; and share results;	PEDO, PMO, Project Director, Social and Gender Staff of PMO (CSC and TPMA for monitoring)
9	Include gender-disaggregated data in monitoring and evaluation and project progress reports.	9.1 Developed a set of quantitative and qualitative sub-indicators of key indicators, and develop a system to consistently collect, retrieve and analyze the gender-disaggregated data of level of participation, immediate results of activities, benefits, and outcomes, of the project on women, men, boys, and girls (disaggregated by gender, income, marginalized and vulnerable groups)	PEDO, PMO, Project Director, Social and Gender Staff of PMO (CSC and TPMA for monitoring)
10	Assess impacts of services on women, men, girls and boys	10.1 Conduct an impact assessment survey as a part of project evaluation to collect gender-disaggregated data to identify differential impacts on women and men, boys and girls due to implementation of RAP, Livelihood Restoration and Improvement Plan and Social Development Plan.	PEDO, PMO, PIC and TPMA

9.10 Social Development Plan (Draft)

A Social Development Plan (SDP) has been prepared beyond compensation and resettlement to enable project-affected populations to reap the project benefits as a form of development strategy to increase investment effectiveness. SDP for the project can be defined as a systematic mechanism to sustainably benefit local communities affected by the project's investment. The strategy substantiates the comprehensive compensation and resettlement policy of the project. Under this plan, community-based projects such as water supply and sanitation schemes, educational facilities, health clinics, access roads, etc. will be taken up. A budget of PKR 780 million (USD 5 million) has been allocated for SDP in the Project's RAP. A detailed description of the plan is given in the **RAP**.

9.11 Grievance Redress Mechanism

9.11.1 PEDO's Existing GRM

PEDO has a provision for receiving written complaints manually and their redressal but does not have standard operating procedures to receive and redress complaints and there is no practice of redressing anonymous complaints. Currently, PEDO has been receiving and redressing complaints under the "Pakistan Citizen Portal," a government-owned Mobile Application established by Prime Minister's Performance Delivery Unit and is being used as a tool to promote citizen-centric and participatory governance. It is an integrated citizens grievance redressal system connecting all government organizations both at federal and provincial levels.

9.11.2 Proposed GRM for the Project

A Project-specific grievance redress mechanism (GRM) will be established to receive, evaluate, and facilitate the resolution of affected parties' concerns, complaints, and grievances about the environmental and social performance of the Project.

A three-tier GRM has been designed to provide a time-bound, early, transparent and fair resolution for APs and other stakeholder grievances regarding E&S management of each project. All complaints received verbally or in writing will be properly documented and recorded in the Complaint Management Register(s). In addition, an easy-to-access web-based GRM will be developed. All possible efforts will be made to redress complaints through project specific GRM and the complainants will also be encouraged to seek redressal of their complaints through this mechanism. Despite all efforts, if the complainant will not be satisfied with the resolution, s/he will have a right to lodge his/her complaint at the higher government administration or at the related court. If the complaint cannot be resolved at these three tiers, the complaint will have a choice to lodge his/her complaint at the related court of law. The GRM for the Program is outlined below and consists of three levels with time-bound schedules for addressing grievances and a detail description of the GRM plan is given in the **RAP**.

First Tier of GRM. The PMO's project site office will be the first tier of GRM, which will offer the fastest and most accessible mechanism for the resolution of grievances at the local level. A local level GRC will be formed for this purpose headed by the Project Director with the membership of Director-ESU, Land Acquisition Collector and other relevant staff of Revenue Department, contractors' representatives, consultants' representatives, representatives of other relevant departments, and two members from each affected persons (Aps) Committee. At this tier, the designated E&S staff of the PMO site office will make an attempt to resolve the complaints within two to 10 working days, depending on the nature of the grievance. The PD will convene the meetings of local GRC and conduct proceedings informally to reach an amicable settlement between the parties within 10 days of receiving a complaint (verbally or in writing) from an affected person or their representative. The report of the GRM meetings will be recorded in writing, and copies will be provided to the parties involved. Grievances will be documented with personal details (name, address, date of the complaint, nature of the complaint, etc.) unless anonymity is requested. A tracking number shall be assigned to each complaint/grievance. Should the grievance remain unresolved or the AP not satisfied with the decision, the grievance can be lodged with the Program level grievance redress committee, led by the head of PMO.

Second Tier of GRM. The E&S staff in PMO will refer to the unresolved issues or grievances (with written documentation) to the second tier of GRM, the PMO central level Grievance Redress Committee (GRC). The central level GRC shall be established by PEDO and will consist of the following persons: (i) a PEDO representative from senior management; (ii) the head of PMO will act as secretary of the GRC; (iii) Project Director of respective project; (iv) representative of DC office; (v) representative of PIC; (vi) Chief

Resident Engineer of the Consultants (on-call); (vii) representative of relevant government offices (on-call); (viii) two to three representative of respective project-affected people (on-call). A hearing can be called with the GRC, if necessary, where the AP(s) can present details of his/her/their concern/grievance. The GRC will meet as necessary when there are grievances to be addressed. The GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 working days, depending on the nature of the grievance. All possible efforts will be made to redress complaints through project specific GRM and the complainants will also be encouraged to seek redressal of their complaints through this mechanism. Despite all efforts of complaint redressal, if the complainant is unsatisfied with the decision, the existence of the GRC shall not impede the complainant's access to the government's administrative or judicial remedies.

Third Tier of GRM: In the event that a grievance cannot be resolved directly by the second tier GRC or If complainant is dissatisfied with the decision of GRC, the affected people can seek alternative redress through the CEO or Board of Directors of PEDO, district administration, the Secretary Energy and Power Department or higher-level administrative authorities, the Pakistan Citizen Portal or the court of law, as appropriate.

Grievance Redressal Committee: The central level Grievance Redress Committee (GRC) will be formed by PEDO and as a continuing and functional structure, engaging personnel of PMO and other parties. The PEDO will specify that representatives of local/community authorities, elders, auditors, displaced persons and any other persons or entities can be included in the Committee as members. The details of central GRC and field-level/project site level GRC are provided in the RAP of GKH including their composition and functions.

Monitoring and reporting. The monitoring reports of RAP and ESMP implementation will include the following aspects pertaining to progress on grievances: (i) number of cases registered, level of jurisdiction (first, second, third tiers), number of hearings held, decisions made, status of pending cases; and (ii) lists of cases in process and already decided upon, may be prepared with details such as name with copy of NIC, complaint number, date of application, date of hearing, decisions, remarks, actions taken to resolve issue(s), and status of grievance (i.e., open, pending, closed).

9.11.3 Proposed GRM for Construction Workers

The GRM, with its present scope, addresses the grievances/complaints lodged by the project affected persons and other local stakeholders. But according to the lessons learned in various project contexts, there is also a need to establish a separate GRM to deal exclusively with those complaints that involve workers employed by the Contractors for construction activities. Such grievances may involve wage rates and unpaid overtime works, irregular and partial payments, lack/inadequacy of living accommodations, lack of clean drinking water and sanitation facilities, and lack of medical care.

The GRCs dealing with labor grievances will have members who are directly and indirectly associated with the construction works. The GRC will include a PMO official who is in charge at the worksite as the convener, resident engineer of the CSC, a worker's representative, and the contractor's representative. The convener will designate an official to receive the complaints and ensure the complainant does not lose his job and is not intimidated into withdrawing the complaint before the formal hearing.

To ensure impartiality and transparency, hearings on complaints will be held in a non-threatening environment and will remain open to all other workers on the site. The GRCs will record the (i) details of the complaints; (ii) reasons that led to acceptance or rejection of the individual cases, as well as the number of accepted and rejected cases; and (iii) decisions agreed with the complainants. PMO will keep

records of all resolved and unresolved complaints and grievances and make them available for review as and when asked for by the World Bank and other interested entities/persons.

9.12 Budget for Implementation of ESIA

The total cost of the ESMP implementation is estimated to be USD 3.94 million (**Table 9.11**). These costs will be covered under the Component C: Environmental and Social Management of the Program.

Table 9.11: Cost Estimates for ESMP Implementation

Sr. No.	Description of Item	Unit	Item Total (million USD)	Covered under the Component of the Program
A	**Contractors Budget**			
1.	Contractors preparation of C-ESMP including OHC Plans		Included in construction cost	Component A 1
2	Contractors ESHS Staff		Included in construction cost	Component A 1
3.	Waste Management (procurement and operation of composters, bailers, and waste management contractors)	LS	500,000	Component C
4	Dust Management (procurement and operation of sprinklers)	LS	200,000	Component C
5	Site/OHS facilities for workers (PPE)	LS	250,000	Component C
6	Training of Workers on Code of Conduct (incl. GBV/SH/AIDs)	LS	50,000	Component C
7	Health facilities at the camp including a fully equipped ambulance, doctor and nurses	LS	400,000	Component C
8	Wastewater treatment facilities (incl. mobile toilets at worksites)	LS	100,000	Component C
9	Spot monitoring for dust and hazardous gases in tunnels	LS	50,000	Component C
10	Environmental Monitoring during construction by a third party (wastewater quality, air, and noise quality) - every 3 months (4 years) at 5 locations	LS	100,000	Component C
B.	**Consultants Budget**			
1	ESHS Staff for the Construction Supervision Consultant	LS	Included in project management cost	Component D
2	Biodiversity Consultants (for additional data collection and monitoring)	LS	200,000	Component C
3.	Cumulative impact assessment of the Program (KPHRED)	LS	400,000	Component C
C.	**PEDO's Budget**			Component C
1.	Tree Plantation and Promotion of Conservation Efforts in Bhan Game Reserve	LS	600,000	Component C
2	Monitoring and management of impacts on fish	LS	200,000	Component C
2	Capacity building of PMO safeguard staff	LS	100,000	Component C
D.	**Contingency**			Component C
	Contingency (25% of A+B+C)		787,500	Component C
	Total		**3,937,500**	

10 Stakeholder Consultations and Disclosure

Details of stakeholder consultations and feedback received from the stakeholders and actions taken or to be taken up by PEDO to address their concerns are described in this chapter.

10.1 Consultation Meetings

Extensive consultations were carried out with the various stakeholders of the Project. Consultations involved multiple methods such as household-level interviews, wise village meetings, focus group discussions, individual meetings with government departments, and workshops. Details of stakeholders consulted are given in **Table 10.1**.

Table 10.1: Details of Stakeholders Consulted

Type of stakeholders	Stakeholders Consulted
The general population in Project Area	Local community including affected people, Female, local community leaders
Local and district governments and NGOs	District Administration, Revenue Department, Communication and Works, Forestry Department, Wildlife Department Agricultural department, Fisheries department, Kalam Development Foundation, Sarhad Rural Support Program
Provincial government	Environmental Protection Agency, Forest Department, Forestry Department, National Highway Authority, Sports, Tourism, Archaeology, and Youth Affairs

A total of 58 consultation meetings with 439 participants (373 male and 66 female) were conducted. These include 48 local village meetings, one provincial-level workshop at Peshawar on October 21, 2019, one disclosure workshop at Kalam on November 7, 2019, to share the draft ESIA and RAP, in which the local communities, including affected communities, district-level government agencies (including representatives forest of wildlife departments, union councilors, and district administration have participated. A summary of the details of these meetings and the list of participants are given in **Table 10.2.** A full list of participants is given in **Annex 6,** and some photographs from the meetings are given in **Annex 7**. Two local non-profit organizations, Sarhad Rural Support Program and Kalam Development Foundation, who advocate for the sustainable management of environment, provision of social services and community infrastructure development, and conserving of the natural resources, were also consulted.

10.2 Approach followed for Consultations with Women and Vulnerable Groups

In general, the women of the project area of influence have a restricted cultural environment. Due to the limitations of women to participate in public meetings, women-specific consultations were conducted to get women's concerns, perspectives, aspirations, needs and priorities. The consultations were conducted at locations that were socially acceptable for women and in their own language by female field staff only. A total of 66 women participated in consultations. The qualitative tools were used to conduct the consultations such as focus group discussions and in depth and key informant interviews. These included perception analysis of women on:

- Poverty

- Nature and extent of positive and adverse impacts and risks of the project on women and children that can enhance or reduce their wellbeing and vulnerability
- Coping strategies to recover from economic shocks such as loss of land, properties and income and livelihoods
- The mitigation measures to avoid or mitigate impacts on their daily and seasonal activities, mobility and privacy due to their roles of water and wood collection, work on their family farms, livestock rearing, socialization within communities and tribes
- All resettlement aspects especially eligibility, entitlements and compensation, resettlement and rehabilitation assistance
- Strategies for rebuilding capacities of women and their household members to enable them to bear shocks of displacement and social and economic losses; and the time period for revival.

Similarly, vulnerable groups (the affected families below the poverty line and those without formal titles) who required special assistance during the relocation and resettlement process were identified and consulted through focus groups discussions and in-depth interviews.

10.3 Feedback from Consultations

Feedback from the consultations was overall supportive of the project from both local communities and the government agencies, but a request was made to enhance the benefits of the project to the local population through the provision of social services, in addition to compensation, resettlement and rehabilitation assistance. Participants appreciated PEDO's efforts in bringing them together from a variety of stakeholders and representatives of affected people for formal consultations in the workshops. All participants unanimously agreed that the draft safeguard reports were very comprehensive and extensively covered all environmental social aspects including the entitlement for resettlement and rehabilitation assistance. However, they have raised some concerns, which have been summarized in **Tables 10.3 and 10.4**.

Table 10.2: Details of Public Consultation Meetings

Type of Meetings conducted	Number of Meetings	Dates	Male Participants	Female Participants	Total Participants
1st Round Consultation Meetings at the community level	46	August 31 to September 2019	249	36	285
2nd Round Consultation Meetings at the community level	2	October 17, 2019	23	4	27
Meetings with government officials	7	October and November 2019	12	-	12
Workshop at Peshawar	1	21 October 2019	21	3	24
Public Consultation and	1	7 November	68	2	70

Type of Meetings conducted	Number of Meetings	Dates	Male Participants	Female Participants	Total Participants
disclosure at Kalam in Hotel Golden Star		2019			
Consultation with women at Kanai and Ashuran	2	14 November 2019	-	21	21
Total	**58**		**373**	**66**	**439**

The main concerns raised during consultations include:

- All local stakeholders strongly demanded to change the name of the project from Gabral-Kalam Hydropower Project to Kalam Hydropower Project (since there a village named Gabral, located away from the project area and it will get undue credit)
- impacts on private land and properties should be minimized, and if minimization is not possible then impacts should be mitigated completely and sufficiently;
- provisions should be made under the project for compensatory tree plantation and preservation of the natural environment;
- provision of employment during construction and operation phase to affected households;
- infrastructure development under the community development program;
- adequate measures should be taken to mitigate impacts on human health, water quality, and emissions, and other environmental issues.

Table 10.3: Feedback from Affected Communities

Key Concerns	Response/Actions
Minimize land acquisition to the extent feasible since the availability of suitable agricultural land is scarce in the project area.	While carrying out the feasibility studies for the Project, PEDO ensured the minimum acquisition of private land.
Adequate compensation for the loss of land. Payments to be made only to the legitimate owners at the prevailing market rates.	The principles and procedures for the valuation of assets at market rate have been laid down in RPF and RAP, in detail.
Compensation for land and structures to be paid prior to the construction.	Construction activities will start only after the payment of compensation to the affected communities of their lost land and other assets, including resettlement and rehabilitation assistance.

Key Concerns	Response/Actions
Development schemes such as schools, health centers, mother and child health care centers, vocational training centers separately for men and women should be implemented in the affected villages. And the access road from Kalam to Utror should be rehabilitated.	A Social Development Plan will be implemented as a part of the Project. The plan will include several interventions to address the priority needs of the local communities particularly the affected population. In addition, a livelihood restoration and improvement plan will be implemented to support the improvement of existing means of livelihoods and alternative off-farm income-earning opportunities including women-specific interventions.
During construction of the tunnel, water discharges from the tunnel may pollute the river water. River water pollution should be avoided from construction activities	Wastewater discharges from tunnels and project facilities will be released to the river after adequate treatment. ESMP includes measures for the treatment of wastewater discharges including water releases from the tunnel.
What would be the mechanism for noise control during the construction phase due to the operation of heavy machinery?	Noise emissions from vehicles and machinery will comply with national standards, and high noise generating equipment will be provided with mufflers. Noise generating activities will not be carried out during night time near the residential areas.
Fish ladders should be constructed.	A Fish ladder will be constructed.
Employment opportunities should be provided to local skilled and unskilled labor in the project to improve the livelihood of the locals. At least one-third of the local community, especially PAPs, should be engaged in the project-related jobs.	Contractors will give preference to the local skilled and unskilled labor. Preference will also be given to the PAPs.
Compensation for land acquisition should be paid before the commencement of work.	Compensation for loss of land, crops, trees, and structures, will be paid in accordance with the entitlement matrix presented in this RAP including compensation based on the market rate as well as replacement cost. Vulnerable affected people have been identified and assistance will be provided to them in addition to entitled compensation.
Compensation should be fair and should be delivered before the start of work. Payment of compensation for project-affected person especially vulnerable PAPs should be ensured.	Compensation for any loss to crops, trees, and structures will be paid in accordance with the rates given in the present RAP. These rates have been established based upon the official rates. Compensation is fair and paid in a timely manner.

Key Concerns	Response/Actions
While selecting the place for weir and powerhouse, impacts on the structures should be avoided and relocation of settlements should be minimized by changing the design, where possible.	The project design is already optimized to minimize land acquisition and resettlement requirements.
Transport for the relocation of assets and timely compensation to all the affectees should be provided.	Transition/ shifting assistance will be provided to the eligible/ entitled persons in addition to the compensation for the lost assets.
Damaged lands should be rehabilitated/ restored after the construction work is completed.	The contractor will rehabilitate/ restore the lands damaged by the construction activities.
Local norms should be honored, and construction work should be completed in time	Liaison with the community will be maintained during construction activities. The construction staff will be provided trainings regarding local norms. The construction staff will comply with the code of conduct. Construction activities will be carried out over a period of five years.
Compensation for the affected cropped area, houses and other private assets should be in harmony with existing market rates/ replacement cost	Compensation against losses of crops, trees, structures, and other assets will be paid to the PAPs in accordance with the present RAP. The compensation rates have been recognized based upon the official rates.
Women's participation in the activities outside the home is limited. However, in case of loss of any property/ assets, crops/ trees, compensation should be provided.	Compensation will be provided to the eligible and entitled PAPs including women and vulnerable people in accordance with the entitlement matrix of compensation given in the present RAP/ entitlement matrix covering the current market rates and replacement cost.
In some cases, local women are working in agricultural fields, so their routine activities should not be disturbed due to the construction activities.	Liaison with the community will be maintained during construction activities. The construction staff will be provided trainings regarding local norms. The construction staff will comply with the code of conduct. A GRM will also be established to address community complaints.

Key Concerns	Response/Actions
Women were inquisitive about the development of the area through the project.	A Social Development will be implemented under the Project, which will include community-based projects such as water supply and sanitation schemes, educational and health facilities, access roads, etc.
The access roads to the villages may be disturbed during the construction phase and there may be road safety concerns due to increased traffic volume.	A traffic management plan will be prepared and implemented.

Table 10.4: Feedback from Institutional Stakeholders

Key Concerns	Response/Actions
The reservoir will be silted up if there are no desilting will be done, and the life of the reservoir will reduce	There will be regular desilting of the reservoir during high flow season through under sluices
Blasting activities may impact the wildlife	Controlled blasting will be carried out, and no nighttime blasting will be carried out
There is a risk of hunting and poaching of animals by the workers	Workers' code of conduct will include a ban on illegal cutting of trees and hunting and poaching of wildlife. The contractor will carry out regular awareness programs to the workers on the protection of flora and fauna
The dam should have been constructed earlier. Rate/Compensations of the trees should be done at the market rate, and in the case of the Deodar tree, the community has 60 % concession and rights. If the project is being executed by the Provincial government, the forest department will not charge for the loss of trees. However, the community would charge against their share. (from forest department)	Forest department support for the project is appreciated and the compensation will be paid according to the market rates. In addition, the project will also support its afforestation activities and compensatory planting for the loss of trees. A budget of USD 0.8 million is proposed in the ESMP for the plantation and wildlife conservation activities.
People should be sensitized and mobilized for environmental protection and growing more trees.	The Project will support the on-going conservation programs of the forest department and wildlife department.
Fishways and fish ladders should be included in the the weir and district fisheries department would support the project activities	A Fish ladders will be built in the weir.
EPA's concern is mainly on the environmental releases from the weir to the downstream during winter and fair compensation to the	Environmental flows will be released from the weir during low flow season, and the requirement of flows are estimated based on the water uses in

Key Concerns	Response/Actions
affected households.	the downstream areas

10.4 Stakeholder Engagement Plan

A stakeholder engagement plan (SEP) is given in **Annex 8,** which is prepared following WB OPs and international best practices. The SEP will act as a guideline to enable PEDO, and other involved parties, to systematically carry out socially and gender-inclusive consultations with the primary and secondary stakeholders, to record their views and concerns and implement mitigation measures. The plan is aimed at enabling active and meaningful engagement of the stakeholder groups, especially the APs and venerable groups amongst them, and assures disclosure of information in a timely manner. The effective implementation of the SEP will mitigate the risks of poor stakeholder relations, particularly with APs throughout the Project lifecycle. The key features of the SEP are (i) identification and analysis of primary and other key stakeholders of the GKH; (ii) principles and key considerations for stakeholder engagement; (iii) stakeholder engagement approach; (iv) detail of GRM in the legal framework of Government of Khyber Pakhtunkhwa and program/projects specific GRM; (v) SEP implementation methodology; (vi) a plan for stakeholder engagement activities throughout the program/projects lifecycle; (vii) SEP monitoring, reviews and reporting, and (viii) key issues identified through stakeholder engagement activities. The SEP is a "living" document which will be regularly updated to include and enable documentation of all consultation activities undertaken and adaptation of stakeholder engagement approach and methodology in the light of results of monitoring and reviews to ensure appropriateness and effectiveness approach and methods used in engaging stakeholders (evaluation).

10.5 Access to Information

This ESIA and Executive Summary of ESIA will be disclosed on the PEDO website and will be sent to the World Bank for disclosure on its external website. The ESIA summary in Urdu will also be uploaded into the PEDO's website, and hard copies of these documents will be made available at local union council offices for public access.

Annex 1: Environmental Code of Practices[35]

The objective of the Environmental Code of Practices (ECPs) is to address all potential and general construction-related impacts during the implementation of the Project. The ECPs will provide guidelines for best-operating practices and environmental management guidelines to be followed by the contractors for sustainable management of all environmental issues. These ECPs shall be annexed to the general conditions of all the contracts, including subcontracts, carried out under the Project.

The list of ECPs prepared for the Project is given below.

- ECP 1: Waste Management
- ECP 2: Fuels and Hazardous Goods Management
- ECP 3: Water Resources Management
- ECP 4: Drainage Management
- ECP 5: Soil Quality Management
- ECP 6: Erosion and Sediment Control
- ECP 7: Topsoil Management
- ECP 8: Topography and Landscaping
- ECP 9: Quarry Areas Development and Operation
- ECP 10: Air Quality Management
- ECP 11: Noise and Vibration Management
- ECP 12: Protection of Flora
- ECP 13: Protection of Fauna
- ECP 14: Protection of Fish
- ECP 15: Road Transport and Road Traffic Management
- ECP 16: Labor Influx Management and Construction Camp Management
- ECP 17: Cultural and Religious Issues
- ECP 18: Workers Health and Safety
- ECP 19: Tunneling and Underground Construction Works
- ECP 20: Instream Construction Works (Diversion, Coffer Dam and Dam Construction)

ECP 1: Waste Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
General Waste	Soil and water pollution from the improper management of wastes and excess materials from the construction sites.	The Contractor shall • Develop a waste management plan for various specific waste streams (e.g., reusable waste, flammable waste, construction debris, food waste, etc.) prior to commencing of construction and submit to CSC for approval. • Organize disposal of all wastes generated during construction in an environmentally acceptable manner. This will include consideration of the nature and location of the disposal site, so as to cause less environmental impact. • Minimize the production of waste materials by 3R (Reduce, Recycle and Reuse) approach.

[35] These Environmental Code of Practices (ECPs) are originally prepared by Dr. Venkata Nukala for Padma Multi-Purpose Bridge Project (2010) and were updated again for Dasu Hydropower Project (2013), Tarbela 5th Extension Hydropower Project and Sukkur Barrage rehabilitation Project (2017) by adding ECPs on Labor Influx, Dredging Works, Tunneling Works and Instream Construction Works.

		• Segregate and reuse or recycle all the wastes, wherever practical. • Prohibit burning of solid waste • Collect and transport non-hazardous wastes to all the approved disposal sites. Vehicles transporting solid waste shall be covered with tarps or nets to prevent spilling waste along the route • Train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process. • Provide refuse containers at each worksite. • Request suppliers to minimize packaging where practicable. • Place a high emphasis on good housekeeping practices. • Maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal.
Hazardous Waste	Health hazards and environmental impacts due to improper waste management practices	The Contractor shall • Collect chemical wastes in 200-liter drums (or similar sealed containers), appropriately labeled for safe transport to an approved chemical waste depot. • Store, transport and handle all chemicals avoiding potential environmental pollution. • Store all hazardous wastes appropriately in bunded areas away from watercourses. • Make available Material Safety Data Sheets (MSDS) for hazardous materials on-site during construction. • Collect hydrocarbon wastes, including lube oils, for safe transport off-site for reuse, recycling, treatment or disposal at approved locations. • Construct concrete or impermeable flooring to prevent seepage in case of spills

ECP 2: Fuels and Hazardous Goods Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Fuels and hazardous goods.	Materials used in construction have the potential to be a source of contamination. Improper storage and handling of fuels, lubricants, chemicals and hazardous goods/materials on-site, and potential spills from these goods may harm the environment or health of construction workers.	The Contractor shall • Prepare spill control procedures and submit the plan for CSC approval. • Train the relevant construction personnel in the handling of fuels and spill control procedures. • Store dangerous goods in bunded areas on a top of a sealed plastic sheet away from watercourses; and also, under rainwater shed (to prevent contact with rainwater). • Refueling shall occur only within bunded areas. • Make available MSDS for chemicals and dangerous goods on-site. • Transport waste of dangerous goods, which cannot be recycled, to a designated disposal site approved by EPA or

		sold to EPA registered vendors. • Provide absorbent and containment material (e.g., absorbent matting) where hazardous material is used and stored, and personnel trained in the correct use. • Provide protective clothing, safety boots, helmets, masks, gloves, goggles, to the construction personnel, appropriate to materials in use. • Make sure all containers, drums, and tanks that are used for storage are in good condition and are labeled with the expiry date. Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur. • Put containers and drums in temporary storage in clearly marked areas, where they will not be run over by vehicles or heavy machinery. The area shall preferably slope or drain to a safe collection area in the event of a spill. • Put containers and drums in permanent storage areas on an impermeable floor that slopes to a safe collection area in the event of a spill or leak. • Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution. • Avoid the use of material with greater potential for contamination by substituting them with more environmentally friendly materials. • Return the gas cylinders to the supplier. However, if they are not empty prior to their return, they must be labeled with the name of the material they contained or contain, information on the supplier, cylinder serial number, pressure, their last hydrostatic test date, and any additional identification marking that may be considered necessary.

ECP 3: Water Resources Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Hazardous Material and Waste	Water pollution from the storage, handling and disposal of hazardous materials and general construction waste, and accidental spillage	The Contractor shall • Follow the management guidelines proposed in ECPs 1 and 2. • Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways, stormwater systems or underground water tables
Discharge from construction sites	Wastewaters from construction sites and work camps. The construction works will modify groundcover and topography changing the	The Contractor shall • Minimize the amount of exposed soil at any one time (only clear vegetation immediately before construction is about to begin) • Install temporary drainage works (channels and bunds) in areas required for sediment and erosion control and

	surface water drainage patterns of the area including infiltration and storage of stormwater.	around storage areas for construction materials • Install temporary sediment basins, where appropriate, to capture sediment-laden run-off from the site • Divert runoff from undisturbed areas around the construction site • Stockpile materials away from drainage lines • Prevent all solid entering waterways by collecting solid waste, oils, chemicals, bitumen spray waste and wastewaters from brick, concrete and asphalt cutting and transport to an approved waste disposal site or recycling depot • Collect, transport and discharge the septic tank waste from the construction camps in the nearby municipal wastewater treatment plants • Ensure that tires of construction vehicles are cleaned in the washing bay (constructed at the entrance of the construction site) to remove the mud from the wheels. This shall be done in every exit of each construction vehicle to ensure the local roads are kept clean.
Soil Erosion and siltation	Soil erosion and dust from the material stockpiles will increase the sediment and contaminant loading of surface water bodies.	The Contractor shall • Ensure that sealed roads used by construction vehicles are swept regularly to remove sediment. • Water the material stockpiles, access roads and bare soils on an as-required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds)

ECP 4: Drainage Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Excavation and earthworks, and construction yards	Lack of proper drainage for rainwater/liquid waste or wastewater owing to the construction activities harms the environment in terms of water and soil contamination, and mosquito growth.	The Contractor shall • Prepare a program for preventing/avoid standing waters, which CSC will verify in advance and confirm during implementation • Provide alternative drainage for rainwater if the construction works/earth-fillings cut the established drainage line • Establish local drainage line with appropriate silt collector and silt screen for rainwater or wastewater connecting to the existing established drainage lines already there • Rehabilitate road drainage structures immediately if damaged by contractors' road transports. • Build new drainage lines as appropriate and required for wastewater from construction yards connecting to the available nearby recipient water bodies. Ensure wastewater quality conforms to the relevant standards provided by NEQS, before it being discharged into the recipient water bodies.

		• Ensure the internal roads/hard surfaces in the construction yards/construction camps that generate has stormwater drainage to accommodate high runoff during a downpour and that there is no stagnant water in the area at the end of the downpour. • Construct wide drains instead of deep drains to avoid sand deposition in the drains that require frequent cleaning. • Provide appropriate silt collector and silt screen at the inlet and manholes and periodically clean the drainage system to avoid drainage congestion • Protect natural slopes of drainage channels to ensure adequate stormwater drains. • Regularly inspect and maintain all drainage channels to assess and alleviate any drainage congestion problem. • Reduce infiltration of contaminated drainage through stormwater management design
Ponding of water	Health hazards due to mosquito breeding	• Do not allow ponding of water especially near the waste storage areas and construction camps • Discard all the storage containers that are capable of storing water, after use or store them in the inverted position

ECP 5: Soil Quality Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Storage of hazardous and toxic chemicals	Spillage of hazardous and toxic chemicals will contaminate the soils	The Contractor shall • Strictly manage the wastes management plans proposed in ECP1 and storage of materials in ECP2 • Construct appropriate spill contaminant facilities for all fuel storage areas • Establish and maintain a hazardous materials register detailing the location and quantities of hazardous substances including the storage, use of disposals • Train personnel and implement safe work practices for minimizing the risk of spillage • Identify the cause of contamination, if it is reported, and contain the area of contamination. The impact may be contained by isolating the source or implementing controls around the affected site • Remediate the contaminated land using the most appropriate available method to achieve required commercial/industrial guideline validation results
Construction material stockpiles	Erosion from construction material stockpiles may contaminate the soils	The Contractor shall • Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds

ECP 6: Erosion and Sediment Control

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities and material stockpiles	The impact of soil erosion are (i) Increased runoff and sedimentation causing a greater flood hazard to the downstream, (ii) destruction of aquatic environment in nearby lakes, streams, and reservoirs caused by erosion and/or deposition of sediment damaging the spawning grounds of fish, and (iii) destruction of vegetation by burying or gullying.	The Contractor shall • Locate stockpiles away from drainage lines • Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds • Remove debris from drainage paths and sediment control structures • Cover the loose sediments and water them if required • Divert natural runoff around construction areas prior to any site disturbance • Install protective measures on-site prior to construction, for example, sediment traps • Observe the performance of drainage structures and erosion controls during rain and modify them as required.

ECP 7: Topsoil Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earthworks	Earthworks will impact the fertile topsoil that is enriched with nutrients required for plant growth or agricultural development.	The Contractor shall • Strip the topsoil to a depth of 15 cm and store in stockpiles of height not exceeding 2m. • Remove unwanted materials from topsoil like grass, roots of trees and similar others. • The stockpiles will be done in slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil. • Locate topsoil stockpiles in areas outside drainage lines and protect from erosion. • Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil. • Spread the topsoil to maintain the physico-chemical and biological activity of the soil. The stored topsoil will be utilized for covering all disturbed area and along with the proposed plantation sites • Prior to the re-spreading of topsoil, the ground surface will be ripped to assist the bunding of the soil layers, water penetration, and revegetation
Transport	Vehicular movement outside right of way of existing roads or temporary access roads	• Limit equipment and vehicular movements within the approved construction zone • Construct temporary access tracks to cross concentrated water flow lines at right angles

	will affect the soil fertility of the agricultural lands	• Plan construction access to make use, if possible, of the final road alignment • Use vehicle-cleaning devices, for example, ramps or wash down areas

ECP 8: Topography and Landscaping

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earthworks	Construction activities especially earthworks will change topography and disturb the natural rainwater/floodwater drainage as well as will change the local landscape.	The Contractor shall • Ensure the topography of the final surface of all raised lands (construction yards, approach roads, access roads, etc.) are conducive to enhance natural draining of rainwater/flood water; • Keep the final or finished surface of all the raised lands free from any kind of depression that insists waterlogging • Undertake mitigation measures for erosion control/prevention by grass-turfing and tree plantation, where there is a possibility of rain-cut that will change the shape of topography. • Cover immediately the uncovered open surface that has no use of construction activities with grass-cover and tree plantation to prevent soil erosion and bring improved landscaping

ECP 9: Quarry and Borrow Areas Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Development and operation of Quarry and borrow areas. The project will use approved quarry sites available near the project site. This ECP will be used only when a new quarry or borrow area to be developed.	Quarry areas will have impacts on local topography, landscaping and natural drainage.	The Contractor shall • Use only quarry and borrow sites that are licensed by the provincial government and approved by the project management unit/Implementation Consultants • Identify new borrow and quarry areas in consultation with Project Director, if required. • Reuse excavated or disposed of material available in the project to the maximum extent possible. • Store topsoil for reinstatement and landscaping. • Develop surface water collection and drainage systems, anti-erosion measures (berms, revegetation, etc.) and retaining walls and gabions where required. Implement mitigation measures in ECP 3: Water Resources Management, ECP 6: Erosion and Sediment Control • The use of explosives should be used in as much minimum quantity as possible to reduce noise, vibration and dust. • Control dust and air quality deterioration by application

		of watering and implementing mitigation measures proposed in ECP 10: Air Quality Management • Noise and vibration control by ECP 11: Noise and Vibration Management.

ECP 10: Air Quality Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Air quality can be adversely affected by vehicle exhaust emissions and combustion of fuels.	The Contractor shall • Fit vehicles with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition. • Operate the vehicles in a fuel-efficient manner • Cover haul vehicles carrying dusty materials moving outside the construction site • Impose speed limits on all vehicle movement at the worksite to reduce dust emissions • Control the movement of construction traffic • Water construction materials prior to loading and transport • Service all vehicles regularly to minimize emissions • Limit the idling time of vehicles not more than 2 minutes
Construction machinery	Air quality can be adversely affected by emissions from machinery and the combustion of fuels.	The Contractor shall • Fit machinery with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition in accordance with the specifications defined by their manufacturers to maximize combustion efficiency and minimize the contaminant emissions. Proof of maintenance register shall be required by the equipment suppliers and contractors/subcontractors • Focus special attention on containing the emissions from generators • Machinery causing excess pollution (e.g. visible smoke) will be banned from construction sites • Service all equipment regularly to minimize emissions • Provide filtering systems, duct collectors or humidification or other techniques (as applicable) to the concrete batching and mixing plant to control the particle emissions in all its stages, including unloading, collection, aggregate handling, cement dumping, circulation of trucks and machinery inside the installations
Construction activities	Dust generation from construction sites, material stockpiles and access roads are a nuisance in the	• Water the material stockpiles, access roads and bare soils on an as-required basis to minimize the potential for environmental nuisance due to dust. Increase the watering frequency during periods of high risk (e.g. high winds). Stored materials such as gravel and sand shall be

	environment and can be a health hazard.	covered and confined to avoid their being wind-drifted • Minimize the extent and period of exposure of the bare surfaces • Reschedule earthwork activities or vegetation clearing activities, where practical, if necessary, to avoid during periods of high wind and if visible dust is blowing off-site • Store the cement in silos and minimize the emissions from silos by equipping them with filters. • Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust dispersion is prevented because of such operations • Crushing of rocky and aggregate materials shall be wet-crushed, or performed with particle emission control systems

ECP 11: Noise and Vibration Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Noise quality will be deteriorated due to vehicular traffic	The Contractor shall • Maintain all vehicles in order to keep it in good working order in accordance with manufactures maintenance procedures • Make sure all drivers will comply with the traffic codes concerning the maximum speed limit, driving hours, etc. • Organize the loading and unloading of trucks, and handling operations for the purpose of minimizing construction noise on the worksite
Construction machinery	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	The Contractor shall • Appropriately site all noise-generating activities to avoid noise pollution to local residents • Use the quietest available plant and equipment • Modify equipment to reduce noise (for example, noise control kits, the lining of truck trays or pipelines) • Maintain all equipment in order to keep it in good working order in accordance with manufactures maintenance procedures. Equipment suppliers and contractors shall present proof of the maintenance register of their equipment. • Install acoustic enclosures around generators to reduce noise levels. • Fit high-efficiency mufflers to appropriate construction equipment • Avoid the unnecessary use of alarms, horns and sirens
Construction activity	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	The Contractor shall • Notify adjacent landholders prior to any typical noise events outside of daylight hours (6 pm to 7 am) if the construction works are being carried out near residential areas

		• Educate the operators of construction equipment on potential noise problems and the techniques to minimize noise emissions • Employ the best available work practices on-site to minimize occupational noise levels • Install temporary noise control barriers where appropriate • Notify affected people if major noisy activities are undertaken, e.g. pile driving • Plan activities on-site and deliveries to and from site to minimize impact • Monitor and analyze noise and vibration results and adjust construction practices as required. • Avoid undertaking the noisiest activities, where possible, when working at night (6pm to 7 am) near the residential areas

ECP 12: Protection of Flora

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Vegetation clearance	Local flora is important to provide shelters for the birds, offer fruits and/or timber/firewood, protect soil erosion and overall keep the environment very friendly to human-living. As such damage to flora has a wide range of adverse environmental impacts.	The Contractor shall • Reduce disturbance to surrounding vegetation • Use appropriate type and minimum size of machine to avoid disturbance to adjacent vegetation. • Get approval from the supervision consultant for the clearance of vegetation. • Make selective and careful pruning of trees where possible to reduce the need for tree removal. • Control noxious weeds by disposing of at designated dump site or burn on site. • Plant only native species that are approved by the local forest department (to confirm that they are not invasive) for plantation in the construction yards and project sites. • Clear only the vegetation that needs to be cleared in accordance with the plans. These measures are applicable to both the construction areas as well as to any associated activities such as sites for stockpiles, disposal of fill and construction of diversion roads, etc. • Before excavation, mark the trees that must remain on the site and cannot be removed. • Do not burn off cleared vegetation – where feasible, chip or mulch and reuse it for the rehabilitation of affected areas, temporary access tracks or landscaping. Mulch provides a seed source, can limit embankment erosion, retains soil moisture and nutrients, and encourages re-growth and protection from weeds. • Return topsoil and mulched vegetation (in areas of native vegetation) to approximately the same area of

		the roadside it came from. • Avoid work within the dripline of trees to prevent damage to the tree roots and compacting the soil. • Minimize the length of time the ground is exposed, or excavation left open by clearing and re-vegetate the area at the earliest practically possible. • Ensure excavation works occur progressively and re-vegetation done at the earliest • Provide adequate knowledge to the workers regarding nature protection and the need to avoid felling trees during construction • Supply appropriate fuel in the work caps to prevent fuelwood collection

ECP 13: Protection of Fauna

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Vegetation clearance	Clearance of vegetation may impact shelter, feeding and/or breeding of animals	The Contractor shall • Restrict the tree removal to the minimum required. • Retain tree hollows on-site, or relocate hollows, where appropriate • Leave dead trees where possible as habitat for fauna • Identify the trees that require specific attention (e.g. the hollow-bearing trees) and fell them in a manner that reduces the potential for fauna mortality. Felled trees will be inspected after felling for fauna and if identified and readily accessible will be removed and relocated or rendered assistance if injured. After felling, hollow-bearing trees will remain unmoved overnight to allow animals to move of their own volition.
Construction camps	Illegal poaching	• Provide adequate knowledge to the workers regarding the protection of flora and fauna, and relevant government regulations and punishments for illegal poaching. • The contractor's code of conduct shall include on the protection of flora and fauna, and ban on tree cutting and hunting of animals. Employees found violating would be subject to strict actions including fines and termination of employment.

ECP 14: Protection of Fish

Project Activity/	Environmental Impacts	Mitigation Measures/ Management Guidelines

Impact Source		
Construction activities in River	The main potential impacts to fisheries are hydrocarbon spills and leaks from riverine transport and disposal of wastes into the river	The Contractor shall • Prepare procedures for the protection of fish and submit them for supervision consultant approval. • Ensure the construction equipment used in the river are well maintained and does not have oil leakage to contaminate river water. • Contain oil immediately on the river in case of accidental spillage from equipment; make an emergency oil spill containment plan (under the Fuels and Hazardous Substances Management Plan) to be supported with enough equipment, materials and human resources. • Do not dump wastes, be it hazardous or non-hazardous into the nearby water bodies or in the river.
Construction activities on the land	The main potential impacts to aquatic flora and fauna River are increased suspended solids from earthworks erosion, sanitary discharge from work camps, and hydrocarbon spills	The Contractor shall • follow mitigation measures proposed in ECP 3: Water Resources Management and EC4: Drainage Management.

ECP 15: Road Transport and Road Traffic Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Increased traffic use of the road by construction vehicles will affect the movement of normal road traffics and the safety of the road-users.	The Contractor shall • Prepare and submit a traffic management plan to the CSC for their approval before the commencement of construction. • Include in the traffic management plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges temporary diversions, necessary barricades, warning signs / lights, and road signs. • Provide signs at strategic locations of the roads complying with the schedules of signs contained in the Pakistan Traffic Regulations. • Install and maintain a display board at each important road intersection on the roads to be used during construction, which shall clearly show the following information in local language: o Location: chainage and village name o Duration of the construction period o Period of proposed detour / alternative route

		○ Suggested detour route map ○ Name and contact address/telephone number of the concerned personnel ○ Name and contact address / telephone number of the Contractor ○ Inconvenience is sincerely regretted.
	Accidents and spillage of fuels and chemicals	• Restrict truck deliveries, where practicable, to daytime working hours (7 am to 6 pm). • Restrict the transport of oversize loads. • Operate road traffics/transport vehicles, if possible, to non-peak periods to minimize traffic disruptions. • Enforce on-site speed limit

ECP 16: Labor Influx Management and Construction Camp Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Siting and Location of construction camps	Campsites for construction workers are the important locations that have significant impacts such as health and safety hazards on local resources and infrastructure of nearby communities.	The Contractor shall • Prepare a management plan for construction of workers camp in accordance with IFC Guidance on Workers Accommodation and submit the plan for supervision consultant's approval. • Locate the construction camps within the designed sites or at areas that are acceptable from the environmental, cultural or social point of view; and approved by the supervision consultant. • Consider the location of construction camps away from communities in order to avoid social conflict in using natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities. • Submit to the supervision consultant for approval a detailed layout plan for the development of the construction camp showing the relative locations of all temporary buildings and facilities that are to be constructed together with the location of site roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, prior to the development of the construction camps. • Local authorities responsible for health, religious and security shall be duly informed on the set up of camp facilities so as to maintain effective surveillance over public health, social and security matters.
Construction Camp Facilities	Lack of proper infrastructure facilities , such as housing, water supply and sanitation facilities will increase	Contractor shall provide the following facilities in the campsites • Adequate accommodation, transportation, and basic services including water, sanitation, and medical care for the workers working on that project Safe and reliable water supply, which should meet NEQS. Drinking water to

	pressure on the local services and generate substandard living standards and health hazards.	be chlorinated at source and ensure the presence of residual chlorine 0.1 ~ 0.25 ppm as a minimum after 30 minutes of chlorine contact time (WHO guideline). • Hygienic sanitary facilities and sewerage systems. The toilets and domestic wastewater will be collected through common sewerage. Provide separate latrines and bathing places for males and females with total isolation by location. The minimum number of toilet facilities required is one toilet for every ten persons. • Treatment facilities for sewerage of toilet and domestic wastes. • Stormwater drainage facilities. • Paved internal roads. • Provide child crèches for women working construction sites. The crèche should have facilities for dormitory, kitchen, indoor and outdoor play area. Schools should be attached to these crèches so that children are not deprived of education whose mothers are construction workers. • Provide in-house community/common entertainment facilities. Dependence of local entertainment outlets by the construction camps to be discouraged/prohibited to the extent possible.
Workers Accommodation	All workers in the camp should have adequate accommodation facilities	The Contractor shall provide the following: • The labor will be provided with accommodation on twin sharing basis made of insulating material and locally available building material, etc.; • The migrant workers with families shall be provided with individual accommodation comprising a bedroom, sanitary and cooking facilities; • The units will be supported by common latrines and bathing facilities duly segregated for male and female labor; • An adequate number of toilets shall be provided in the accommodation facilities. A minimum of 1 unit to 15 males and 1 unit for 10 females shall be provided; • The contractor shall provide a kitchen facility for the construction workers and the food will be of appropriate nutritional value and will consider religious/cultural backgrounds; • All doors and windows shall be lockable and mobile partitions/curtains shall be provided for privacy; • Facilities for the storage of personal belongings for workers shall be provided within the campsite only; • Dustbins shall be provided for collection of garbage and will be removed on a daily basis; • It is also required to provide first aid box in adequate numbers; and • Ventilation should be appropriate for the climatic conditions and provide workers with a comfortable and healthy environment to rest and spend their spare time.

Disposal of waste	Management of wastes is crucial to minimize impacts on the environment	The Contractor shall • Ensure proper collection and disposal of solid wastes within the construction camps • Insist waste separation by source; organic wastes in one pot and inorganic wastes in another pot at the household level. • Store inorganic wastes in a safe place within the household and clear organic wastes on a daily basis to waste collectors. Establish waste collection, transportation and disposal systems with the manpower and equipment/vehicles needed. • Dispose of organic wastes in a designated safe place on a daily basis. At the end of the day cover the organic wastes with a thin layer of sand so that flies, mosquitoes, dogs, cats, rats are not attracted. One may dig a large hole to put organic wastes in it; take care to protect groundwater from contamination by leachate formed due to decomposition of wastes. Cover the bed of the pit with an impervious layer of materials (clayey or thin concrete) to protect groundwater from contamination. • Locate the garbage pit/waste disposal site min 500 m away from the residence so that peoples are not disturbed with the odor likely to be produced from anaerobic decomposition of wastes at the waste dumping places. Encompass the waste dumping place by fencing and tree plantation to prevent children from entering and playing with. • Do not establish site-specific landfill sites. All solid waste will be collected and removed from the work camps and treated by composting.
Fuel supplies for cooking purposes	Illegal sourcing of fuelwood by construction workers will impact the natural flora and fauna	The Contractor shall • Provide fuel to the construction camps for their domestic purpose, in order to discourage them from using fuelwood or another biomass. • Made available alternative fuels like natural gas or kerosene on ration to the workforce to prevent them from using biomass for cooking. • Conduct awareness campaigns to educate workers on preserving the protecting the biodiversity and wildlife of the project area, and relevant government regulations and punishments on wildlife protection.
Health and Hygiene	There will be a potential for diseases to be transmitted including malaria, exacerbated by inadequate health and safety practices. There will be an increased risk	The Contractor shall • Provide adequate health care facilities within construction sites. • Provide first aid facility round the clock. Maintain stock of medicines in the facility and appoint full-time designated first aider or nurse. • Provide ambulance facility for the laborers during an emergency to be transported to the nearest hospitals.

	of work crews spreading sexually transmitted infections and HIV/AIDS.	• Initial health screening of the laborers coming from outside areas
		• Inspect all camp facilities regularly to ensure
		  ○ Daily sweeping of rooms and houses shall be undertaken;
		  ○ Regular cleaning of sanitary facilities shall be undertaken;
		  ○ The kitchen and canteen premises shall be established under good hygiene conditions;
		  ○ Daily mealtimes shall be fixed for the labor;
		  ○ Smoking and alcohol consumption shall be prohibited in the workplace;
		  ○ Waterlogging shall be prevented at areas near the accommodation facilities and adequate drainage is to be provided; and
		  ○ Checklists pertaining to the daily housekeeping schedule shall be maintained and displayed at houses, toilets, and kitchen.
		• Train all construction workers in basic sanitation and health care issues and safety matters, and on the specific hazards of their work
		• Provide HIV awareness programming, including STI (sexually transmitted infections) and HIV information, education and communication for all workers on a regular basis
		• Complement educational interventions with easy access to condoms at campsites as well as voluntary counseling and testing
		• Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellant sprays during monsoon.
		• Carryout short training sessions on best hygiene practices to be mandatorily participated by all workers. Place display boards at strategic locations within the camps containing messages on best hygienic practices

Safety	Inadequate safety facilities to the construction camps may create security problems and fire hazards	The Contractor shall • Provide appropriate security personnel (police / home guard or private security guards) and enclosures to prevent unauthorized entry into the camp area. • Maintain register to keep a track on a headcount of persons present in the camp at any given time. • Encourage the use of flameproof material for the construction of labor housing / site office. Also, ensure that these houses/rooms are of sound construction and capable of withstanding windstorms/cyclones. • Provide the appropriate type of firefighting equipment suitable for the construction camps • Display emergency contact numbers clearly and prominently at strategic places in camps. • Communicate the roles and responsibilities of laborers in

		case of an emergency in the monthly meetings with contractors.
Site Restoration	Restoration of the construction camps to the original condition requires the demolition of construction camps.	The Contractor shall • Dismantle and remove from the site all facilities established within the construction camp including the perimeter fence and lockable gates at the completion of the construction work. • Dismantle camps in phases and as the work gets decreased and not wait for the entire work to be completed • Give prior notice to the laborers before demolishing their camps/units • Reuse the demolition debris to a maximum extent. Dispose of remaining debris at the designated waste disposal site. • Handover the construction camps with all built facilities as it is if an agreement between both parties (contractor and landowner) has been made so. • Restore the site to its condition prior to commencement of the works or to an agreed condition with the landowner. • Not make false promises to the laborers for future employment in O&M of the project.

ECP 17: Socio-cultural and Religious Issues

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities near residential areas	Disturbance from construction activities (dust, noise, traffic, conflicts with contractor's workforce, etc.)	The Contractor shall • Establish a system for receiving complaints from the community and address them (the community can also make complaints to the GRM established under the project) • Shall ensure all the construction workers follows the following code of conduct: • All workers are strictly forbidden to establish any kind of relationship with local women brings any un-related women to the project site. • All workers should avoid sexual harassment and child abuse. • All workers must not leave the camps or work sites unless written authorization is issued by the respective supervisor • The contractors will advise and prohibit the local population and its authorities or representatives not to enter the project operation areas (campsites, colonies, etc.) in order to minimize the potential risk of incidents related to the operations.
Construction	Disturbance from	The Contractor shall

activities near-religious and cultural sites	construction works to the cultural and religious sites, and contractors' lack of knowledge on cultural issues cause social disturbances.	• Communicate to the public through community consultation and newspaper announcements regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restriction. • Do not block access to cultural and religious sites, wherever possible • Restrict all construction activities within the footprints of the construction sites. • Stop construction works that produce noise (particularly during prayer time) shall there be any mosque/religious/educational institutions close to the construction sites, and users make objections. • Take special care and use appropriate equipment when working next to a cultural/religious institution. • Stop work immediately and notify the site manager if, during construction, an archaeological or burial site is discovered. It is an offence to recommence work in the vicinity of the site until approval to continue is given by the CSC/PMU. • Provide separate prayer facilities to the construction workers. • Show appropriate behavior with all construction workers especially women and elderly people • Allow the workers to participate in praying during construction time • Resolve cultural issues in consultation with local leaders and supervision consultants • Establish a mechanism that allows local people to raise grievances arising from the construction process. • Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works so as to maintain effective surveillance over public health, social and security matters

ECP 18: Worker Health and Safety

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Best practices	Construction works may pose health and safety risks to the construction workers and site visitors leading to severe injuries and deaths. The population in the proximity of the construction site and the construction workers will be exposed to a number of (i) biophysical health	The Contractor shall • Implement suitable safety standards for all workers and site visitors which shall not be less than those laid down on the international standards (e.g. International Labor Office guideline on 'Safety and Health in Construction; World Bank Group's 'Environmental Health and Safety Guidelines') and standards applicable in US/UK/Australia/or any other developed country can also be used. • Provide the workers with a safe and healthy work environment, taking into account inherent risks in its particular construction activity and specific classes of

	risk factors, (e.g., noise, dust, chemicals, construction material, solid waste, wastewater, vector transmitted diseases, etc.), (ii) risk factors resulting from human behavior (e.g., STD, HIV etc.) and (iii) road accidents from construction traffic.	hazards in the work areas, • Provide personal protection equipment (PPE) for workers, such as safety boots, helmets, masks, gloves, protective clothing, goggles, full-face eye shields, and ear protection. Maintain the PPE properly by cleaning dirty ones and replacing them with the damaged ones. • Safety procedures include the provision of information, training and protective clothing to workers involved in hazardous operations and proper performance of their job • Appoint an environment, health and safety manager to look after the health and safety of the workers • Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works and establishment of construction camps so as to maintain effective surveillance over public health, social and security matters
	Child and pregnant labor	The Contractor shall • not hire children of less than 18 years of age and pregnant women or women who delivered a child within 8 preceding weeks, in accordance with the National Labor Laws
Accidents	Lack of first aid facilities and health care facilities in the immediate vicinity will aggravate the health conditions of the victims	• Provide health care facilities and first aid facilities are readily available. Appropriately equipped first-aid stations shall be easily accessible throughout the place of work • Document and report occupational accidents, diseases, and incidents. • Prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards. In a manner consistent with good international industry practice. • Identify potential hazards to workers, particularly those that may be life-threatening and provide necessary preventive and protective measures. • Provide awareness to the construction drivers to strictly follow the driving rules • Provide adequate lighting in the construction area and along the roads
Construction Camps	Lack of proper infrastructure facilities, such as housing, water supply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health	The Contractor shall provide the following facilities in the campsites to improve health and hygienic conditions as mentioned in ECP 15 • Adequate ventilation facilities • Safe and reliable water supply. • Hygienic sanitary facilities and sewerage systems. The toilets and domestic wastewater will be collected through common sewerage. • Treatment facilities for sewerage of toilet and domestic

	hazards.	wastes • Stormwater drainage facilities. • Recreational and social facilities • Safe storage facilities for petroleum and other chemicals in accordance with ECP 2 • Solid waste collection and disposal system in accordance with ECP1. • Arrangement for trainings • Paved internal roads. • Security fence at least 2 m height. • Sickbay and first aid facilities
Water and sanitation facilities at the construction sites	Lack of Water sanitation facilities at construction sites cause inconvenience to the construction workers and affect their personal hygiene.	The contractor shall provide portable toilets at the construction sites, if about 25 people are working the whole day for a month. The location of portable facilities shall be at least 6 m away from the storm drain system and surface waters. These portable toilets shall be cleaned once a day and all the sewerage shall be pumped from the collection tank once a day and shall be brought to the common septic tank for further treatment. The contractor shall provide bottled drinking water facilities to the construction workers at all the construction sites.
Other ECPs	Potential risks on health and hygiene of construction workers and general public	The Contractor shall follow the following ECPs to reduce health risks to the construction workers and nearby community ECP 2: Fuels and Hazardous Goods Management ECP 4: Drainage Management ECP 10: Air Quality Management ECP 11: Noise and Vibration Management ECP 14: Road Transport and Road Traffic Management
Trainings	Lack of awareness and basic knowledge in health care among the construction workforce, make them susceptible to potential diseases.	The Contractor shall • Train all construction workers in basic sanitation and health care issues (e.g., how to avoid malaria and transmission of sexually transmitted infections (STI) HIV/AIDS. • Train all construction workers in general health and safety matters, and on the specific hazards of their work . Training shall consist of basic hazard awareness, site-specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. • Commence malaria, HIV/AIDS and STI education campaign before the start of the construction phase and complement it with a strong condom marketing, increased access to condoms in the area as well as to voluntary counseling and testing. • Implement malaria, HIV/AIDS and STI education campaign targeting all workers hired, international and national, female and male, skilled, semi- and unskilled occupations, at the time of recruitment and thereafter pursued throughout the construction phase on ongoing

		and regular basis. This shall be complemented by easy access to condoms at the workplace as well as to voluntary counseling and testing.

ECP 19: Tunneling and Underground Construction Works

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Ventilation	Poor ventilation results in oxygen depletion and exposure to excessive heat and fumes, which can lead to acute or long-term health problems;	The Contractor shall • follow Specifications on Ventilation and Lighting for Underground Works of the International tunneling association.
Atmospheric pollution	Release of toxic gases, fumes and vapors	The Contractor shall follow Technical Specifications on Ventilation and Lighting for Underground Works
	Release of dust and silica. Long-term exposure to respirable dust can lead to diseases ranging from bronchitis to cancer. Even if the dust is not at harmful levels it can cause irritation to the eyes and throat and increase the risk of physical injury due to poor visibility	The Contractor shall • Identify possible sources of the generation of dust in a tunnel and control measures implemented to eliminate or minimize, so far as is reasonably practicable, the generation of the dust at the source. • Maintain extraction at or close to the point of • Use extractors or dust collection devices in-line near the face • Increase ventilation capacity by increasing the extraction rate when and where needed • Use wet spraying to suppress dust at the point of generation e.g. conveyors, spoil heaps after blasting, while loading and on roadways • providing PPE like respirators rated for the concentration and duration of exposure
Work Place Facilities	All underground workers should have access to adequate water and sanitation facilities	The Contractor shall • Provide adequate facilities for workers including toilets, drinking water, washing facilities and eating facilities • Ensure the facilities are maintained in good working order, clean, safe and accessible • Ensure the eating facilities (crib rooms) should be away from dusty environments • Ensure regular collection and disposal of solid waste and other construction waste from underground areas.
Heat Stress	Heat stress causes tiredness, irritability, light-headedness, muscular cramps, etc.	The Contractor shall • Regulate the airflow or modifying ventilation to ensure cooling • Reduce items of heat-producing equipment in the tunnel • Provide extra ventilation fans to create air flows in low-flow areas • Provide cool drinking water
	Fire and explosion	The Contractor shall

		• Conduct fueling in designated fueling bays • Eliminate ignition sources underground where practicable • Isolate fuel sources from remaining ignition sources • Remove potential fuel sources from the work area • Store only necessary fuel underground • Implement firefighting training and procedures • Ensure the availability of firefighting resources • Restrict smoking to designated areas
	Collisions with moving plant (vehicle and equipment)	The contractor shall • plan pedestrian movements are separated from vehicle movements • providing lighting for safe movement • provide a system to warn workers when the plant is reversing or special loads like explosives are being moved
Emergency Response	Emergency Plan	The Contractor shall prepare an emergency response plan with • emergency procedures including • an effective response to an emergency • evacuation procedures • notifying emergency service organisations at the earliest opportunity • effective communication between the person authorised by the person conducting the business or undertaking to co-ordinate the emergency response and people at the workplace • testing emergency procedures including the frequency of testing, and • Information, training and instruction to relevant workers about implementing the emergency procedures
	Check-in/check-out procedures	The Control shall • Maintain a check-in/check-out procedure to ensure that the above-ground personnel maintain an accurate accounting of the number of persons underground and to prevent unauthorized persons from gaining access to the site. This is especially important in the event of an emergency but is a commonsense requirement at all times. • Any time an employee is working underground, at least one designated person must be on duty above ground. This person is responsible for calling for immediate assistance and keeping an accurate count of employees who remain underground in the event of an emergency.
	Communication system	The contractor shall establish a communication system throughout the construction site to pass the information and instructions, the monitoring of systems and the control of operations such as lifting; transporting persons, materials and plants; coordinating maintenance and managing emergencies.

ECP 20: Instream Construction Works (Diversion, Coffer Dam and Dam Construction)

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
General Construction Works	River water quality and aquatic habitat due to risk of release of deleterious substances into the river	The Contractor shall • Prevent the release of silt, sediment, sediment-laden water, raw concrete, concrete leachate, or any other deleterious substances into the River. • Ensure equipment and machinery are in good operating condition (power washed), free of leaks, excess oil and lubricants, and grease. • Machinery leaking fuel, lubricants, hydraulic fluids or solvents shall not work within the river. • Keep a spill containment kit readily accessible onsite in the event of a release of a deleterious substance to the environment. Train onsite staff in its use.
	Stranding of fish in the dewatered area	The Contractor shall • Complete fish salvage before the start of works from the dewatered portion of the river using appropriate techniques.
	Risk of safety relative to river work	The Contractor shall • Devise an evacuation plan, including installation of warning signals and emergency exits, to safely evacuate employees and equipment from the work area. • Ensure risk management procedures are in place on all work sites to minimise the potential for damage arising from inclement weather and/or/elevated river levels during the course of work.
Excavation Works	.	The Contractor shall • Remove excavated material and dispose of it into the designated disposal areas, not dumping these materials into the river. Use mitigating measures to protect excavated material from being eroded and reintroduced into the river
Concrete Works	Concrete leachate is alkaline and highly toxic to fish and other aquatic life.	The Contractor shall • Provide appropriate devices and measures against the discharge of toxic materials and fluids originated from concreting work into the rivers, • Ensure that any materials or liquids produced by works involving the use of concrete, cement and cementitious materials shall not be deposited at non-designated places, and not be discharged into or about any watercourse without treatment. • Provide containment facilities for the wash-down water from concrete delivery trucks, concrete pumping equipment, and other tools and equipment.

Annex 2: Biodiversity within 50 Km of the Project Area[36]

Table 1: List of Mammalian species

S.No.	order_	family	genus	binomial	common_name	category	Population trend
1	"RODENTIA"	"SCIURIDAE"	"Eupetaurus"	"Eupetaurus cinereus"	"Woolly Flying Squirrel"	"EN"	"unknown"
2	"CETARTIODACTYLA"	"MOSCHIDAE"	"Moschus"	"Moschus cupreus"	"Kashmir Muskdeer"	"EN"	"decreasing"
3	"CARNIVORA"	"FELIDAE"	"Panthera"	"Panthera pardus"	"Leopard"	"VU"	"decreasing"
4	"CARNIVORA"	"FELIDAE"	"Panthera"	"Panthera uncia"	"Snow Leopard"	"VU"	"decreasing"
5	"CARNIVORA"	"URSIDAE"	"Ursus"	"Ursus thibetanus"	"Asiatic Black Bear"	"VU"	"decreasing"
6	"CETARTIODACTYLA"	"BOVIDAE"	"Capra"	"Capra falconeri"	"Markhor"	"NT OR LR/NT"	"increasing"
7	"CARNIVORA"	"HYAENIDAE"	"Hyaena"	"Hyaena hyaena"	"Striped Hyaena"	"NT OR LR/NT"	"decreasing"
8	"RODENTIA"	"CRICETIDAE"	"Hyperacrius"	"Hyperacrius fertilis"	"Burrowing Vole"	"NT OR LR/NT"	"unknown"
9	"CETARTIODACTYLA"	"BOVIDAE"	"Naemorhedus"	"Naemorhedus goral"	"Himalayan Goral"	"NT OR LR/NT"	"decreasing"
10	"CARNIVORA"	"FELIDAE"	"Otocolobus"	"Otocolobus manul"	"Pallas's Cat"	"NT OR LR/NT"	"decreasing"
11	"CARNIVORA"	"MUSTELIDAE"	"Mustela"	"Mustela altaica"	"Altai Weasel"	"NT OR LR/NT"	"decreasing"
12	"CHIROPTERA"	"MINIOPTERIDAE"	"Miniopterus"	"Miniopterus schreibersii"	"Schreiber's Bent-winged Bat"	"NT OR LR/NT"	"decreasing"
13	"RODENTIA"	"CRICETIDAE"	"Alticola"	"Alticola argentatus"	"Silver Mountain Vole"	"LC OR LR/LC"	"unknown"
14	"RODENTIA"	"MURIDAE"	"Apodemus"	"Apodemus rusiges"	"Kashmir Field Mouse"	"LC OR LR/LC"	"unknown"
15	"RODENTIA"	"MURIDAE"	"Apodemus"	"Apodemus pallipes"	"Himalayan Field Mouse"	"LC OR LR/LC"	"unknown"
16	"RODENTIA"	"CALOMYSCIDAE"	"Calomyscus"	"Calomyscus baluchi"	"Baluchi Brush-tailed Mouse"	"LC OR LR/LC"	"unknown"
17	"CARNIVORA"	"CANIDAE"	"Canis"	"Canis lupus"	"Grey Wolf"	"LC OR LR/LC"	"stable"
18	"RODENTIA"	"CRICETIDAE"	"Cricetulus"	"Cricetulus migratorius"	"Gray Dwarf Hamster"	"LC OR LR/LC"	"unknown"
19	"RODENTIA"	"GLIRIDAE"	"Dryomys"	"Dryomys nitedula"	"Forest Dormouse"	"LC OR LR/LC"	"unknown"
20	"RODENTIA"	"SCIURIDAE"	"Eoglaucomys"	"Eoglaucomys fimbriatus"	"Small Kashmir Flying Squirrel"	"LC OR LR/LC"	"unknown"
21	"CHIROPTERA"	"VESPERTILIONIDAE"	"Eptesicus"	"Eptesicus serotinus"	"Serotine"	"LC OR LR/LC"	"unknown"
22	"CHIROPTERA"	"VESPERTILIONIDAE"	"Eptesicus"	"Eptesicus bottae"	"Botta's Serotine"	"LC OR LR/LC"	"unknown"
23	"CHIROPTERA"	"HIPPOSIDERIDAE"	"Hipposideros"	"Hipposideros fulvus"	"Fulvus Leaf-nosed Bat"	"LC OR LR/LC"	"stable"
24	"RODENTIA"	"HYSTRICIDAE"	"Hystrix"	"Hystrix indica"	"Indian Crested Porcupine"	"LC OR LR/LC"	"stable"
25	"CHIROPTERA"	"VESPERTILIONIDAE"	"Kerivoula"	"Kerivoula hardwickii"	"Hardwickeâ€™s Woolly Bat"	"LC OR LR/LC"	"stable"
26	"PRIMATES"	"CERCOPITHECIDAE"	"Macaca"	"Macaca mulatta"	"Rhesus Monkey"	"LC OR LR/LC"	"unknown"
27	"RODENTIA"	"SCIURIDAE"	"Marmota"	"Marmota caudata"	"Long-tailed Marmot"	"LC OR LR/LC"	"unknown"
28	"CHIROPTERA"	"VESPERTILIONIDAE"	"Murina"	"Murina huttoni"	"White-bellied Tube-nosed Bat"	"LC OR LR/LC"	"unknown"
29	"CHIROPTERA"	"VESPERTILIONIDAE"	"Murina"	"Murina tubinaris"	"Scully's Tube-nosed Bat"	"LC OR LR/LC"	"unknown"
30	"CHIROPTERA"	"VESPERTILIONIDAE"	"Myotis"	"Myotis blythii"	"Lesser Mouse-eared Myotis"	"LC OR LR/LC"	"decreasing"
31	"CHIROPTERA"	"VESPERTILIONIDAE"	"Myotis"	"Myotis muricola"	"Nepalese Whiskered Myotis"	"LC OR LR/LC"	"stable"
32	"CHIROPTERA"	"VESPERTILIONIDAE"	"Nyctalus"	"Nyctalus leisleri"	"Lesser Noctule"	"LC OR LR/LC"	"unknown"
33	"RODENTIA"	"SCIURIDAE"	"Petaurista"	"Petaurista petaurista"	"Red Giant Flying Squirrel"	"LC OR LR/LC"	"decreasing"
34	"CHIROPTERA"	"VESPERTILIONIDAE"	"Pipistrellus"	"Pipistrellus kuhlii"	"Kuhl's Pipistrelle"	"LC OR LR/LC"	"unknown"

[36] Data sources for this annex are IBAT and Secondary Literature

S.No.	order_	family	genus	binomial	common_name	category	Population trend
35	"CHIROPTERA"	"VESPERTILIONIDAE"	"Pipistrellus"	"Pipistrellus pipistrellus"	"Common Pipistrelle"	"LC OR LR/LC"	"stable"
36	"CHIROPTERA"	"VESPERTILIONIDAE"	"Pipistrellus"	"Pipistrellus coromandra"	"Coromandel Pipistrelle"	"LC OR LR/LC"	"unknown"
37	"CHIROPTERA"	"VESPERTILIONIDAE"	"Pipistrellus"	"Pipistrellus javanicus"	"Javan Pipistrelle"	"LC OR LR/LC"	"stable"
38	"CHIROPTERA"	"VESPERTILIONIDAE"	"Pipistrellus"	"Pipistrellus tenuis"	"Least Pipistrelle"	"LC OR LR/LC"	"stable"
39	"CARNIVORA"	"FELIDAE"	"Prionailurus"	"Prionailurus bengalensis"	"Leopard Cat"	"LC OR LR/LC"	"stable"
40	"RODENTIA"	"MURIDAE"	"Rattus"	"Rattus rattus"	"House Rat"	"LC OR LR/LC"	"stable"
41	"RODENTIA"	"MURIDAE"	"Rattus"	"Rattus pyctoris"	"Himalayan Rat"	"LC OR LR/LC"	"unknown"
42	"CHIROPTERA"	"RHINOLOPHIDAE"	"Rhinolophus"	"Rhinolophus ferrumequinum"	"Greater Horseshoe Bat"	"LC OR LR/LC"	"decreasing"
43	"CHIROPTERA"	"PTEROPODIDAE"	"Rousettus"	"Rousettus leschenaultii"	"Leschenaultâ€™s Rousette"	"LC OR LR/LC"	"stable"
44	"CHIROPTERA"	"VESPERTILIONIDAE"	"Scotophilus"	"Scotophilus heathii"	"Greater Asiatic Yellow House Bat"	"LC OR LR/LC"	"stable"
45	"RODENTIA"	"DIPODIDAE"	"Sicista"	"Sicista concolor"	"Chinese Birch Mouse"	"LC OR LR/LC"	"unknown"
46	"CHIROPTERA"	"VESPERTILIONIDAE"	"Vespertilio"	"Vespertilio murinus"	"Particoloured Bat"	"LC OR LR/LC"	"stable"
47	"CARNIVORA"	"CANIDAE"	"Vulpes"	"Vulpes vulpes"	"Red Fox"	"LC OR LR/LC"	"stable"
48	"CARNIVORA"	"MUSTELIDAE"	"Martes"	"Martes foina"	"Beech Marten"	"LC OR LR/LC"	"stable"
49	"CARNIVORA"	"MUSTELIDAE"	"Mustela"	"Mustela erminea"	"Stoat"	"LC OR LR/LC"	"stable"
50	"PRIMATES"	"CERCOPITHECIDAE"	"Semnopithecus"	"Semnopithecus schistaceus"	"Nepal Gray Langur"	"LC OR LR/LC"	"decreasing"
51	"LAGOMORPHA"	"OCHOTONIDAE"	"Ochotona"	"Ochotona macrotis"	"Large-eared Pika"	"LC OR LR/LC"	"unknown"
52	"LAGOMORPHA"	"OCHOTONIDAE"	"Ochotona"	"Ochotona roylei"	"Royle's Pika"	"LC OR LR/LC"	"stable"
53	"LAGOMORPHA"	"LEPORIDAE"	"Lepus"	"Lepus capensis"	"Cape Hare"	"LC OR LR/LC"	"decreasing"
54	"LAGOMORPHA"	"LEPORIDAE"	"Lepus"	"Lepus nigricollis"	"Indian Hare"	"LC OR LR/LC"	"unknown"
55	"LAGOMORPHA"	"LEPORIDAE"	"Lepus"	"Lepus tibetanus"	"Desert Hare"	"LC OR LR/LC"	"unknown"
56	"EULIPOTYPHLA"	"SORICIDAE"	"Crocidura"	"Crocidura gmelini"	""	"LC OR LR/LC"	"unknown"
57	"EULIPOTYPHLA"	"SORICIDAE"	"Suncus"	"Suncus murinus"	"House Shrew"	"LC OR LR/LC"	"stable"
58	"CHIROPTERA"	"VESPERTILIONIDAE"	"Eptesicus"	"Eptesicus gobiensis"	"Gobi Big Brown Bat"	"LC OR LR/LC"	"unknown"
59	"CARNIVORA"	"MUSTELIDAE"	"Martes"	"Martes flavigula"	"Yellow-throated Marten"	"LC OR LR/LC"	"decreasing"
60	"CARNIVORA"	"MUSTELIDAE"	"Mustela"	"Mustela sibirica"	"Siberian Weasel"	"LC OR LR/LC"	"stable"
61	"CARNIVORA"	"VIVERRIDAE"	"Paguma"	"Paguma larvata"	"Masked Palm Civet"	"LC OR LR/LC"	"decreasing"
62	"CARNIVORA"	"VIVERRIDAE"	"Paradoxurus"	"Paradoxurus hermaphroditus"	"Common Palm Civet"	"LC OR LR/LC"	"decreasing"
63	"CETARTIODACTYLA"	"SUIDAE"	"Sus"	"Sus scrofa"	"Wild Boar"	"LC OR LR/LC"	"unknown"
64	"CETARTIODACTYLA"	"BOVIDAE"	"Capra"	"Capra sibirica"	"Siberian Ibex"	"LC OR LR/LC"	"unknown"
65	"CHIROPTERA"	"VESPERTILIONIDAE"	"Hypsugo"	"Hypsugo savii"	"Savi's Pipistrelle"	"LC OR LR/LC"	"stable"
66	"CHIROPTERA"	"VESPERTILIONIDAE"	"Myotis"	"Myotis nipalensis"	"Nepal Myotis"	"LC OR LR/LC"	"unknown"
67	"CARNIVORA"	"HERPESTIDAE"	"Herpestes"	"Herpestes auropunctatus"	"Small Indian Mongoose"	"LC OR LR/LC"	"unknown"
68	"CHIROPTERA"	"VESPERTILIONIDAE"	"Barbastella"	"Barbastella leucomelas"	"Eastern Barbastelle"	"LC OR LR/LC"	"unknown"
69	"CHIROPTERA"	"VESPERTILIONIDAE"	"Otonycteris"	"Otonycteris hemprichii"	"Desert Long-eared Bat"	"LC OR LR/LC"	"unknown"
70	"EULIPOTYPHLA"	"SORICIDAE"	"Crocidura"	"Crocidura pullata"	"Kashmir White-toothed Shrew"	"DD"	"unknown"

Table 2: List of Reptiles

S.No.	order_	family	genus	binomial	common_name	category	Population trend
1	"SQUAMATA"	"NATRICIDAE"	*"Natrix"*	*"Natrix Tessellata"*	"Tessellated Water Snake"	"LC OR LR/LC"	"decreasing"
2	"SQUAMATA"	"COLUBRIDAE"	*"Hemorrhois"*	*"Hemorrhois Ravergieri"*	"Spotted Whip Snake"	"LC OR LR/LC"	"stable"

S.No.	order_	family	genus	binomial	common_name	category	Population trend
3	"SQUAMATA"	"VARANIDAE"	*"Varanus"*	*"Varanus Bengalensis"*	"Common Indian Monitor"	"LC OR LR/LC"	"decreasing"
4	"SQUAMATA"	"COLUBRIDAE"	*"Boiga"*	*"Boiga Trigonata"*	"Indian Gamma Snake"	"LC OR LR/LC"	"stable"
5	"SQUAMATA"	"AGAMIDAE"	*"Paralaudakia"*	*"Paralaudakia Lehmanni"*	"Turkestan Rock Agama"	"LC OR LR/LC"	"stable"
6	"SQUAMATA"	"AGAMIDAE"	*"Sitana"*	*"Sitana Ponticeriana"*	"Fan Throated Lizard"	"LC OR LR/LC"	"stable"
7	"SQUAMATA"	"GEKKONIDAE"	*"Cyrtopodion"*	*"Cyrtopodion Potoharense"*	"Potwar Gecko"	"LC OR LR/LC"	"unknown"
8	"SQUAMATA"	"GEKKONIDAE"	*"Altiphylax"*	*"Altiphylax Stoliczkai"*	"Frontier Bow-fingered Gecko"	"LC OR LR/LC"	"stable"
9	"SQUAMATA"	"GEKKONIDAE"	*"Mediodactylus"*	*"Mediodactylus Walli"*	"Chitral Gecko"	"LC OR LR/LC"	"unknown"
10	SQUAMATA	AGAMIDAE	*Uromastyx*	*Uromastyx Hardwickii*	Spiny tailed lizard	Not Evaluated	Unknown
11	SQUAMATA	GEKKONIDAE	*Cyrtopodion*	*Cyrtopodion Baigii*	Rough bent-toed gecko	Data Deficient	Unknown
12	SQUAMATA	GEKKONIDAE	*Hemidactylus*	*Hemidactylus Flaviviridis*	Yellow- belly gecko	Not Evaluated	Unknown
13	SQUAMATA	GEKKONIDAE	*Cyrtodactylus*	*Cyrtodactylus Battalensis*	Reticulate Plump- bodied gecko	Not Evaluated	Unknown
14	SQUAMATA	SCINCIDAE	*Eutropis*	*Eutropis Dissimilis*	Striped Grass Skink	Not Evaluated	Unknown
15	SQUAMATA	SCINCIDAE	*Asymblepharus*	*Asymblepharus Himalayana*	Himalayan griund Skink	Not Evaluated	Stable
16	SQUAMATA	VARANIDAE	*Varanus*	*Varanus Bengalensis*	Bengal monitor	Not Evaluated	Decreasing
17	SQUAMATA	COLUBRIDAE	*Platyceps*	*Platyceps Rhodorachis*	Cliff Racer	Unknown	Not Evaluated
18	SQUAMATA	VIPERIDAE	*Macrovipera*	*Macrovipera Lebetina Obtusa*	Blunt nosed pit viper	Unknown	Not Evaluated

Table 3: List of Amphibians

S.No.	order_	family	genus	binomial	common_name	category	Population trend
1	"ANURA"	"BUFONIDAE"	"Duttaphrynus"	"Duttaphrynus himalayanus"	"GÃ¼nther's High Altitude Toad"	"LC OR LR/LC"	"stable"
2	"ANURA"	"BUFONIDAE"	"Bufotes"	"Bufotes pseudoraddei"	""	"LC OR LR/LC"	"stable"
3	"ANURA"	"BUFONIDAE"	"Duttaphrynus"	"Duttaphrynus stomaticus"	""	"LC OR LR/LC"	"stable"
4	"ANURA"	"DICROGLOSSIDAE"	"Euphlyctis"	"Euphlyctis cyanophlyctis"	""	"LC OR LR/LC"	"stable"
5	"ANURA"	"DICROGLOSSIDAE"	"Fejervarya"	"Fejervarya limnocharis"	"Asian Grass Frog"	"LC OR LR/LC"	"stable"
6	"ANURA"	"DICROGLOSSIDAE"	"Hoplobatrachus"	"Hoplobatrachus tigerinus"	"Indian Bullfrog"	"LC OR LR/LC"	"stable"

Table 4: List of Birds

S.No.		order_	family	genus	binomial	common_name	category	Population trend
1		"CHARADRIIFORMES"	"CHARADRIIDAE"	"Vanellus"	"Vanellus gregarius"	"Sociable Lapwing"	"CR"	"decreasing"
2		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Gyps"	"Gyps bengalensis"	"White-rumped Vulture"	"CR"	"decreasing"
3		"ANSERIFORMES"	"ANATIDAE"	"Oxyura"	"Oxyura leucocephala"	"White-headed Duck"	"EN"	"decreasing"
4		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Haliaeetus"	"Haliaeetus leucoryphus"	"Pallas's Fish-eagle"	"EN"	"decreasing"
5		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Neophron"	"Neophron percnopterus"	"Egyptian Vulture"	"EN"	"decreasing"
6		"FALCONIFORMES"	"FALCONIDAE"	"Falco"	"Falco cherrug"	"Saker Falcon"	"EN"	"decreasing"

S.No.		order_	family	genus	binomial	common_name	category	Population trend
7		"GALLIFORMES"	"PHASIANIDAE"	"Catreus"	"Catreus wallichii"	"Cheer Pheasant"	"VU"	"decreasing"
8		"ANSERIFORMES"	"ANATIDAE"	"Marmaronetta"	"Marmaronetta angustirostris"	"Marbled Teal"	"VU"	"decreasing"
9		"ANSERIFORMES"	"ANATIDAE"	"Aythya"	"Aythya ferina"	"Common Pochard"	"VU"	"decreasing"
10		"CHARADRIIFORMES"	"LARIDAE"	"Rynchops"	"Rynchops albicollis"	"Indian Skimmer"	"VU"	"decreasing"
11		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Clanga"	"Clanga clanga"	"Greater Spotted Eagle"	"VU"	"decreasing"
12		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Aquila"	"Aquila rapax"	"Tawny Eagle"	"VU"	"decreasing"
13		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Aquila"	"Aquila heliaca"	"Eastern Imperial Eagle"	"VU"	"decreasing"
14		"CICONIIFORMES"	"CICONIIDAE"	"Ciconia"	"Ciconia episcopus"	"Asian Woollyneck"	"VU"	"decreasing"
15		"ANSERIFORMES"	"ANATIDAE"	"Aythya"	"Aythya nyroca"	"Ferruginous Duck"	"NT OR LR/NT"	"decreasing"
16		"PSITTACIFORMES"	"PSITTACIDAE"	"Psittacula"	"Psittacula eupatria"	"Alexandrine Parakeet"	"NT OR LR/NT"	"decreasing"
17		"OTIDIFORMES"	"OTIDIDAE"	"Tetrax"	"Tetrax tetrax"	"Little Bustard"	"NT OR LR/NT"	"decreasing"
18		"CHARADRIIFORMES"	"SCOLOPACIDAE"	"Limosa"	"Limosa limosa"	"Black-tailed Godwit"	"NT OR LR/NT"	"decreasing"
19		"CHARADRIIFORMES"	"SCOLOPACIDAE"	"Numenius"	"Numenius arquata"	"Eurasian Curlew"	"NT OR LR/NT"	"decreasing"
20		"CHARADRIIFORMES"	"CHARADRIIDAE"	"Vanellus"	"Vanellus vanellus"	"Northern Lapwing"	"NT OR LR/NT"	"decreasing"
21		"CHARADRIIFORMES"	"LARIDAE"	"Sterna"	"Sterna aurantia"	"River Tern"	"NT OR LR/NT"	"decreasing"
22		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Gypaetus"	"Gypaetus barbatus"	"Bearded Vulture"	"NT OR LR/NT"	"decreasing"
23		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Gyps"	"Gyps himalayensis"	"Himalayan Griffon"	"NT OR LR/NT"	"stable"
24		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Aegypius"	"Aegypius monachus"	"Cinereous Vulture"	"NT OR LR/NT"	"decreasing"
25		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Circus"	"Circus macrourus"	"Pallid Harrier"	"NT OR LR/NT"	"decreasing"
26		"FALCONIFORMES"	"FALCONIDAE"	"Falco"	"Falco jugger"	"Laggar Falcon"	"NT OR LR/NT"	"decreasing"
27		"PELECANIFORMES"	"PELECANIDAE"	"Pelecanus"	"Pelecanus crispus"	"Dalmatian Pelican"	"NT OR LR/NT"	"decreasing"
28		"PASSERIFORMES"	"PHYLLOSCOPIDAE"	"Phylloscopus"	"Phylloscopus tytleri"	"Tytler's Leaf-warbler"	"NT OR LR/NT"	"decreasing"
29		"GALLIFORMES"	"PHASIANIDAE"	"Tetraogallus"	"Tetraogallus himalayensis"	"Himalayan Snowcock"	"LC OR LR/LC"	"stable"
30		"GALLIFORMES"	"PHASIANIDAE"	"Alectoris"	"Alectoris chukar"	"Chukar"	"LC OR LR/LC"	"stable"
31		"GALLIFORMES"	"PHASIANIDAE"	"Francolinus"	"Francolinus francolinus"	"Black Francolin"	"LC OR LR/LC"	"stable"
32		"GALLIFORMES"	"PHASIANIDAE"	"Coturnix"	"Coturnix coturnix"	"Common Quail"	"LC OR LR/LC"	"decreasing"
33		"GALLIFORMES"	"PHASIANIDAE"	"Pucrasia"	"Pucrasia macrolopha"	"Koklass Pheasant"	"LC OR LR/LC"	"decreasing"
34		"GALLIFORMES"	"PHASIANIDAE"	"Lophophorus"	"Lophophorus impejanus"	"Himalayan Monal"	"LC OR LR/LC"	"decreasing"
35		"ANSERIFORMES"	"ANATIDAE"	"Anser"	"Anser indicus"	"Bar-headed Goose"	"LC OR LR/LC"	"decreasing"
36		"ANSERIFORMES"	"ANATIDAE"	"Tadorna"	"Tadorna ferruginea"	"Ruddy Shelduck"	"LC OR LR/LC"	"unknown"
37		"ANSERIFORMES"	"ANATIDAE"	"Anas"	"Anas platyrhynchos"	"Mallard"	"LC OR LR/LC"	"increasing"
38		"ANSERIFORMES"	"ANATIDAE"	"Mergus"	"Mergus merganser"	"Goosander"	"LC OR LR/LC"	"unknown"
39		"PICIFORMES"	"PICIDAE"	"Dendrocopos"	"Dendrocopos himalayensis"	"Himalayan Woodpecker"	"LC OR LR/LC"	"stable"
40		"PICIFORMES"	"PICIDAE"	"Picus"	"Picus squamatus"	"Scaly-bellied Woodpecker"	"LC OR LR/LC"	"stable"
41		"BUCEROTIFORMES"	"UPUPIDAE"	"Upupa"	"Upupa epops"	"Common Hoopoe"	"LC OR LR/LC"	"decreasing"
42		"CORACIIFORMES"	"CORACIIDAE"	"Coracias"	"Coracias garrulus"	"European Roller"	"LC OR LR/LC"	"decreasing"
43		"CORACIIFORMES"	"ALCEDINIDAE"	"Alcedo"	"Alcedo atthis"	"Common Kingfisher"	"LC OR LR/LC"	"unknown"
44		"CORACIIFORMES"	"ALCEDINIDAE"	"Megaceryle"	"Megaceryle lugubris"	"Crested Kingfisher"	"LC OR LR/LC"	"decreasing"
45		"CORACIIFORMES"	"MEROPIDAE"	"Merops"	"Merops persicus"	"Blue-cheeked Bee-eater"	"LC OR LR/LC"	"stable"
46		"CORACIIFORMES"	"MEROPIDAE"	"Merops"	"Merops philippinus"	"Blue-tailed Bee-eater"	"LC OR LR/LC"	"stable"
47		"CORACIIFORMES"	"MEROPIDAE"	"Merops"	"Merops apiaster"	"European Bee-eater"	"LC OR LR/LC"	"stable"
48		"CUCULIFORMES"	"CUCULIDAE"	"Cuculus"	"Cuculus canorus"	"Common Cuckoo"	"LC OR LR/LC"	"decreasing"
49		"CUCULIFORMES"	"CUCULIDAE"	"Cuculus"	"Cuculus poliocephalus"	"Lesser Cuckoo"	"LC OR LR/LC"	"stable"

S.No.		order_	family	genus	binomial	common_name	category	Population trend
50		"CUCULIFORMES"	"CUCULIDAE"	"Eudynamys"	"Eudynamys scolopaceus"	"Western Koel"	"LC OR LR/LC"	"stable"
51		"PSITTACIFORMES"	"PSITTACIDAE"	"Psittacula"	"Psittacula himalayana"	"Slaty-headed Parakeet"	"LC OR LR/LC"	"stable"
52		"CAPRIMULGIFORMES"	"APODIDAE"	"Tachymarptis"	"Tachymarptis melba"	"Alpine Swift"	"LC OR LR/LC"	"stable"
53		"CAPRIMULGIFORMES"	"APODIDAE"	"Apus"	"Apus apus"	"Common Swift"	"LC OR LR/LC"	"stable"
54		"CAPRIMULGIFORMES"	"APODIDAE"	"Apus"	"Apus affinis"	"Little Swift"	"LC OR LR/LC"	"increasing"
55		"STRIGIFORMES"	"STRIGIDAE"	"Otus"	"Otus brucei"	"Pallid Scops-owl"	"LC OR LR/LC"	"stable"
56		"STRIGIFORMES"	"STRIGIDAE"	"Otus"	"Otus scops"	"Eurasian Scops-owl"	"LC OR LR/LC"	"decreasing"
57		"STRIGIFORMES"	"STRIGIDAE"	"Bubo"	"Bubo bubo"	"Eurasian Eagle-owl"	"LC OR LR/LC"	"decreasing"
58		"STRIGIFORMES"	"STRIGIDAE"	"Bubo"	"Bubo bengalensis"	"Rock Eagle-owl"	"LC OR LR/LC"	"stable"
59		"STRIGIFORMES"	"STRIGIDAE"	"Ketupa"	"Ketupa zeylonensis"	"Brown Fish-owl"	"LC OR LR/LC"	"decreasing"
60		"STRIGIFORMES"	"STRIGIDAE"	"Glaucidium"	"Glaucidium brodiei"	"Collared Owlet"	"LC OR LR/LC"	"decreasing"
61		"STRIGIFORMES"	"STRIGIDAE"	"Athene"	"Athene noctua"	"Little Owl"	"LC OR LR/LC"	"stable"
62		"STRIGIFORMES"	"STRIGIDAE"	"Asio"	"Asio otus"	"Northern Long-eared Owl"	"LC OR LR/LC"	"decreasing"
63		"STRIGIFORMES"	"STRIGIDAE"	"Asio"	"Asio flammeus"	"Short-eared Owl"	"LC OR LR/LC"	"decreasing"
64		"CAPRIMULGIFORMES"	"CAPRIMULGIDAE"	"Caprimulgus"	"Caprimulgus europaeus"	"European Nightjar"	"LC OR LR/LC"	"decreasing"
65		"COLUMBIFORMES"	"COLUMBIDAE"	"Columba"	"Columba rupestris"	"Hill Pigeon"	"LC OR LR/LC"	"decreasing"
66		"COLUMBIFORMES"	"COLUMBIDAE"	"Columba"	"Columba leuconota"	"Snow Pigeon"	"LC OR LR/LC"	"stable"
67		"COLUMBIFORMES"	"COLUMBIDAE"	"Columba"	"Columba palumbus"	"Common Woodpigeon"	"LC OR LR/LC"	"increasing"
68		"COLUMBIFORMES"	"COLUMBIDAE"	"Columba"	"Columba hodgsonii"	"Speckled Woodpigeon"	"LC OR LR/LC"	"stable"
69		"COLUMBIFORMES"	"COLUMBIDAE"	"Streptopelia"	"Streptopelia orientalis"	"Oriental Turtle-dove"	"LC OR LR/LC"	"stable"
70		"COLUMBIFORMES"	"COLUMBIDAE"	"Spilopelia"	"Spilopelia senegalensis"	"Laughing Dove"	"LC OR LR/LC"	"stable"
71		"GRUIFORMES"	"GRUIDAE"	"Anthropoides"	"Anthropoides virgo"	"Demoiselle Crane"	"LC OR LR/LC"	"increasing"
72		"GRUIFORMES"	"RALLIDAE"	"Zapornia"	"Zapornia parva"	"Little Crake"	"LC OR LR/LC"	"stable"
73		"GRUIFORMES"	"RALLIDAE"	"Fulica"	"Fulica atra"	"Common Coot"	"LC OR LR/LC"	"increasing"
74		"CHARADRIIFORMES"	"SCOLOPACIDAE"	"Scolopax"	"Scolopax rusticola"	"Eurasian Woodcock"	"LC OR LR/LC"	"stable"
75		"CHARADRIIFORMES"	"SCOLOPACIDAE"	"Gallinago"	"Gallinago solitaria"	"Solitary Snipe"	"LC OR LR/LC"	"stable"
76		"CHARADRIIFORMES"	"SCOLOPACIDAE"	"Gallinago"	"Gallinago gallinago"	"Common Snipe"	"LC OR LR/LC"	"decreasing"
77		"CHARADRIIFORMES"	"SCOLOPACIDAE"	"Tringa"	"Tringa totanus"	"Common Redshank"	"LC OR LR/LC"	"unknown"
78		"CHARADRIIFORMES"	"SCOLOPACIDAE"	"Tringa"	"Tringa nebularia"	"Common Greenshank"	"LC OR LR/LC"	"stable"
79		"CHARADRIIFORMES"	"SCOLOPACIDAE"	"Actitis"	"Actitis hypoleucos"	"Common Sandpiper"	"LC OR LR/LC"	"decreasing"
80		"CHARADRIIFORMES"	"JACANIDAE"	"Hydrophasianus"	"Hydrophasianus chirurgus"	"Pheasant-tailed Jacana"	"LC OR LR/LC"	"decreasing"
81		"CHARADRIIFORMES"	"IBIDORHYNCHIDAE"	"Ibidorhyncha"	"Ibidorhyncha struthersii"	"Ibisbill"	"LC OR LR/LC"	"unknown"
82		"CHARADRIIFORMES"	"CHARADRIIDAE"	"Charadrius"	"Charadrius dubius"	"Little Ringed Plover"	"LC OR LR/LC"	"stable"
83		"CHARADRIIFORMES"	"CHARADRIIDAE"	"Vanellus"	"Vanellus indicus"	"Red-wattled Lapwing"	"LC OR LR/LC"	"unknown"
84		"CHARADRIIFORMES"	"GLAREOLIDAE"	"Glareola"	"Glareola lactea"	"Little Pratincole"	"LC OR LR/LC"	"unknown"
85		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Pernis"	"Pernis ptilorhynchus"	"Oriental Honey-buzzard"	"LC OR LR/LC"	"stable"
86		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Gyps"	"Gyps fulvus"	"Griffon Vulture"	"LC OR LR/LC"	"increasing"
87		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Accipiter"	"Accipiter nisus"	"Eurasian Sparrowhawk"	"LC OR LR/LC"	"stable"
88		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Butastur"	"Butastur teesa"	"White-eyed Buzzard"	"LC OR LR/LC"	"stable"
89		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Aquila"	"Aquila fasciata"	"Bonelli's Eagle"	"LC OR LR/LC"	"decreasing"
90		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Hieraaetus"	"Hieraaetus pennatus"	"Booted Eagle"	"LC OR LR/LC"	"unknown"
91		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Nisaetus"	"Nisaetus nipalensis"	"Mountain Hawk-eagle"	"LC OR LR/LC"	"decreasing"
92		"FALCONIFORMES"	"FALCONIDAE"	"Falco"	"Falco naumanni"	"Lesser Kestrel"	"LC OR LR/LC"	"stable"

S.No.		order_	family	genus	binomial	common_name	category	Population trend
93		"FALCONIFORMES"	"FALCONIDAE"	"Falco"	"Falco tinnunculus"	"Common Kestrel"	"LC OR LR/LC"	"decreasing"
94		"FALCONIFORMES"	"FALCONIDAE"	"Falco"	"Falco subbuteo"	"Eurasian Hobby"	"LC OR LR/LC"	"decreasing"
95		"PODICIPEDIFORMES"	"PODICIPEDIDAE"	"Tachybaptus"	"Tachybaptus ruficollis"	"Little Grebe"	"LC OR LR/LC"	"decreasing"
96		"PODICIPEDIFORMES"	"PODICIPEDIDAE"	"Podiceps"	"Podiceps nigricollis"	"Black-necked Grebe"	"LC OR LR/LC"	"unknown"
97		"PELECANIFORMES"	"ARDEIDAE"	"Ardea"	"Ardea alba"	"Great White Egret"	"LC OR LR/LC"	"unknown"
98		"PELECANIFORMES"	"ARDEIDAE"	"Nycticorax"	"Nycticorax nycticorax"	"Black-crowned Night-heron"	"LC OR LR/LC"	"decreasing"
99		"PELECANIFORMES"	"ARDEIDAE"	"Botaurus"	"Botaurus stellaris"	"Eurasian Bittern"	"LC OR LR/LC"	"decreasing"
100		"PELECANIFORMES"	"THRESKIORNITHIDAE"	"Plegadis"	"Plegadis falcinellus"	"Glossy Ibis"	"LC OR LR/LC"	"decreasing"
101		"CICONIIFORMES"	"CICONIIDAE"	"Ciconia"	"Ciconia nigra"	"Black Stork"	"LC OR LR/LC"	"unknown"
102		"PASSERIFORMES"	"LANIIDAE"	"Lanius"	"Lanius vittatus"	"Bay-backed Shrike"	"LC OR LR/LC"	"stable"
103		"PASSERIFORMES"	"LANIIDAE"	"Lanius"	"Lanius schach"	"Long-tailed Shrike"	"LC OR LR/LC"	"unknown"
104		"PASSERIFORMES"	"CORVIDAE"	"Garrulus"	"Garrulus lanceolatus"	"Black-headed Jay"	"LC OR LR/LC"	"stable"
105		"PASSERIFORMES"	"CORVIDAE"	"Urocissa"	"Urocissa flavirostris"	"Yellow-billed Blue Magpie"	"LC OR LR/LC"	"stable"
106		"PASSERIFORMES"	"CORVIDAE"	"Pyrrhocorax"	"Pyrrhocorax pyrrhocorax"	"Red-billed Chough"	"LC OR LR/LC"	"decreasing"
107		"PASSERIFORMES"	"CORVIDAE"	"Pyrrhocorax"	"Pyrrhocorax graculus"	"Yellow-billed Chough"	"LC OR LR/LC"	"stable"
108		"PASSERIFORMES"	"CORVIDAE"	"Corvus"	"Corvus monedula"	"Eurasian Jackdaw"	"LC OR LR/LC"	"stable"
109		"PASSERIFORMES"	"CORVIDAE"	"Corvus"	"Corvus splendens"	"House Crow"	"LC OR LR/LC"	"stable"
110		"PASSERIFORMES"	"CORVIDAE"	"Corvus"	"Corvus frugilegus"	"Rook"	"LC OR LR/LC"	"decreasing"
111		"PASSERIFORMES"	"CAMPEPHAGIDAE"	"Pericrocotus"	"Pericrocotus roseus"	"Rosy Minivet"	"LC OR LR/LC"	"decreasing"
112		"PASSERIFORMES"	"CAMPEPHAGIDAE"	"Pericrocotus"	"Pericrocotus ethologus"	"Long-tailed Minivet"	"LC OR LR/LC"	"decreasing"
113		"PASSERIFORMES"	"DICRURIDAE"	"Dicrurus"	"Dicrurus macrocercus"	"Black Drongo"	"LC OR LR/LC"	"unknown"
114		"PASSERIFORMES"	"DICRURIDAE"	"Dicrurus"	"Dicrurus leucophaeus"	"Ashy Drongo"	"LC OR LR/LC"	"unknown"
115		"PASSERIFORMES"	"CINCLIDAE"	"Cinclus"	"Cinclus cinclus"	"White-throated Dipper"	"LC OR LR/LC"	"decreasing"
116		"PASSERIFORMES"	"CINCLIDAE"	"Cinclus"	"Cinclus pallasii"	"Brown Dipper"	"LC OR LR/LC"	"stable"
117		"PASSERIFORMES"	"MUSCICAPIDAE"	"Monticola"	"Monticola saxatilis"	"Rufous-tailed Rock-thrush"	"LC OR LR/LC"	"decreasing"
118		"PASSERIFORMES"	"MUSCICAPIDAE"	"Monticola"	"Monticola cinclorhyncha"	"Blue-capped Rock-thrush"	"LC OR LR/LC"	"stable"
119		"PASSERIFORMES"	"MUSCICAPIDAE"	"Monticola"	"Monticola solitarius"	"Blue Rock-thrush"	"LC OR LR/LC"	"stable"
120		"PASSERIFORMES"	"MUSCICAPIDAE"	"Myophonus"	"Myophonus caeruleus"	"Blue Whistling-thrush"	"LC OR LR/LC"	"unknown"
121		"PASSERIFORMES"	"TURDIDAE"	"Turdus"	"Turdus unicolor"	"Tickell's Thrush"	"LC OR LR/LC"	"unknown"
122		"PASSERIFORMES"	"TURDIDAE"	"Turdus"	"Turdus rubrocanus"	"Chestnut Thrush"	"LC OR LR/LC"	"unknown"
123		"PASSERIFORMES"	"TURDIDAE"	"Turdus"	"Turdus viscivorus"	"Mistle Thrush"	"LC OR LR/LC"	"decreasing"
124		"PASSERIFORMES"	"MUSCICAPIDAE"	"Muscicapa"	"Muscicapa striata"	"Spotted Flycatcher"	"LC OR LR/LC"	"decreasing"
125		"PASSERIFORMES"	"MUSCICAPIDAE"	"Muscicapa"	"Muscicapa sibirica"	"Dark-sided Flycatcher"	"LC OR LR/LC"	"stable"
126		"PASSERIFORMES"	"MUSCICAPIDAE"	"Ficedula"	"Ficedula ruficauda"	"Rusty-tailed Flycatcher"	"LC OR LR/LC"	"stable"
127		"PASSERIFORMES"	"MUSCICAPIDAE"	"Ficedula"	"Ficedula superciliaris"	"Ultramarine Flycatcher"	"LC OR LR/LC"	"stable"
128		"PASSERIFORMES"	"MUSCICAPIDAE"	"Larvivora"	"Larvivora brunnea"	"Indian Blue Robin"	"LC OR LR/LC"	"decreasing"
129		"PASSERIFORMES"	"MUSCICAPIDAE"	"Phoenicurus"	"Phoenicurus erythronotus"	"Eversmann's Redstart"	"LC OR LR/LC"	"stable"
130		"PASSERIFORMES"	"MUSCICAPIDAE"	"Phoenicurus"	"Phoenicurus coeruleocephala"	"Blue-capped Redstart"	"LC OR LR/LC"	"stable"
131		"PASSERIFORMES"	"MUSCICAPIDAE"	"Phoenicurus"	"Phoenicurus ochruros"	"Black Redstart"	"LC OR LR/LC"	"increasing"
132		"PASSERIFORMES"	"MUSCICAPIDAE"	"Phoenicurus"	"Phoenicurus erythrogastrus"	"White-winged Redstart"	"LC OR LR/LC"	"stable"
133		"PASSERIFORMES"	"MUSCICAPIDAE"	"Phoenicurus"	"Phoenicurus frontalis"	"Blue-fronted Redstart"	"LC OR LR/LC"	"stable"

S.No.		order_	family	genus	binomial	common_name	category	Population trend
134		"PASSERIFORMES"	"MUSCICAPIDAE"	"Phoenicurus"	"Phoenicurus leucocephalus"	"White-capped Water-redstart"	"LC OR LR/LC"	"stable"
135		"PASSERIFORMES"	"MUSCICAPIDAE"	"Phoenicurus"	"Phoenicurus fuliginosus"	"Plumbeous Water-redstart"	"LC OR LR/LC"	"stable"
136		"PASSERIFORMES"	"MUSCICAPIDAE"	"Enicurus"	"Enicurus scouleri"	"Little Forktail"	"LC OR LR/LC"	"stable"
137		"PASSERIFORMES"	"MUSCICAPIDAE"	"Enicurus"	"Enicurus maculatus"	"Spotted Forktail"	"LC OR LR/LC"	"stable"
138		"PASSERIFORMES"	"MUSCICAPIDAE"	"Saxicola"	"Saxicola torquatus"	"Common Stonechat"	"LC OR LR/LC"	"stable"
139		"PASSERIFORMES"	"MUSCICAPIDAE"	"Saxicola"	"Saxicola caprata"	"Pied Bushchat"	"LC OR LR/LC"	"stable"
140		"PASSERIFORMES"	"MUSCICAPIDAE"	"Oenanthe"	"Oenanthe albonigra"	"Hume's Wheatear"	"LC OR LR/LC"	"stable"
141		"PASSERIFORMES"	"MUSCICAPIDAE"	"Oenanthe"	"Oenanthe picata"	"Variable Wheatear"	"LC OR LR/LC"	"stable"
142		"PASSERIFORMES"	"MUSCICAPIDAE"	"Oenanthe"	"Oenanthe pleschanka"	"Pied Wheatear"	"LC OR LR/LC"	"stable"
143		"PASSERIFORMES"	"MUSCICAPIDAE"	"Oenanthe"	"Oenanthe deserti"	"Desert Wheatear"	"LC OR LR/LC"	"stable"
144		"PASSERIFORMES"	"MUSCICAPIDAE"	"Oenanthe"	"Oenanthe isabellina"	"Isabelline Wheatear"	"LC OR LR/LC"	"stable"
145		"PASSERIFORMES"	"STURNIDAE"	"Sturnia"	"Sturnia pagodarum"	"Brahminy Starling"	"LC OR LR/LC"	"unknown"
146		"PASSERIFORMES"	"STURNIDAE"	"Sturnus"	"Sturnus vulgaris"	"Common Starling"	"LC OR LR/LC"	"decreasing"
147		"PASSERIFORMES"	"SITTIDAE"	"Sitta"	"Sitta cashmirensis"	"Kashmir Nuthatch"	"LC OR LR/LC"	"decreasing"
148		"PASSERIFORMES"	"SITTIDAE"	"Sitta"	"Sitta tephronota"	"Eastern Rock Nuthatch"	"LC OR LR/LC"	"stable"
149		"PASSERIFORMES"	"SITTIDAE"	"Tichodroma"	"Tichodroma muraria"	"Wallcreeper"	"LC OR LR/LC"	"stable"
150		"PASSERIFORMES"	"CERTHIIDAE"	"Certhia"	"Certhia himalayana"	"Bar-tailed Treecreeper"	"LC OR LR/LC"	"decreasing"
151		"PASSERIFORMES"	"REMIZIDAE"	"Remiz"	"Remiz coronatus"	"White-crowned Penduline-tit"	"LC OR LR/LC"	"decreasing"
152		"PASSERIFORMES"	"PARIDAE"	"Cephalopyrus"	"Cephalopyrus flammiceps"	"Fire-capped Tit"	"LC OR LR/LC"	"unknown"
153		"PASSERIFORMES"	"PARIDAE"	"Periparus"	"Periparus rufonuchalis"	"Rufous-naped Tit"	"LC OR LR/LC"	"stable"
154		"PASSERIFORMES"	"PARIDAE"	"Parus"	"Parus monticolus"	"Green-backed Tit"	"LC OR LR/LC"	"stable"
155		"PASSERIFORMES"	"AEGITHALIDAE"	"Aegithalos"	"Aegithalos leucogenys"	"White-cheeked Tit"	"LC OR LR/LC"	"stable"
156		"PASSERIFORMES"	"AEGITHALIDAE"	"Aegithalos"	"Aegithalos niveogularis"	"White-throated Tit"	"LC OR LR/LC"	"stable"
157		"PASSERIFORMES"	"HIRUNDINIDAE"	"Ptyonoprogne"	"Ptyonoprogne rupestris"	"Eurasian Crag Martin"	"LC OR LR/LC"	"stable"
158		"PASSERIFORMES"	"HIRUNDINIDAE"	"Hirundo"	"Hirundo rustica"	"Barn Swallow"	"LC OR LR/LC"	"decreasing"
159		"PASSERIFORMES"	"HIRUNDINIDAE"	"Hirundo"	"Hirundo smithii"	"Wire-tailed Swallow"	"LC OR LR/LC"	"increasing"
160		"PASSERIFORMES"	"HIRUNDINIDAE"	"Delichon"	"Delichon dasypus"	"Asian House Martin"	"LC OR LR/LC"	"increasing"
161		"PASSERIFORMES"	"CISTICOLIDAE"	"Prinia"	"Prinia crinigera"	"Striated Prinia"	"LC OR LR/LC"	"stable"
162		"PASSERIFORMES"	"ZOSTEROPIDAE"	"Zosterops"	"Zosterops palpebrosus"	"Oriental White-eye"	"LC OR LR/LC"	"decreasing"
163		"PASSERIFORMES"	"SCOTOCERCIDAE"	"Horornis"	"Horornis fortipes"	"Brownish-flanked Bush-warbler"	"LC OR LR/LC"	"decreasing"
164		"PASSERIFORMES"	"ACROCEPHALIDAE"	"Acrocephalus"	"Acrocephalus melanopogon"	"Moustached Warbler"	"LC OR LR/LC"	"stable"
165		"PASSERIFORMES"	"ACROCEPHALIDAE"	"Acrocephalus"	"Acrocephalus concinens"	"Blunt-winged Warbler"	"LC OR LR/LC"	"stable"
166		"PASSERIFORMES"	"ACROCEPHALIDAE"	"Acrocephalus"	"Acrocephalus stentoreus"	"Clamorous Reed-warbler"	"LC OR LR/LC"	"stable"
167		"PASSERIFORMES"	"AEGITHALIDAE"	"Leptopoecile"	"Leptopoecile sophiae"	"White-browed Tit-warbler"	"LC OR LR/LC"	"stable"
168		"PASSERIFORMES"	"PHYLLOSCOPIDAE"	"Phylloscopus"	"Phylloscopus trochilus"	"Willow Warbler"	"LC OR LR/LC"	"decreasing"
169		"PASSERIFORMES"	"PHYLLOSCOPIDAE"	"Phylloscopus"	"Phylloscopus affinis"	"Tickell's Leaf-warbler"	"LC OR LR/LC"	"stable"
170		"PASSERIFORMES"	"PHYLLOSCOPIDAE"	"Phylloscopus"	"Phylloscopus griseolus"	"Sulphur-bellied Warbler"	"LC OR LR/LC"	"stable"
171		"PASSERIFORMES"	"PHYLLOSCOPIDAE"	"Phylloscopus"	"Phylloscopus subviridis"	"Brooks's Leaf-warbler"	"LC OR LR/LC"	"stable"
172		"PASSERIFORMES"	"PHYLLOSCOPIDAE"	"Phylloscopus"	"Phylloscopus magnirostris"	"Large-billed Leaf-warbler"	"LC OR LR/LC"	"stable"
173		"PASSERIFORMES"	"PHYLLOSCOPIDAE"	"Phylloscopus"	"Phylloscopus occipitalis"	"Western Crowned Leaf-	"LC OR LR/LC"	"stable"

S.No.		order_	family	genus	binomial	common_name	category	Population trend
						warbler"		
174		"PASSERIFORMES"	"LEIOTRICHIDAE"	"Trochalopteron"	"Trochalopteron variegatum"	"Variegated Laughingthrush"	"LC OR LR/LC"	"decreasing"
175		"PASSERIFORMES"	"TIMALIIDAE"	"Erythrogenys"	"Erythrogenys erythrogenys"	"Rusty-cheeked Scimitar-babbler"	"LC OR LR/LC"	"stable"
176		"PASSERIFORMES"	"LEIOTRICHIDAE"	"Leiothrix"	"Leiothrix lutea"	"Red-billed Leiothrix"	"LC OR LR/LC"	"decreasing"
177		"PASSERIFORMES"	"PANURIDAE"	"Panurus"	"Panurus biarmicus"	"Bearded Reedling"	"LC OR LR/LC"	"unknown"
178		"PASSERIFORMES"	"SYLVIIDAE"	"Sylvia"	"Sylvia mystacea"	"Menetries's Warbler"	"LC OR LR/LC"	"stable"
179		"PASSERIFORMES"	"ALAUDIDAE"	"Calandrella"	"Calandrella acutirostris"	"Hume's Lark"	"LC OR LR/LC"	"stable"
180		"PASSERIFORMES"	"ALAUDIDAE"	"Galerida"	"Galerida cristata"	"Crested Lark"	"LC OR LR/LC"	"decreasing"
181		"PASSERIFORMES"	"ALAUDIDAE"	"Alauda"	"Alauda gulgula"	"Oriental Skylark"	"LC OR LR/LC"	"decreasing"
182		"PASSERIFORMES"	"PASSERIDAE"	"Passer"	"Passer pyrrhonotus"	"Sind Sparrow"	"LC OR LR/LC"	"stable"
183		"PASSERIFORMES"	"PASSERIDAE"	"Passer"	"Passer cinnamomeus"	"Russet Sparrow"	"LC OR LR/LC"	"stable"
184		"PASSERIFORMES"	"PASSERIDAE"	"Gymnoris"	"Gymnoris xanthocollis"	"Chestnut-shouldered Bush-sparrow"	"LC OR LR/LC"	"stable"
185		"PASSERIFORMES"	"PASSERIDAE"	"Petronia"	"Petronia petronia"	"Rock Sparrow"	"LC OR LR/LC"	"increasing"
186		"PASSERIFORMES"	"MOTACILLIDAE"	"Motacilla"	"Motacilla alba"	"White Wagtail"	"LC OR LR/LC"	"stable"
187		"PASSERIFORMES"	"MOTACILLIDAE"	"Motacilla"	"Motacilla citreola"	"Citrine Wagtail"	"LC OR LR/LC"	"increasing"
188		"PASSERIFORMES"	"MOTACILLIDAE"	"Motacilla"	"Motacilla cinerea"	"Grey Wagtail"	"LC OR LR/LC"	"stable"
189		"PASSERIFORMES"	"MOTACILLIDAE"	"Anthus"	"Anthus rufulus"	"Paddyfield Pipit"	"LC OR LR/LC"	"stable"
190		"PASSERIFORMES"	"MOTACILLIDAE"	"Anthus"	"Anthus campestris"	"Tawny Pipit"	"LC OR LR/LC"	"stable"
191		"PASSERIFORMES"	"MOTACILLIDAE"	"Anthus"	"Anthus trivialis"	"Tree Pipit"	"LC OR LR/LC"	"decreasing"
192		"PASSERIFORMES"	"MOTACILLIDAE"	"Anthus"	"Anthus roseatus"	"Rosy Pipit"	"LC OR LR/LC"	"stable"
193		"PASSERIFORMES"	"MOTACILLIDAE"	"Anthus"	"Anthus spinoletta"	"Water Pipit"	"LC OR LR/LC"	"stable"
194		"PASSERIFORMES"	"MOTACILLIDAE"	"Anthus"	"Anthus sylvanus"	"Upland Pipit"	"LC OR LR/LC"	"stable"
195		"PASSERIFORMES"	"PRUNELLIDAE"	"Prunella"	"Prunella collaris"	"Alpine Accentor"	"LC OR LR/LC"	"stable"
196		"PASSERIFORMES"	"PRUNELLIDAE"	"Prunella"	"Prunella himalayana"	"Altai Accentor"	"LC OR LR/LC"	"stable"
197		"PASSERIFORMES"	"PRUNELLIDAE"	"Prunella"	"Prunella strophiata"	"Rufous-breasted Accentor"	"LC OR LR/LC"	"stable"
198		"PASSERIFORMES"	"PRUNELLIDAE"	"Prunella"	"Prunella fulvescens"	"Brown Accentor"	"LC OR LR/LC"	"stable"
199		"PASSERIFORMES"	"PRUNELLIDAE"	"Prunella"	"Prunella atrogularis"	"Black-throated Accentor"	"LC OR LR/LC"	"stable"
200		"PASSERIFORMES"	"ESTRILDIDAE"	"Euodice"	"Euodice malabarica"	"Indian Silverbill"	"LC OR LR/LC"	"stable"
201		"PASSERIFORMES"	"ESTRILDIDAE"	"Lonchura"	"Lonchura punctulata"	"Scaly-breasted Munia"	"LC OR LR/LC"	"stable"
202		"PASSERIFORMES"	"FRINGILLIDAE"	"Fringilla"	"Fringilla coelebs"	"Common Chaffinch"	"LC OR LR/LC"	"increasing"
203		"PASSERIFORMES"	"FRINGILLIDAE"	"Fringilla"	"Fringilla montifringilla"	"Brambling"	"LC OR LR/LC"	"decreasing"
204		"PASSERIFORMES"	"FRINGILLIDAE"	"Serinus"	"Serinus pusillus"	"Red-fronted Serin"	"LC OR LR/LC"	"stable"
205		"PASSERIFORMES"	"FRINGILLIDAE"	"Linaria"	"Linaria flavirostris"	"Twite"	"LC OR LR/LC"	"decreasing"
206		"PASSERIFORMES"	"FRINGILLIDAE"	"Linaria"	"Linaria cannabina"	"Common Linnet"	"LC OR LR/LC"	"decreasing"
207		"PASSERIFORMES"	"FRINGILLIDAE"	"Leucosticte"	"Leucosticte nemoricola"	"Plain Mountain-finch"	"LC OR LR/LC"	"stable"
208		"PASSERIFORMES"	"FRINGILLIDAE"	"Leucosticte"	"Leucosticte brandti"	"Brandt's Mountain-finch"	"LC OR LR/LC"	"stable"
209		"PASSERIFORMES"	"FRINGILLIDAE"	"Callacanthis"	"Callacanthis burtoni"	"Spectacled Finch"	"LC OR LR/LC"	"stable"
210		"PASSERIFORMES"	"FRINGILLIDAE"	"Bucanetes"	"Bucanetes mongolicus"	"Mongolian Finch"	"LC OR LR/LC"	"stable"
211		"PASSERIFORMES"	"FRINGILLIDAE"	"Rhodospiza"	"Rhodospiza obsoleta"	"Desert Finch"	"LC OR LR/LC"	"stable"
212		"PASSERIFORMES"	"FRINGILLIDAE"	"Carpodacus"	"Carpodacus erythrinus"	"Common Rosefinch"	"LC OR LR/LC"	"decreasing"
213		"PASSERIFORMES"	"FRINGILLIDAE"	"Carpodacus"	"Carpodacus rodochroa"	"Pink-browed Rosefinch"	"LC OR LR/LC"	"stable"

S.No.		order_	family	genus	binomial	common_name	category	Population trend
214		"PASSERIFORMES"	"FRINGILLIDAE"	"Carpodacus"	"Carpodacus rhodochlamys"	"Red-mantled Rosefinch"	"LC OR LR/LC"	"stable"
215		"PASSERIFORMES"	"FRINGILLIDAE"	"Carpodacus"	"Carpodacus rubicilla"	"Great Rosefinch"	"LC OR LR/LC"	"stable"
216		"PASSERIFORMES"	"FRINGILLIDAE"	"Carpodacus"	"Carpodacus puniceus"	"Red-fronted Rosefinch"	"LC OR LR/LC"	"stable"
217		"PASSERIFORMES"	"FRINGILLIDAE"	"Pyrrhula"	"Pyrrhula aurantiaca"	"Orange Bullfinch"	"LC OR LR/LC"	"stable"
218		"PASSERIFORMES"	"FRINGILLIDAE"	"Coccothraustes"	"Coccothraustes coccothraustes"	"Hawfinch"	"LC OR LR/LC"	"increasing"
219		"PASSERIFORMES"	"FRINGILLIDAE"	"Mycerobas"	"Mycerobas icterioides"	"Black-and-yellow Grosbeak"	"LC OR LR/LC"	"stable"
220		"PASSERIFORMES"	"FRINGILLIDAE"	"Mycerobas"	"Mycerobas carnipes"	"White-winged Grosbeak"	"LC OR LR/LC"	"stable"
221		"PASSERIFORMES"	"EMBERIZIDAE"	"Emberiza"	"Emberiza leucocephalos"	"Pine Bunting"	"LC OR LR/LC"	"stable"
222		"PASSERIFORMES"	"EMBERIZIDAE"	"Emberiza"	"Emberiza stewarti"	"White-capped Bunting"	"LC OR LR/LC"	"stable"
223		"PASSERIFORMES"	"EMBERIZIDAE"	"Emberiza"	"Emberiza cia"	"Rock Bunting"	"LC OR LR/LC"	"increasing"
224		"PASSERIFORMES"	"EMBERIZIDAE"	"Emberiza"	"Emberiza fucata"	"Chestnut-eared Bunting"	"LC OR LR/LC"	"stable"
225		"STRIGIFORMES"	"STRIGIDAE"	"Strix"	"Strix aluco"	"Tawny Owl"	"LC OR LR/LC"	"stable"
226		"CAPRIMULGIFORMES"	"CAPRIMULGIDAE"	"Caprimulgus"	"Caprimulgus jotaka"	"Grey Nightjar"	"LC OR LR/LC"	"stable"
227		"CORACIIFORMES"	"ALCEDINIDAE"	"Halcyon"	"Halcyon smyrnensis"	"White-breasted Kingfisher"	"LC OR LR/LC"	"increasing"
228		"CHARADRIIFORMES"	"CHARADRIIDAE"	"Charadrius"	"Charadrius alexandrinus"	"Kentish Plover"	"LC OR LR/LC"	"decreasing"
229		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Circus"	"Circus cyaneus"	"Hen Harrier"	"LC OR LR/LC"	"decreasing"
230		"COLUMBIFORMES"	"COLUMBIDAE"	"Streptopelia"	"Streptopelia decaocto"	"Eurasian Collared-dove"	"LC OR LR/LC"	"increasing"
231		"PASSERIFORMES"	"PHYLLOSCOPIDAE"	"Phylloscopus"	"Phylloscopus sindianus"	"Mountain Chiffchaff"	"LC OR LR/LC"	"stable"
232		"PASSERIFORMES"	"PHYLLOSCOPIDAE"	"Phylloscopus"	"Phylloscopus humei"	"Hume's Leaf-warbler"	"LC OR LR/LC"	"stable"
233		"ANSERIFORMES"	"ANATIDAE"	"Anas"	"Anas crecca"	"Common Teal"	"LC OR LR/LC"	"unknown"
234		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Circaetus"	"Circaetus gallicus"	"Short-toed Snake-eagle"	"LC OR LR/LC"	"stable"
235		"PASSERIFORMES"	"CERTHIIDAE"	"Certhia"	"Certhia hodgsoni"	"Hodgson's Treecreeper"	"LC OR LR/LC"	"stable"
236		"PASSERIFORMES"	"MUSCICAPIDAE"	"Oenanthe"	"Oenanthe chrysopygia"	"Red-tailed Wheatear"	"LC OR LR/LC"	"stable"
237		"ACCIPITRIFORMES"	"ACCIPITRIDAE"	"Milvus"	"Milvus migrans"	"Black Kite"	"LC OR LR/LC"	"unknown"
238		"PASSERIFORMES"	"SYLVIIDAE"	"Sylvia"	"Sylvia curruca"	"Lesser Whitethroat"	"LC OR LR/LC"	"stable"
239		"PASSERIFORMES"	"REGULIDAE"	"Regulus"	"Regulus regulus"	"Goldcrest"	"LC OR LR/LC"	"decreasing"
240		"PASSERIFORMES"	"LEIOTRICHIDAE"	"Trochalopteron"	"Trochalopteron lineatum"	"Streaked Laughingthrush"	"LC OR LR/LC"	"stable"
241		"PELECANIFORMES"	"ARDEIDAE"	"Ixobrychus"	"Ixobrychus minutus"	"Common Little Bittern"	"LC OR LR/LC"	"decreasing"
242		"CHARADRIIFORMES"	"ROSTRATULIDAE"	"Rostratula"	"Rostratula benghalensis"	"Greater Painted-snipe"	"LC OR LR/LC"	"decreasing"
243		"PASSERIFORMES"	"MUSCICAPIDAE"	"Ficedula"	"Ficedula parva"	"Red-breasted Flycatcher"	"LC OR LR/LC"	"increasing"
244		"PASSERIFORMES"	"PARIDAE"	"Periparus"	"Periparus ater"	"Coal Tit"	"LC OR LR/LC"	"decreasing"
245		"PASSERIFORMES"	"PARIDAE"	"Parus"	"Parus major"	"Great Tit"	"LC OR LR/LC"	"increasing"
246		"PASSERIFORMES"	"HIRUNDINIDAE"	"Riparia"	"Riparia diluta"	"Pale Sand Martin"	"LC OR LR/LC"	"unknown"
247		"PASSERIFORMES"	"TURDIDAE"	"Turdus"	"Turdus atrogularis"	"Black-throated Thrush"	"LC OR LR/LC"	"unknown"
248		"PASSERIFORMES"	"MUSCICAPIDAE"	"Tarsiger"	"Tarsiger rufilatus"	"Himalayan Bush-robin"	"LC OR LR/LC"	"stable"
249		"CHARADRIIFORMES"	"BURHINIDAE"	"Burhinus"	"Burhinus oedicnemus"	"Eurasian Thick-knee"	"LC OR LR/LC"	"decreasing"
250		"FALCONIFORMES"	"FALCONIDAE"	"Falco"	"Falco peregrinus"	"Peregrine Falcon"	"LC OR LR/LC"	"stable"
251		"COLUMBIFORMES"	"COLUMBIDAE"	"Spilopelia"	"Spilopelia suratensis"	"Western Spotted Dove"	"LC OR LR/LC"	"increasing"
252		"PICIFORMES"	"MEGALAIMIDAE"	"Psilopogon"	"Psilopogon asiaticus"	"Blue-throated Barbet"	"LC OR LR/LC"	"stable"
253		"GRUIFORMES"	"RALLIDAE"	"Gallinula"	"Gallinula chloropus"	"Common Moorhen"	"LC OR LR/LC"	"stable"
254		"PELECANIFORMES"	"ARDEIDAE"	"Egretta"	"Egretta garzetta"	"Little Egret"	"LC OR LR/LC"	"increasing"
255		"PASSERIFORMES"	"ALAUDIDAE"	"Alauda"	"Alauda arvensis"	"Eurasian Skylark"	"LC OR LR/LC"	"decreasing"
256		"PASSERIFORMES"	"ORIOLIDAE"	"Oriolus"	"Oriolus kundoo"	"Indian Golden Oriole"	"LC OR LR/LC"	"unknown"

S.No.		order_	family	genus	binomial	common_name	category	Population trend
257		"PASSERIFORMES"	"MONARCHIDAE"	"Terpsiphone"	"Terpsiphone paradisi"	"Indian Paradise-flycatcher"	"LC OR LR/LC"	"stable"
258		"PASSERIFORMES"	"LANIIDAE"	"Lanius"	"Lanius isabellinus"	"Isabelline Shrike"	"LC OR LR/LC"	"stable"
259		"PASSERIFORMES"	"LANIIDAE"	"Lanius"	"Lanius phoenicuroides"	"Red-tailed Shrike"	"LC OR LR/LC"	"stable"
260		"PASSERIFORMES"	"LANIIDAE"	"Lanius"	"Lanius excubitor"	"Great Grey Shrike"	"LC OR LR/LC"	"decreasing"
261		"PASSERIFORMES"	"CORVIDAE"	"Pica"	"Pica pica"	"Eurasian Magpie"	"LC OR LR/LC"	"stable"
262		"PASSERIFORMES"	"CORVIDAE"	"Nucifraga"	"Nucifraga multipunctata"	"Large-spotted Nutcracker"	"LC OR LR/LC"	"decreasing"
263		"PASSERIFORMES"	"CORVIDAE"	"Corvus"	"Corvus macrorhynchos"	"Large-billed Crow"	"LC OR LR/LC"	"stable"
264		"PASSERIFORMES"	"FRINGILLIDAE"	"Carduelis"	"Carduelis caniceps"	"Eastern Goldfinch"	"LC OR LR/LC"	"stable"
265		"PASSERIFORMES"	"ALAUDIDAE"	"Calandrella"	"Calandrella brachydactyla"	"Greater Short-toed Lark"	"LC OR LR/LC"	"unknown"
266		"PASSERIFORMES"	"MUSCICAPIDAE"	"Calliope"	"Calliope pectoralis"	"Himalayan Rubythroat"	"LC OR LR/LC"	"stable"
267		"PASSERIFORMES"	"HIRUNDINIDAE"	"Delichon"	"Delichon urbicum"	"Northern House Martin"	"LC OR LR/LC"	"decreasing"
268		"PASSERIFORMES"	"HIRUNDINIDAE"	"Cecropis"	"Cecropis daurica"	"Red-rumped Swallow"	"LC OR LR/LC"	"stable"
269		"PASSERIFORMES"	"PASSERIDAE"	"Passer"	"Passer domesticus"	"House Sparrow"	"LC OR LR/LC"	"decreasing"
270		"PASSERIFORMES"	"PASSERIDAE"	"Montifringilla"	"Montifringilla nivalis"	"White-winged Snowfinch"	"LC OR LR/LC"	"stable"
271		"PASSERIFORMES"	"MOTACILLIDAE"	"Anthus"	"Anthus richardi"	"Richard's Pipit"	"LC OR LR/LC"	"stable"
272		"PASSERIFORMES"	"MOTACILLIDAE"	"Anthus"	"Anthus similis"	"Long-billed Pipit"	"LC OR LR/LC"	"stable"
273		"PASSERIFORMES"	"PYCNONOTIDAE"	"Hypsipetes"	"Hypsipetes leucocephalus"	"Black Bulbul"	"LC OR LR/LC"	"stable"
274		"PASSERIFORMES"	"FRINGILLIDAE"	"Carpodacus"	"Carpodacus thura"	"Himalayan White-browed Rosefinch"	"LC OR LR/LC"	"stable"
275		"PASSERIFORMES"	"PHYLLOSCOPIDAE"	"Phylloscopus"	"Phylloscopus trochiloides"	"Greenish Warbler"	"LC OR LR/LC"	"increasing"
276		"PASSERIFORMES"	"AEGITHALIDAE"	"Aegithalos"	"Aegithalos iredalei"	"Red-headed Tit"	"LC OR LR/LC"	"stable"
277		"PASSERIFORMES"	"LEIOTRICHIDAE"	"Turdoides"	"Turdoides striata"	"Jungle Babbler"	"LC OR LR/LC"	"stable"
278		"PASSERIFORMES"	"SITTIDAE"	"Sitta"	"Sitta leucopsis"	"White-cheeked Nuthatch"	"LC OR LR/LC"	"decreasing"
279		"PASSERIFORMES"	"TROGLODYTIDAE"	"Troglodytes"	"Troglodytes troglodytes"	"Northern Wren"	"LC OR LR/LC"	"increasing"
280		"PASSERIFORMES"	"TURDIDAE"	"Turdus"	"Turdus maximus"	"Tibetan Blackbird"	"LC OR LR/LC"	"stable"
281		"PASSERIFORMES"	"TURDIDAE"	"Turdus"	"Turdus ruficollis"	"Rufous-throated Thrush"	"LC OR LR/LC"	"unknown"
282		"PASSERIFORMES"	"ALAUDIDAE"	"Alaudala"	"Alaudala rufescens"	"Lesser Short-toed Lark"	"LC OR LR/LC"	"decreasing"
283		"PASSERIFORMES"	"MUSCICAPIDAE"	"Tarsiger"	"Tarsiger cyanurus"	"Orange-flanked Bush-robin"	"LC OR LR/LC"	"stable"

Table 5: List of only Key Plant Species

S.No.	order_	family	genus	binomial	common_name	Growth Form	category	populationtrend
1	"ASTERALES"	"ASTERACEAE"	"Anacyclus"	"Anacyclus pyrethrum"	"Atlas Daisy"	Flower	"VU"	"decreasing"
2	"SAPINDALES"	"ANACARDIACEAE"	"Pistacia"	"Pistacia khinjuk"	""	Fruit tree	"LC OR LR/LC"	"stable"
3	"LAMIALES"	"LINDERNIACEAE"	"Lindernia"	"Lindernia procumbens"	"Lindernie couchÃ©e"	Flowering plant	"LC OR LR/LC"	"stable"
4	"ASTERALES"	"ASTERACEAE"	"Grangea"	"Grangea maderaspatana"	""	Flowering plant	"LC OR LR/LC"	"stable"
5	"CERATOPHYLLALES"	"CERATOPHYLLACEAE"	"Ceratophyllum"	"Ceratophyllum muricatum"	""	Hornwort weed	"LC OR LR/LC"	"unknown"
6	"MYRTALES"	"LYTHRACEAE"	"Trapa"	"Trapa natans"	"Water Caltrop"	Floating plant	"LC OR LR/LC"	"unknown"
7	"SCROPHULARIALES"	"SCROPHULARIACEAE"	"Bacopa"	"Bacopa monnieri"	"Water Hyssop"	Herb	"LC OR LR/LC"	"stable"
8	"NYMPHAEALES"	"NYMPHAEACEAE"	"Nymphaea"	"Nymphaea tetragona"	""	Flower	"LC OR LR/LC"	"unknown"
9	"MYRTALES"	"LYTHRACEAE"	"Trapa"	"Trapa incisa"	""	Floating plant	"LC OR LR/LC"	"unknown"

10	"APIALES"	"APIACEAE"	"Centella"	"Centella asiatica"	"Centella"	Pennywort Herb	"LC OR LR/LC"	"stable"
11	"ASTERALES"	"ASTERACEAE"	"Wedelia"	"Wedelia chinensis"	"Chinese Wedelia"	Flowering plant	"LC OR LR/LC"	"stable"
12	"APIALES"	"APIACEAE"	"Oenanthe"	"Oenanthe javanica"	"Water Dropwort"	Dropwort herb	"LC OR LR/LC"	"stable"
13	"NYMPHAEALES"	"NYMPHAEACEAE"	"Euryale"	"Euryale ferox"	"Prickly Water Lily"	Flowering plant	"LC OR LR/LC"	"stable"
14	"SCROPHULARIALES"	"ACANTHACEAE"	"Hygrophila"	"Hygrophila salicifolia"	""	Plant	"LC OR LR/LC"	"unknown"
15	"SCROPHULARIALES"	"ACANTHACEAE"	"Acanthus"	"Acanthus ilicifolius"	"Holy Mangrove"	Medicinal herb	"LC OR LR/LC"	"unknown"
16	"FABALES"	"FABACEAE"	"Aeschynomene"	"Aeschynomene indica"	"Indian Jointvetch"	Flowering plant	"LC OR LR/LC"	"stable"
17	"NYMPHAEALES"	"NYMPHAEACEAE"	"Nymphaea"	"Nymphaea pubescens"	"Hairy Water Lily"	Flower	"LC OR LR/LC"	"unknown"
18	"SCROPHULARIALES"	"ACANTHACEAE"	"Hygrophila"	"Hygrophila pinnatifida"	"Miramar Weed"	Weed	"LC OR LR/LC"	"unknown"
19	"SCROPHULARIALES"	"SCROPHULARIACEAE"	"Limnophila"	"Limnophila rugosa"	""	Herb	"LC OR LR/LC"	"unknown"
20	"NYMPHAEALES"	"NYMPHAEACEAE"	"Nymphaea"	"Nymphaea nouchali"	"Blue Lotus"	Flowering plant	"LC OR LR/LC"	"unknown"
21	"SOLANALES"	"HYDROLEACEAE"	"Hydrolea"	"Hydrolea zeylanica"	""	Herb	"LC OR LR/LC"	"unknown"
22	"FABALES"	"FABACEAE"	"Aeschynomene"	"Aeschynomene aspera"	"Sola Pith Plant"	Flowering plant	"LC OR LR/LC"	"unknown"
23	"SCROPHULARIALES"	"SCROPHULARIACEAE"	"Dopatrium"	"Dopatrium junceum"	"Rushlike Dopatrium"	Herb	"LC OR LR/LC"	"unknown"
24	"SCROPHULARIALES"	"ACANTHACEAE"	"Hygrophila"	"Hygrophila polysperma"	"Dwarf Hygrophila"	Weed	"LC OR LR/LC"	"unknown"
25	"ASTERALES"	"ASTERACEAE"	"Enydra"	"Enydra fluctuans"	"Buffalo Spinach"	Herb	"LC OR LR/LC"	"stable"
26	"SCROPHULARIALES"	"SCROPHULARIACEAE"	"Limnophila"	"Limnophila indica"	"Indian Marshweed"	Herb	"LC OR LR/LC"	"unknown"
27	"NEPENTHALES"	"DROSERACEAE"	"Drosera"	"Drosera burmanni"	""	Herb	"LC OR LR/LC"	"unknown"
28	"PODOSTEMALES"	"PODOSTEMACEAE"	"Hydrobryum"	"Hydrobryum griffithii"	""	Tree	"LC OR LR/LC"	"unknown"
29	"ROSALES"	"ROSACEAE"	"Prunus"	"Prunus mahaleb"	"Mahaleb Cherry"	Tree	"LC OR LR/LC"	"unknown"
30	"FABALES"	"FABACEAE"	"Sesbania"	"Sesbania bispinosa"	"Sesbania Pea"	Tree	"LC OR LR/LC"	"stable"
31	"SCROPHULARIALES"	"SCROPHULARIACEAE"	"Curanga"	"Curanga amara"	""	Herb	"LC OR LR/LC"	"unknown"
32	"SCROPHULARIALES"	"SCROPHULARIACEAE"	"Limnophila"	"Limnophila micrantha"	""	Weed	"LC OR LR/LC"	"unknown"
33	"SAPINDALES"	"ANACARDIACEAE"	"Cotinus"	"Cotinus coggygria"	"Smoke-bush"	Tree	"LC OR LR/LC"	"stable"
34	"MYRTALES"	"MYRTACEAE"	"Myrtus"	"Myrtus communis"	"Myrtle"	Flowering plant	"LC OR LR/LC"	"stable"
35	"MALPIGHIALES"	"SALICACEAE"	"Populus"	"Populus alba"	"White Poplar"	Tree	"LC OR LR/LC"	"decreasing"
36	"MALPIGHIALES"	"SALICACEAE"	"Salix"	"Salix excelsa"	""	Tree	"LC OR LR/LC"	"unknown"
37	"SAPINDALES"	"ANACARDIACEAE"	"Pistacia"	"Pistacia eurycarpa"	""	Tree	"LC OR LR/LC"	"stable"
38	"ROSALES"	"ROSACEAE"	"Prunus"	"Prunus bifrons"	""	Shrub	"DD"	"decreasing"
39	"ROSALES"	"ROSACEAE"	"Prunus"	"Prunus bokhariensis"	"Alubukhara"	Flowering plant	"DD"	"unknown"
40	"ROSALES"	"ROSACEAE"	"Prunus"	"Prunus jaquemontii"	"Flowering Almond"	Flowering plant	"DD"	"unknown"

Table 6: List of Fish Species

Sr.No	Order	Family	Genus	Bionomial	Common Name	Category	Population Trend
1	"Cypriniformes"	Cyprinidae	*Salmostoma*	*Salmophasia punjabensis*	Punjab Razorbelly Minnow	Endemic	Not Evaluated
2	"Cypriniformes"	Cyprinidae	*Barilius*	*Barilius Pakistanicus*	-	Endemic	Not Evaluated
3	"Cypriniformes"	Cyprinidae	*Naziritor*	*Naziritor zhobensis*	Zhobi Mahseer	Endemic	Not Evaluated
4	"Cypriniformes"	Cyprinidae	*Puntius*	*Puntius punjabensis*	-	Endemic	Not Evaluated
5	"Cypriniformes"	Cyprinidae	*Botia*	*Botia javedi*	-	Endemic	Not Evaluated
6	Cypriniformes	Cyprinidae	*Schistura*	*Schistura afasciata*	-	Endemic	Not Evaluated
7	Cypriniformes	Cyprinidae	*Schistura*	*Schistura fascimaculata*	-	Endemic	Not Evaluated
8	Actinopterygii	Nemacheilidae	*Paraschistura*	*Paraschistura lepidocaulis*	-	Endemic	Not Evaluated
9	Cypriniformes	Nemacheilidae	*Schistura*	*Schistura kohatensis*	-	Endemic	Not Evaluated
10	Cypriniformes	Nemacheilidae	*Schistura*	*Schistura macrolepis*	-	Endemic	Not Evaluated
11	Cypriniformes	Nemacheilidae	*Paraschistura*	*Paraschistura microlabra*	-	Endemic	Not Evaluated
12	Cypriniformes	Nemacheilidae	*Schistura*	*Schistura nalbanti*	-	Endemic	Not Evaluated
13	Cypriniformes	Nemacheilidae	*Paraschistura*	*Paraschistura prashari*	-	Endemic	Not Evaluated
14	Cypriniformes	Nemacheilidae	*Triplophysa*	*Triplophysa hazaraensis*	-	Endemic	Not Evaluated
15	Cypriniformes	Nemacheilidae	*Triplophysa*	*Triplophysa naziri*	-	Endemic	Not Evaluated
16	Siluriformes	Sisoridae	*Gagata*	*Gagata pakistanica*	-	Endemic	Not Evaluated
17	Siluriformes	Sisoridae	*Glyptothorax*	*Glyptothorax naziri*	-	Endemic	Not Evaluated
18	Siluriformes	Sisoridae	*Glyptothorax*	*Glyptothorax punjabensis*	-	Endemic	Not Evaluated
19	Siluriformes	Sisoridae	*Glyptothorax*	*Glyptothorax stocki*	-	Endemic	Not Evaluated
20	Cypriniformes	Cyprinidae	*Tor*	*Tor putitora*	Mahsheer	Indigenous	Endangered
21	Siluriformes	Sisoridae	*Ompok*	*Ompok bimaculatus*	Butter Catfish	Indigenous	Near Threatened
22	Siluriformes	Sisoridae	*Ompok*	*Ompok pabda*	-	Indigenous	Near Threatened
23	Siluriformes	Sisoridae	*Wallago*	*Wallago attu*	Catfish	Indigenous	Near Threatened
24	Cypriniformes	Cyprinidae	*Schizothorax*	*Schizothorax plagiostomus*	Snow Trout	Indigenous	Not Evaluated

25	Cypriniformes	Cyprinidae	*Gibelion*	*Gibelion catla*	Indian Trout	Indigenous	Least Concerned
26	Cypriniformes	Cyprinidae	*Labeo*	*Labeo dyocheilus pakistanicus*	-	Indigenous	Least Concerned
27	Cypriniformes	Cyprinidae	*Labeo*	*Labeo calbasu*	Orangefin Labeo	Indigenous	Least Concerned
28	Cypriniformes	Nemachilidea	*Aborichthys*	*Aborichthys boutanensis*	Racoma abiate	Indigenous	Least Concerned
29	Cypriniformes	Cyprinidae	*Schizothorax*	*Schizothorax esocinus*	Chirruh Snowtrout	Indigenous	Not Evaluated
30	Cypriniformes	Cyprinidae	*Cirrhinus*	*Cirrhinus mrigala*	Mrigal Carp	Indigenous	Least Concerned
31	Siluriformes	Bagridae	*Sperata*	*Sperata seenghala*	Guizza, *Seenghala*	Indigenous	Least Concerned
32	Siluriformes	Bagridae	*Rita*	*Rita rita*	Rita	Indigenous	Least Concerned
33	Siluriformes	Ailiidae	*Clupisoma*	*Clupisoma naziri*	Indus Garua	Indigenous	Not Evaluated
34	Anabantiformes	Channidae	*Channa*	*Channa marulius*	Bullseye Snakehead	Indigenous	Least Concern
35	Synbranchiformes	Mastacembelidae	*Mastacembelus*	*Mastacembelus armatus*	Zig-Zag Eel	Indigenous	Least Concerned
36	Cypriniformes	Cyprinidae	*Danio*	*Danio rerio*	Zebrafish	Indigenous	Least Concerned/Very Rare
37	Cypriniformes	Cyprinidae	*Megarasbora*	*Megarasbora elanga*	Bengala Barb	Indigenous	Least Concerned/Very Rare
38	Cichliformes	Cichlidae	*Oreochromis*	*Oreochromis mossambicus*	Mozambique Tilapia	Indigenous	Near Threatened
39	Cypriniformes	Cyprinidae	*Cyprinus*	*Cyprinus carpio*	Common Carp	Exotic	Vulnerable
40	Salmoniformes	Salmonidae	*Oncorhynchus*	*Oncorhynchus mykiss*	Rainbow Trout	Exotic	Not Evaluated
41	Cypriniformes	Cyprinidae	*Schistura*	*Schistura abiatee*	-	Endemic	Least Concern

Annex 3: Biodiversity of the Project Area

Table 1: List of Plants Species

Sr. No.	Order	Family	Genus	Binomial	Common Name	Growth Form	IUCN Status (2019)	Population Trend
1	*Conifers*	Pinaceae	Fir	*Abies pindrow*	Chokar/Char	plant	Least Concern	Stable
2	*Asterales*	Asteraceae	Yarrow	*Achillea millefolium*	Kingha	Flowering plant	Least Concern	Unknown
3	Acorales	Araceae	Acorus	*Acorus calamus*	Skhawaja	Flowering plant	Least Concern	Increasing
4	Polypodiales	Adiantaceae	*Adiantum*	*Adiantum incisum*	Sumbal	Shrub	Not Evaluated	Unknown
5	*Polypodiales*	Adiantaceae	maidenhair fern	*Adiantum venustum*	Sumbal	Shrub	Not Evaluated	Unknown
6	Aesculus	Hippocastanaceae	*Sapindales*	*Aesculus indica*	Jawaz	Plant	Not Evaluated	Unknown
7	*Lamiales*	Lamiaceae	*Bugleweed*	*Ajuga bracteosa*	Panrkash	Flowering plant	Not Evaluated	Unknown
8	Lamiales	Lamiaceae	*Ajuga*	*Ajuga parviflora*	Sasmay boti	Flowering plant	Not Evaluated	Unknown
9	*Asparagales*	Alliaceae	Onion	*Allium cepa*	Piaz	Flowering plant	Not Evaluated	Unknown
10	Fagales	Betulaceae	*Alnus*	*Alnus nitida*	Geiray	Plant	Least Concern	Stable
11	*Caryophyllales*	Amaranthaceae	*Amaranth*	*Amaranthus spinosus*	Chalvary	Plant	Not Evaluated	Unknown
12	Ericales	Primulaceae	*Pimpernels*	*Anagallis arvensis*	Chichra	Flower	Not Evaluated	Unknown
13	Poales	Poaceae	*Apluda*	*Apluda mutica*	Wakha	Plant	Not Evaluated	Unknown
14	Alismatales	Araceae	*Arisaema*	*Arisaema flavum*	Marjarai	Flower	Not Evaluated	Unknown
15	Asterales	Asteraceae	*Artemisia*	*Artemisia scoparia*	Jaa	Shrub	Not Evaluated	Unknown
16	Asterales	Asteraceae	*Artemisia*	*Artemisia vulgaris*	Jaa	Plant	Not Evaluated	Unknown
17	Fabales	Fabaceae	*Astragalus*	*Astragalus anisacanthus*	Mamol	Plant	Not Evaluated	Unknown
18	Solanaceae	Solanaceae	*Atropa*	*Atropa acuminata*	Barghak	Flowering plant	Not Evaluated	Unknown
19	Ranunculales	Berberidaceae	*Berberis*	*Berberis lycium*	Khawaray	Flowering plant	Not Evaluated	Unknown
20	Ranunculales	Berberidaceae	*Berberis*	*Berberis vulgaris*	Kwarray	Medicinal plant	Least Concern	Stable
21	Saxifragales	Saxifragaceae	*Bergenia*	*Bergenia ciliata*	Barmia	Flower	Not Evaluated	Unknown
22	Fagales	Betulaceae	*Betula*	*Betula utilis*	Birch	Plant	Least Concern	Decreasing
23	Caryophyllales	Nyctaginaceae	*Boerhavia*	*Boerhavia diffusa*	Bashkhera	Flowering plant	Not Evaluated	Unknown
24	Asterales	Asteraceae	*Calendula*	*Calendula arvensis*	Charkeet	Flower	Not Evaluated	Unknown
25	Ranunculales	Ranunculaceae	*Caltha*	*Caltha alba*	Makhan Path	Flower	Not Evaluated	Unknown
26	Sapindales	Meliaceae	Cedrela	*Cedrela serrata*	Meem	Shrub	Least Concern	Unknown
27	Pinales	Pinaceae	*Cedrus*	*Cedrus deodara*	Diyar	Plant	Least Concern	Unknown
28	Caryophyllales	Chenopodiaceae	*Chenopodium*	*Chenopodium album*	Udharam	Plant	Least Concern	Unknown
29	Caryophyllales	Chenopodiaceae	*Dysphania*	*Chenopodium botrys*	Harawa	Plant	Not Evaluated	Unknown
30	Cladophorales	Cladophoraceae	*Chladophora*	*Chladophora crispata*	Jaloos	Plant	Not Evaluated	Unknown
31	Asterales	Asteraceae	*Cichorium*.	*Cichorum intybus*	Haspa bootay	Flower	Not Evaluated	Unknown
32	Ranunculales	Ranunculaceae	*Clamatis*	*Clamatis gouriana*	Zealai	Flower	Not Evaluated	Unknown
33	Ranunculales	Cucurbitaceae	*Coccinia*	*Coccinia grandis*	Kanduri	Flower plant	Not Evaluated	Unknown
34	Liliales	Liliaceae	*Colchicum*	*Colchicum luteum*	SuranjanTalkh	Flower	Not Evaluated	Unknown
35	Solanales	Convulvolaceae	*Convolvulus*	*Convolvulus arvensis*	Sahargul	Flower	Not Evaluated	Unknown
36	Asterales	Asteraceae	*Conyza*	*Conyza canadensis*	Malooch	Plant	Not Evaluated	Unknown

Sr. No.	Order	Family	Genus	Binomial	Common Name	Growth Form	IUCN Status (2019)	Population Trend
37	Solanales	Cuscutaceae	*Cuscuta*	*Cuscuta reflexa*	Aamool	Plant	Not Evaluated	Unknown
38	Poales	Poaceae	*Cymbopogon*	*Cymbopogon stracheyi*	Raizada	Plant	Not Evaluated	Unknown
39	Poales	Poaceae	*Cynodon*	*Cynodon dactylon*	Kabal	Grass	Not Evaluated	Unknown
40	Malvales	Thymeliaceae	*Daphne*	*Daphne mucronata*	Laighonai	Flowering plant	Not Evaluated	Unknown
41	Ranunculales	Ranunculaceae	*Delphinium*	*Delphinium denudatum*	Ghojab	Flower	Not Evaluated	Unknown
42	Poales	Poaceae	*Dicanthium*	*Dicanthium annulatum*	Wakha	Grass	Not Evaluated	Unknown
43	Ericales	Ebenaceae	*Diospyros*	*Diospyros lotus*	Amlook	Fruit plant	Least Concern	Unknown
44	Ephedrales	Ephedraceae	*Ephedra*	*Ephedra gerardiana*	Someni	Shrub	Not Evaluated	Unknown
45	Ephedrales	Ephedraceae	*Ephedra*	*Ephedra intermedia*	Huma	Shrub	Not Evaluated	Unknown
46	Malpighiales	Euphorbiaceae	*Euphorbia*	*Euphorbia prostrate*	Warmaga	Shrub	Not Evaluated	Unknown
47	Malpighiales	Euphorbiaceae	*Euphorbia*	*Euphorbia wallichii*	Shangla	Plant	Not Evaluated	Unknown
48	Rosales	Moraceae	*Ficus*	*Ficus carica*	Inzar	Fruit plant	Least Concern	Unknown
49	Rosales	Rosaceae	*Fragaria*	*Fragaria nubicola*	Lacaita	Flowering plant	Least Concern	Unknown
50	Ranunculales	Fumariaceae	*Fumaria*	*Fumaria indica*	Papra	Flower	Not Evaluated	Unknown
51	Geraniales	Geraniaceae	*Geranium*	*Geranium wallichianum*	Rattan Jook	Flower	Not Evaluated	Unknown
52	Rosales	Elaegnaceae	*Hippophae*	*Hippophae rhamnoides*	Seebak tharn	Fruit plant	Least Concern	Stable
53	Malpighiales	Hypericaeae	*Hypericum*	*Hypericum perforatum*	Shna Chai	Flower	Least Concern	Unknown
54	Fabales	Fabaceae	*Indigofera*	*Indigofera heterantha*	Ghoureja	Flowering plant	Not Evaluated	Unknown
55	Pinales	Juniperaceae	*Juniperus*	*Juniperus communis*	Juniper	Plant	Least Concern	Increasing
56	*Lamiales*	Lamiaceae	*Mentha*	*Mentha longifolia*	Villanay	Medicinal plant	Least Concern	Unknown
57	*Lamiales*	Lamiaceae	*Mentha*	*Mentha spicata*	Podina	Plant	Least Concern	Unknown
58	*Lamiales*	Oleaceae	*Olea*	*Olea ferruginea*	Khona	Fruit plant	Least Concern	Unknown
59	Caryophyllales	Polygonaceae	*Bistorta*	*Bistorta amplexicaule*	Anjabar	Flowering plant	Least Concern	Unknown
60	Pinales	Pinaceae	*Pinus*	*Pinus wallichiana*	Peeuch	Plant	Least Concern	Unknown
61	Ranunculales	Podophylaceae	*Podophyllum*	*Podophyllum emodi*	Banasher	Flowering plant	Least Concern	Unknown
62	Caryophyllales	Polygonaceae	*Polygonum*	*Polygonum aviculare*	Bandakay	Grass	Least Concern	Unknown
63	Polygonales	Polygonaceae	*Polygonum*	*Polygonum barbatum*	Palpulak	Plant	Not Evaluated	Unknown
64	Ericales	Primulaceae	*Primula*	*Primula denticulata*	Zangali Surma	Flower	Not Evaluated	Unknown
65	Ranunculales	Ranunculaceae	*Ranunculus*	*Ranunculus muricatus*	Ghat Ziargulay	Flower	Not Evaluated	Unknown
66	*Rosales*	Rosaceae	*Rosa*	*Rosa webbiana*	Palwari	Flowering plant	Not Evaluated	Unknown
67	Malpighiales	Salicaceae	*Salix*	*Salix tetrasperma*	Wala	Plant	Not Evaluated	Unknown
68	*Lamiales*	Lamiaceae	*Salvia*	*Salvia lanata*	Mattar jarrai	Flowering plant	Not Evaluated	Unknown
69	*Dipsacales*	Valerianaceae	*Valeriana*	*Valeriana jatamansi*	Musk-e-bala	Flower	Not Evaluated	Unknown
70	Dipsacales	Caprifoliaceae	*Viburnum*	*Viburnum cotinifolium*	Kasarbotay	Plant	Not Evaluated	Unknown
71	Solanales	Solanaceae	*Withania*	*Withania somnifera*	Dunal	Flowering plant	Not Evaluated	Unknown
72	Asterales	Asteraceae	*Xanthium*	*Xanthium strumarium*	Geskay	Plant	Not Evaluated	Unknown

Table 2: List of Fish

Sr. No.	*Binomial*	Order	Common Name	*Genus*	Family	IUCN Status	Population Trend
1	*Schizothorax plagiostomus*	Cypriniformes	Snow trout	*Schizothorax*	Cyprinidae	Not Evaluated	"stable"
2	*Salmo trutta*	Salmoniformes	Brown trout	*Salmo*	Salmonidae	Least Concerned	"increasing"

Table 3: List of Mammals

Sr. No.	*Binomial*	Order	Common Name	*Genus*	Family	IUCN status	Population Trend
1	*Crocidura suaveolens*	Eulipotyphla	White-toothed Shrew	*Soriculus*	Soricidae	Least concerned	Stable
2	*Rhinolophus ferrumequinum*	Chiroptera	Greater Horse-shoe Bat	*Rhinolophus*	Rhinolophidae	Least Concerned	Decreasing
3	*Pipistrellus pipistrellus*	Chiroptera	Common Pipistrelle	*Pipistrellus*	Vespertilionidae	Least Concerned	Stable
4	*Lepus capensis*	Lagomorpha	Cape Hare	*Lepus*	Leporidae	Least Concerned	Decreasing
5	*Petaurista albiventer*	Rodentia	Giant Red Himalayan Flying Squirrel	*Petaurista*	Sciuridae	Critically endangered	Unknown
6	*Apodemus rusiges*	Rodentia	Himalayan Wood Mouse	*Apodemus*	Muridae	Least Concerned	Unknown
7	*Ratus ratus*	Rodentia	House Rat	*Rattus*	Muridae	Least Concerned	Unknown
8	*Mus musculus*	Rodentia	House Mouse	*Mus*	Muridae	Least Concerned	Stable
9	*Macaca mulatta*	Primates	Rhesus monkey	*Macaca*	Cercopithecidae	Least Concerned	Unknown
10	*Canis lupus*	Carnivora	Indian Wolf	*Canis*	Canidae	Endangered	Stable
11	*Canis aureus*	Carnivora	Asiatic Jackal	*Canis*	Canidae	Least Concerned	increasing
12	*Ursus thibetanus*	Carnivora	Asiatic Black Bear	*Ursus*	Ursidae	Vulnerable	Decreasing
13	*Lutra lutra*	Carnivora	Eurasian Otter	*Lutra*	Mustelidae	Near Threatened	Decreasing

Table 4: List of Amphibians

Sr. No.	*Binomial*	Order	Family	Common Name	*Genus*	IUCN Status	Population trend
1	*Bufo stomaticus*	Anura	Bufonidae	Indus valley toad	*Bufo*	Least Concerned	Stable
2	*Bufo pseudoraddei pseudoraddei*	Anura	Bufonidae	Indus valley toad	*Bufo pseudoraddei*	Least Concerned	Stable

Sr. No.	*Binomial*	Order	Family	Common Name	*Genus*	IUCN Status	Population trend
3	*Euphlyctis cyanophlyctis microspinulata*	Anura	Ranidae	Skittering frog	*Euphlyctis cyanophlyctis*	Least Concerned	Stable

Table 5: List of Reptiles

Sr. No.	*Binomial*	Order	Family	Common Name	*Genus*	IUCN Status	Population Trend
1	*Laudakia himalayana*	Squamata	Agamidae	Himalayan Agama	*Laudakia*	Not Evaluated	Unknown
2	*Laudakia pakistanica auffenbergi*	Squamata	Agamidae	North-Pakistan Agama	*Laudakia*	Not Evaluated	Unknow
3	*Laudakia tuberculata*	Squamata	Agamidae	Kashmir Rock Agama	*Laudakia*	Not Evaluated	Unknown
4	*Ophisops jerdonii*	Squamata	Lacertidae	Rugose-spectacled lacerta	*Ophisops*	Least Concerned	Stable
5	*Ablepharus pannonicus*	Squamata	Scincidae	Snake-eyed skink	*Ablepharus*	Not Evaluated	Unknown
6	*Scincella himalayana*	Squamata	Scincidae	Himalayan skink	*Scincella*	Not Evaluated	Unknown
7	*Platyceps rhodorachis ladacensis*	Squamata	Colubridae	Ladakh Cliff racer	*Platycepsrho do achis*	Not Evaluated	Unknown
8	*Pseudocyclophis persicus*	Squamata	Colubridae	Dark-head Dwarf racer	*Pseudocyclo phis*	Not Evaluated	Unknown
9	*Ptyas mucosus mucosus*	Squamata	Colubridae	Rope-snake	*Ptyas mucosus*	Not Evaluated	Unknown
10	*Spalerosophis diadema diadema*	Squamata	Colubridae	Blotched diadem snake	*Spalerosophi s diadea*	Not Evaluated	Unknown
11	*Naja oxiana*	Squamata	Elapidae	Brown cobra	*Naja*	Data Deficient	Unknown

Table 6:List of Bird Species

Sr. No.	*Binomial*	Order	Family	Common Names	Genus	IUCN Status 2019	Population Trend
1	*Alectoris chukar*	*Galliformes*	*Phasianidae*	Chukar Partridge	*Alectoris*	Least Concern	Stable
2	*Coturnix coturnix*	*Galliformes*	*Phasianidae*	Common Quail	*Coturnix*	Least Concern	Stable
3	*Pucrasiama crolopha*	*Galliformes*	*Phasianidae*	Koklass Pheasant	*Pucrasiama*	Least Concern	Decreasing
4	*Lophophorus impejanus*	*Galliformes*	*Phasianidae*	Himalayn Monal	*Lophophorus*	Least Concern	Decreasing
5	*Anser anser*	*Anseriformes*	*Anatidae*	Greylag Gooze	*Anser*	Least Concern	Increasing
6	*Anser indicus*	*Anseriformes*	*Anatidae*	Bar-headed Gooze	*Anser*	Least Concern	Decreasing
7	*Anas strepera*	*Anseriformes*	*Anatidae*	Gadwall	*Anas*	Least Concern	Increasing
8	*Anas penelope*	*Anseriformes*	*Anatidae*	Eurasian Wigeon	*Anas*	Least Concern	Decreasing
9	*Anas platyrhynchos*	*Anseriformes*	*Anatidae*	Mallard	*Anas*	Least Concern	Increasing
10	*Anas crecca*	*Anseriformes*	*Anatidae*	Common Teal	*Anas*	Least Concern	Unknown
11	*Anas acuta*	*Anseriformes*	*Anatidae*	Northern Pintail	*Anas*	Least Concern	Decreasing
12	*Anas clypeata*	*Anseriformes*	*Anatidae*	Northern Shoveler	*Anas*	Least Concern	Decreasing
13	*Jynx torquilla*	*Piciformes*	*Picidae*	Eurasian wryneck	*Jynx*	Least Concern	Decreasing
14	*Dendrocopos himalayensis*	*Piciformes*	*Picidae*	Himalayan Woodpecker	*Dendrocopos*	Least Concern	Stable
15	*Upupa epops*	*Bucerotiforme*	*Upupidae*	Common Hoopoe	*Upupa*	Least Concern	Decreasing
16	*Coracias benghalensis*	*Coraciiformes*	*Coraciidae*	Indian Roller	*Coracias*	Least Concern	Increasing
17	*Coracias garrulus*	*Coraciiformes*	*Coraciidea*	Eurasian Roller	*Coracias*	Least Concern	Decreasing
18	*Halcyon smyrnensis*	*Coraciiformes*	*Coraciidea*	White-throated Kingfisher	*Halcyon*	Least Concern	Increasing
19	*Alcedo atthis*	*Coraciiformes*	*Coraciidea*	Common Kingfisher	*Alcedo*	Least Concern	Unknown
20	*Merops orientalis*	*Coraciiformes*	*Coraciidea*	Green Bee-eater	*Merops*	Least Concern	Increasing
21	*Cuculus canorus*	*Cuculiformes*	*Cuculidae*	Eurasian Cuckoo	*Cuculus*	Least Concern	Decreasing
22	*Psittacula krameri*	*Psittaciformes*	*Psittaculidae*	Rose-ringed Parakeet	*Psittacula*	Least Concern	Increasing
23	*Apus affinis*	*Apodiformes*	*Apodidae*	House Swift	*Apus*	Least Concern	Increasing
24	*Apus apus*	*Apodiformes*	*Apodidae*	Common Swift	*Apus*	Least Concern	Stable
25	*Tachymarptis melba*	*Apodiformes*	*Apodidae*	Alpine Swift	*Tachymarptis*	Least Concern	Stable
26	*Otus bakkamoena*	*Strigiformes*	*Strigidae*	Collared Scops Owl	*Otus*	Least Concern	Stable
27	*Athene brama*	*Strigiformes*	*Strigidae*	Spotted Owlet	*Athene*	Least Concern	Stable
28	*Bubo bubo*	*Strigiformes*	*Strigidae*	Eurasian Eagle Owl	*Bubo*	Least Concern	Decreasing
29	*Strix aluco*	*Strigiformes*	*Strigidae*	Tawny Owl	*Strix*	Least Concern	Stable
30	*Caprimulgus europaeus*	Caprimulgiformes	*Caprimulgidae*	Eurasian Nightjar	*Caprimulgus*	Least Concern	Decreasing
31	*Columba livia*	Columbiformes	*Columbidae*	Rock Pigeon	*Columba*	Least Concern	Decreasing
32	*Streptopelia orientalis*	Columbiformes	*Columbidae*	Oriental Turtle Dove	*Streptopelia*	Least Concern	Increasing
33	*Streptopelia decaocto*	Columbiformes	*Columbidae*	Eurasian Collared Dove	*Streptopelia*	Least Concern	Increasing
34	*Streptopelia chinensis*	Columbiformes	*Columbidae*	Spotted Dove	*Streptopelia*	Least Concern	Stable
35	*Gallinula chloropus*	Gruiformes	*Rallidae*	Common Moorhen	*Gallinula*	Least Concern	Stable
36	*Fulica atra*	Gruiformes	*Rallidae*	Common Coot	*Fulica*	Least Concern	Increasing
37	*Actitis hypoleucos*	Charadriiformes	*Scolopacidae*	Common Sandpiper	*Actitis*	Least Concern	Decreasing

Sr. No.	*Binomial*	Order	Family	Common Names	Genus	IUCN Status 2019	Population Trend
38	*Vanellus vanellus*	Charadriiformes	*Scolopacidae*	Northern Lapwing	*Vanellus*	Near Threatened	Decreasing
39	*Milvus migrans*	Accipitriformes	Accipitridae	Black Kite	*Milvus*	Least Concern	Unknown
40	*Gypaetus barbatus*	Accipitriformes	Accipitridae	Lammergier	*Gypaetus*	Near Threatened	Decreasing
41	*Gyps himalayensis*	Accipitriformes	Accipitridae	Himalayan Griffon	*Gyps*	Near Threatened	Stable
42	*Circus aeruginosus*	Accipitriformes	Accipitridae	Eurasian Marsh Harrier	*Circus*	Near Threatened	Stable
43	*Accipiter nisus*	Accipitriformes	Accipitridae	Eurasian Sparrow-hawk	*Accipiter*	Least Concern	Stable
44	*Buteo rufinus*	Accipitriformes	Accipitridae	Long-legged Buzzard	*Buteo*	Least Concern	Stable
45	*Hieraetus pennatus*	Accipitriformes	Accipitridae	Booted Eagle	*Hieraetus*	Least Concern	Unknown
46	*Falco tinnunculus*	Falconiformes	Falconidae	Common Kestrel	*Falco*	Least Concern	Decreasing
47	*Falco peregrinus*	Falconiformes	Falconidae	Peregrine Falcon	*Falco*	Least Concern	Stable
48	*Bubulcus ibis*	Pelecaniformes	Ardeidae	Cattle Egret	*Bubulcus*	Least Concern	Increasing
49	*Nycticorax nycticorax*	Pelecaniformes	Ardeidae	Night Heron	*Nycticorax*	Least Concern	Decreasing
50	*Lanius isabellinus*	Passeriformes	Laniidae	Rufous-tailed Shrike	*Lanius*	Least Concern	Stable
51	*Lanius schach*	Passeriformes	Laniidae	Long-tailed Shrike	*Lanius*	Least Concern	Unknown
52	*Garrulus lanceolatus*	Passeriformes	Corvidae	Black-headed Jay	*Garrulus*	Least Concern	Stable
53	*Corvus macrorhynchos*	Passeriformes	Corvidae	Large-billed Crow	*Corvus*	Least Concern	Stable
54	*Oriolus oriolus*	Passeriformes	Oriolidae	Eurasian Golden Oriole	*Oriolus*	Least Concern	Stable
55	*Dicrurus macrocercus*	Passeriformes	Dicruridae	Black Drongo	*Dicrurus*	Least Concern	Unknown
56	*Cinclus pallasii*	Passeriformes	Cinclidae	Brown Dipper	*Cinclus*	Least Concern	Stable
57	*Monticola solitarius*	Passeriformes	Turdidae	Blue Rock Thrush	*Monticola*	Least Concern	Stable
58	*Myophonus caeruleus*	Passeriformes	Muscicapidae	Blue Whistling Thrush	*Myophonus*	Least Concern	Unknown
59	*Turdus merula*	Passeriformes	Turdidae	Eurasian Blackbird	*Turdus*	Least Concern	Increasing
60	*Turdus ruficollis*	Passeriformes	Turdidae	Dark-throated Thrush	*Turdus*	Least Concern	Unknown
61	*Luscinia pectoralis*	Passeriformes	Muscicapidae	White-tailed Rubythroat	*Luscinia*	Least Concern	Unknown
62	*Phoenicurus ochruros*	Passeriformes	Muscicapidae	Black Redstart	*Phoenicurus*	Least Concern	Increasing
63	*Chaimarrornis leucocephalus*	Passeriformes	Muscicapidae	White-capped Water Redstart	*Chaimarrornis*	Least Concern	Stable
64	*Rhyacornis fuliginosus*	Passeriformes	Muscicapidae	Plumbeous Water Redstart	*Rhyacornis*	Least Concern	Stable
65	*Saxicola caprata*	Passeriformes	Muscicapidae	Pied Bush chat	*Saxicola*	Least Concern	Stable
66	*Saxicola torquata*	Passeriformes	Muscicapidae	Common Stonechat	*Saxicola*	Least Concern	Stable
67	*Oenanthe pleschanka*	Passeriformes	Muscicapidae	Pied Wheatear	*Oenanthe*	Least Concern	Stable
68	*Oenanthe isabellina*	Passeriformes	Muscicapidae	Isabelline Wheatear	*Oenanthe*	Least Concern	Stable
69	*Acridotheres tristis*	Passeriformes	Sturnidae	Common Myna	*Acridotheres*	Least Concern	Increasing
70	*Tichodroma muraria*	Passeriformes	Tichodromidae	Wall Creeper	*Tichodroma*	Least Concern	Stable
71	*Certhia familiaris*	Passeriformes	Certhiidae	Bar-tailedTree Creeper	*Certhia*	Least Concern	Stable
72	*Parus rufonuchalis*	Passeriformes	Paridae	Rufous-naped tit	*Parus*	Least Concern	Stable
73	*Parus major*	Passeriformes	Paridae	Great tit	*Parus*	Least Concern	Increasing
74	*Riparia diluta*	Passeriformes	Hirundinidae	Pale Martin	*Riparia*	Least Concern	Unknown
75	*Hirundo rupestris*	Passeriformes	Hirundinidae	Eurasian Crag Martin	*Hirundo*	Least Concern	Stable
76	*Delichon dasypus*	Passeriformes	Hirundinidae	Asian House Martin	*Delichon*	Least Concern	Increasing
77	*Hirundo rustica*	Passeriformes	Hirundinidae	Barn Swallow	*Hirundo*	Least Concern	Decreasing

Sr. No.	*Binomial*	Order	Family	Common Names	Genus	IUCN Status 2019	Population Trend
78	*Pycnonotus leucogenys*	Passeriformes	Pycnonotidae	Himalayan Bulbul	*Pycnonotus*	Least Concern	Increasing
79	*Sylvia curruca*	Passeriformes	Sylviidae	Lesser Whitethroat	*Sylvia*	Least Concern	Stable
80	*Phylloscopus collybita*	Passeriformes	Phylloscopidae	Common Chiffchaf	*Phylloscopu*	Least Concern	Increasing
81	*Phylloscopus trochiloides*	Passeriformes	Phylloscopidae	Greenish Warbler	*Phylloscopu*	Least Concern	Increasing
82	*Garrulax lineatus*	Passeriformes	Leiothrichidae	Streaked Laughing Thrush	*Garrulax*	Least Concern	Stable
83	*Galerida cristata*	Passeriformes	Alaudidae	Crested Lark	*Galerida*	Least Concern	Decreasing
84	*Alauda arvensis*	Passeriformes	Alaudidae	Eurasian Skylark	*Alauda*	Least Concern	Decreasing
85	*Alauda gulgula*	Passeriformes	Alaudidae	Oriental Skylark	*Alauda*	Least Concern	Decreasing
86	*Passer domesticus*	Passeriformes	Passeridae	House Sparrow	*Passer*	Least Concern	Decreasing
87	*Passer hispaniolensis*	Passeriformes	Passeridae	Spanish Sparrow	*Passer*	Least Concern	Decreasing
88	*Passer montanus*	Passeriformes	Passeridae	Eurasian Tree Sparrow	*Passer*	Least Concern	Decreasing
89	*Motacilla alba*	Passeriformes	Motacillidae,	White Wagtail	*Motacilla*	Least Concern	Stable
90	*Motacilla flava*	Passeriformes	Motacillidae,	Yellow Wagtail	*Motacilla*	Least Concern	Decreasing
91	*Motacilla citreola*	Passeriformes	Motacillidae,	Citrine Wagtail	*Motacilla*	Least Concern	Increasing
92	*Motacilla cineria*	Passeriformes	Motacillidae,	Grey Wagtail	*Motacilla*	Least Concern	Stable
93	*Anthus similis*	Passeriformes	Motacillidae	Long-billed Pipit	*Anthus*	Least Concern	Stable
94	*Anthus spinoletta*	Passeriformes	Motacillidae	Water Pipit	*Anthus*	Least Concern	Stable
95	*Prunella collaris*	Passeriformes	Prunellidae	Alpine Accentor	*Prunella*	Least Concern	Stable
96	*Leucosticte nemoricola*	Passeriformes	Fringillidae	Plain Mountain Finch	*Leucosticte*	Least Concern	Stable
97	*Carduelis carduelis*	Passeriformes	Fringillidae	Eurasian Goldfinch	*Carduelis*	Least Concern	Increasing
98	*Lonchura malabarica*	Passeriformes	Estrildidae	Indian Silverbill	*Lonchura*	Least Concern	Stable
99	*Carpodacus erythrinus*	Passeriformes	Fringillidae	Common Rosefinch	*Carpodacus*	Least Concern	Decreasing
100	*Emberiza cia*	Passeriformes	Emberizidae	Rock Bunting	*Emberiza*	Least Concern	Increasing

Annex 4: TOR for Biodiversity Studies and Monitoring During Construction

Baseline Ecological Studies and Monitoring for Gabral Kalam Hydropower Project

During the Gabral-Kalam Hydropower Project (GKH) ESIA, a lack of readily available and reliable baseline secondary data on flora and fauna was seriously felt due to time constraints. ESIA of the GKH has recommended preparing to develop a sound ecological baseline for the project influence area and carry out detailed monitoring during the implementation of the project to identify and address impacts on the local ecology.

These TORs are for carrying out additional baseline studies and to update the mitigation measures to address any potential impacts on the ecology. The assignment will be carried out to the international standard as per the World Bank safeguard operational policies, particularly OP 4.01 Environmental Assessment, OP 4.04 Natural Habitats, and OP 4.36 Forests.

Background: The GKH is located on the Gabral River, a tributary of the Swat River. Being ecologically important and potential area, no recent studies are available describing the flora, aquatic fauna, herpetological elements, avian fauna, and mammalian species. The ecological studies carried out under ESIA covered the summer season of 2019 and not all the seasons. Therefore, additional floral and faunal studies are needed in order to describe the aquatic and terrestrial ecological profile of the area .

OBJECTIVES

- Develop baseline data for all types of terrestrial and aquatic macro and microfauna, including invertebrates and vertebrates, information on the presence, seasonal behavior and biotope characteristics of selected species at the project locations
- Develop baseline data for all types of terrestrial and aquatic vegetation, forests, medicinal plants, non-timber forest products, etc.
- Characterization and delineation of any natural habitats and update environmental and ecological baseline information of the ESIA
- Update detailed environmental and ecological baseline information of the ESIA
- Breeding, spawning, migration, and other biological characterization of indigenous cold-water fish species.
- Review the impacts and mitigation measures of the proposed project and develop additional mitigation measures based on enhanced understanding to offset potential impacts if required.
- Ensure all mitigation measures will result in no net loss in the natural habitat in compliance with World Bank Policy and recommend proactive measures to improve the aquatic and terrestrial habitat.
- Develop measures to support the tree plantation and biodiversity conservation programs recommended in the ESIA
- Carry out seasonal monitoring during the construction stages of the project to identify any potential impacts on the ecology, and develop adequate mitigation measures

Detailed Scope of the Study

The proposed assignment will consist of seven main tasks viz., preparing plans for baseline monitoring, aquatic ecology, terrestrial ecology, avian fauna, and development of a GIS-based ecological database. These tasks are interrelated, and hence, a coordinated and comprehensive approach is required to prepare the survey plans, geo-referencing and base-mapping, data collection and interpretation and

finally preparing a comprehensive ecological baseline. The design of the tasks will be based on the preliminary baseline data collected and the mitigation measures proposed in the ESIA.

Literature Review and Consolidation of Available Data

Existing information will be collected and consolidated through the compilation of full literature. The review should not be limited to the project area of influence only but will also cover the habitats in surrounding areas, especially in the Bhan Khwar valley, for developing the ecological linkages. The resulting list of species and list of conservation activities will be annotated as much as possible (number, location, year, season, other relevant remarks).

Preparation of Survey Plan

Field visits to study the existence, identification, population, and ecological linkages of various groups of biodiversity in the project area will be planned during different seasons keeping in view the availability of various floral and faunal elements. Vegetation surveys and analysis should be conducted during the spring and autumn season to record the maximum species. Amphibians and reptiles are cold-blooded animals and hibernate during colder months. Therefore, to study these groups, field visits will be planned during the summer season (April to August). Avian surveys will be conducted during summer to study resident birds while during winter to study the migratory birds. Mammalian fauna will also be studied during summer and winter.

Task 1: Baseline Monitoring Plan

This task will include the development of the updated baseline. The Environmental and Social Impact Assessment (ESIA) carried out for the project covers the baseline, expected impacts, and necessary mitigation and management measures in an integrated fashion for almost all aspects of the project and its ancillary facilities but for a short duration.

The Consultant will review and make use of all the existing information available and, in particular, will develop tools and models that will be helpful in preparing detailed baseline and supporting environmental and social studies. This will include reports, maps, surveys conducted, hydrological studies, Environmental and Social Assessments, economic analysis, etc.

Task 2: Plan for Aquatic Ecology

The purpose of this task is to collect baseline data on fish and aquatic ecology. covering all seasons and establish baseline terrestrial ecology of the area, and update the impact assessment in ESIA and develop additional mitigation and management plans to address all potential impacts adequately. The studies will cover baseline data for breeding, spawning, migration and other biological characterization of indigenous cold water fish species. The baseline data will provide knowledge on migration behavior and reproduction needs of fish species, and locations and features of important habitat, including locations of pools used for overwintering, spawning, and juvenile rearing. The study will also focus on aquatic flora and fauna including phytoplankton, zooplankton, aquatic macro-invertebrates, aquatic flora in Gabral River, and its tributaries. The ecological linkages among all the biotic and abiotic components of the aquatic ecosystem will be studied. The study will also assess the adequacy of environmental flows to be released through the weir to maintain the ecological connectivity of fish and other aquatic habitats.

Task 3: Plan for Terrestrial Ecology

The purpose of this task is to collect baseline terrestrial ecology covering all seasons and establish baseline terrestrial ecology of the area, and update the impact assessment in ESIA and develop additional mitigation and management plans to adequately address all potential impacts, and provide input to tree plantation of wildlife conservation activities proposed under the project. In order to

prepare this plan, ecological baseline data for all types of terrestrial flora and fauna and wildlife of the study area, including information on the occurrence, distribution, seasonal and migratory behavior, breeding needs, threatened species, and habitat characteristics supporting diverse mountain species will be collected. The baseline studies will cover vegetation analysis, forest types, ecological zones, micro and macro-invertebrates, and vertebrate fauna, including amphibians, reptiles, birds, mammals, and ecological linkages between all the components of the regional ecosystem.

The outcome of this task to establish baseline terrestrial ecology of the project area and address the impacts of the project on flora and fauna of the project area. The plan will also provide inputs for wildlife conservation and tree plantation.

Task 4: Plan for Avifauna

The task will also cover necessary baseline data collection on indigenous and migratory bird species, their distribution, seasonal and migratory behavior, breeding needs, threatened species, and habitat characteristics supporting diverse mountain species will be collected to carry out an avian risk assessment. An avian risk assessment and management plan will be prepared as an outcome of this task and on the basis of this baseline study as well as a review of the alignment of proposed transmission lines.

Task 5: Development of GIS-Based Database System

The purpose of this task is the development of the database of the project area using GIS Software and other modern techniques covering all aspects of ecological features. The GIS maps/database should provide all information about the physical existence of flora, fauna, and lakes for migratory birds, land use/land cover maps covering forestry, agricultural, grazing, and barren land and location of natural fish hatcheries in the project area.

Task 5: Monitoring of Impacts on Ecological Environment during Project Construction

The purpose of this task is to develop a monitoring plan to monitor the impacts of the GKH construction activities on the ecological receptors and carry out the monitoring throughout the construction period. The monitoring activities will cover all aspects of aquatic ecology, terrestrial ecology, and avifauna.

Staff and Qualifications

The key staff and their qualification requirements for carrying out this study are given in the following table. The studies will be carried out over a period of six years, covering all seasons during project implementation. Baseline monitoring and Ecological studies and wildlife surveys will be conducted during the first year. The monitoring will be carried out during the entire construction period as per the agreed monitoring plan.

Sr. No.	Expertise	Qualification and Experience	Man Months	Key Tasks
1	Team Leader/Ecological Specialist	Ph.D. in relevant discipline with at least 15 years of relevant experience	24	-Overall supervision of baseline studies and monitoring activities - Develop baseline reports -Prepare monitoring reports and present to the concerned forums -Liaise with the local communities and project authorities
2	Terrestrial Ecologist	Ph.D. in Plant Ecology with at least 10 years of	16	-Delineation of the study area into different Landscape Ecological Units.

		relevant experience		-Baseline survey of plant communities with reference to different Landscape Ecological Units and classification of observed species into different growth forms. - Assessment of seasonal changes in floristic composition and cover at representative habitats -Assess the conservation status of recorded flora with reference to the IUCN Red List of Threatened Species. -Prepare relevant baseline and monitoring reports. -Assist and support to Team Leader in relevant matters
3	Ornithologist	Post-graduation, preferably Ph.D. in biological sciences with at least 10 years of relevant experience	8	- Baseline survey of migratory as well as sedentary birds in the project area of influence - Monitoring of birds population with reference to different habitats and seasons. -Assess the conservation status of birds with reference to the IUCN Red List of Threatened Species. -Prepare relevant baseline and monitoring reports. Assist and support to Team Leader in relevant matters.
4	Ichthyologist/Freshwater Biologist	Post-graduation, preferably Ph.D. in biological sciences with at least 10 years of relevant experience	16	-Baseline survey of fish and other aquatic life (aquatic plants, macro, and micro-invertebrates, etc.) in water bodies existing in the project area of influence. - Monitoring of fish population with reference to different habitats/localities and seasons. -Prepare relevant baseline and monitoring reports. -Assist and support to Team Leader in relevant matters
5	GIS Specialist	Graduation in engineering or sciences with at least 10 years of relevant experience	6	-Prepare GIS/RS based maps as per requirements of the team members - Assist and support to Team members

Annex 5: TOR for Cumulative Impact Assessment Studies of the Swat River Basin

Background of the Study

Pakistan is rich in natural resources including hydropower potential. Only a small portion of hydropower potential (about 15%) has been developed so far. In Khyber Pakhtunkhwa (KP) province, hydropower potential is concentrated in districts – Chitral, Dir, Swat, Kohistan, Mansehra and in the merged tribal districts. Despite being rich in hydropower resources, some of these remote areas are also facing an acute shortage of electricity. Government of Khyber Pakhtunkhwa, therefore, is pursuing the development of several of these projects through the public and private sector and is seeking World Bank financing for the development of hydropower projects in the Swat River basin.

The Government of Khyber Pakhtunkhwa (GoKP) through the Pakhtunkhwa Energy Development Organization (PEDO) is planning to implement the Khyber Pakhtunkhwa Hydropower and Renewable Energy Development Program (KPHREDP) (the Program) and is seeking financial assistance from the World Bank (WB). Under the Program, PEDO intends to develop hydropower projects and also implement other renewable energy projects in the Swat River basin.

The Component B of the Program, 'Institutional Strengthening and Energy Sector Development' will help prepare and implement a strategic roadmap and business plan for the development of KP energy systems and associated infrastructure to promote renewable energy, maximize investments and government revenue. It will also entail strengthening of institutional systems and processes so that the Energy Department GoKP and PEDO can efficiently and effectively manage their duties as a developer of renewable energy program as well as operations and maintenance of existing and future energy projects. The objectives of this component will be achieved through the following sub-components:

Component B includes a subcomponent on 'Preparation of Plans, Feasibilities and Design Studies'. Key elements of this work would be developing a framework to select and prioritize projects, ensure their readiness through pre-feasibility, feasibility, design and safeguard studies, carryout geological investigations and surveys required for each stage, devise project structuring and financing strategy, development of power evacuation plan and grid connectivity and help secure commercial financing and private investments.

PEDO is currently in the process of procuring The Planning Consultant to develop a Comprehensive Plan for Hydropower and Energy Systems in KP through (i) Assessment and Appraisal of potential hydropower and alternative renewable energy sites in KP, and preparation of a long-term integrated plan for development of renewable energy and hydropower resources in the province, and (ii) Sequencing of the investment program over 10 years, 20 years and 30 years periods considering priorities, objective agreed criteria, demands and implementation constraints, etc. and electricity price for the generators and consumers. The Consultant will also carry out feasibility studies for some priority subprojects.

Objective of the Study

The above-mentioned cascade development could potentially result in a greater fragmentation of the ecosystem as these schemes could result in changes to flow regimes, water quality and the productivity and species composition of rivers.

PEDO would like to conduct a cumulative impact assessment (CIA) with the overall goal of CIA to better understand the environmental and social impacts and opportunities for hydropower development in the Swat River basin consistent with the principles of sustainability. CIA will be done for the whole basin considering the investments to be identified by the Planning Consultant. Given the critical role of water

resources in the project areas, this study will seek to support the efforts of the Government of Khyber Pakhtunkhwa to integrate hydropower development into an overall long-term sustainable vision for the development of the province's economy.

The specific objectives of this assignment are:

- To identify key objectives and indicators for sustainable management of the Swat River Basin, covering environmental, social and economic values
- To establish analytical tools to support ongoing sustainable planning
- To describe the cumulative impacts of hydropower development in the Swat River Basin under different scenarios
- To contribute to awareness and local capacity in river basin management
- To develop integrated mitigation measures, biophysical and social environment, that can be adopted during the design and construction of the projects

This assignment will identify key valued environmental components (VECs), and collect necessary baseline details and assess potential cumulative impacts. The following VECs are initially identified for the detailed study, and the consultants will identify additional VECs, if needed, based on their field studies:

(i) River flows/water balance analysis: Describe impacts on flows, hydrology and water balance in the basin. Identify river management objectives and estimate potential impacts. The river water is used for irrigation and also recharges springs and water wells.

(ii) Terrestrial and aquatic ecology: Estimate cumulative impacts of hydropower cascade development on terrestrial and aquatic ecology in the basin and river itself. The river supports a number of fauna and flora in the basin.

(iii) Social impacts: Estimate positive as well as stresses of social significance resulting from hydropower cascade development, showing gender-disaggregated impacts. These may include impacts on livelihoods and economic activity; loss of land, and the resulting alienation from a home and source of subsistence ;health (as a result of changes in water flows); influx of skilled and unskilled labor (Number, size, skill levels of local/regional labor force, measures for shifts in livelihoods, and sustainability of livelihoods); increased traffic flows; increase in tourism due to more access roads built under the projects; additional incidents of disease, alcohol and drugs problems, and crime as a result of increase in visitors/workers; and the capacity of local communities and municipal governments to cope with these changes. Swat valley attracts thousands of tourists, especially in the summer months, and in recent years has provided skilled labor for the hydropower projects in the Swat valley.

Scope and Methodology

The study will cover spatial and temporal dimensions relevant to the cumulative impacts on the basin-level and cover medium- and long-term strategic planning. Consultants, in consultation with affected communities and stakeholders, will define the spatial and temporal coverage with respect to selected valued environment and social components (VECs) associated with hydropower development in the Swat and Panjkora River in their inception report, to ascertain how the projects may contribute to cumulative impacts on VECs and/or may be at risk from cumulative effects on VECs they depend on. Some additional guidelines for the study are provided below:

(i) Data: The study will be predominantly based on information available from the Planning Consultants, secondary sources, including available project documents (feasibility studies, detailed engineering reports, evaluation reports, etc., of the current and proposed hydropower projects), planning reports of the Khyber Pakhtunkhwa province (on road, energy, water resources, water supply, hydro, tourism, etc.) and province level and disaggregated socio-economic, environmental and planning data. The Consultant will complement these secondary sources with publicly available data sets, with particular reference to GIS and remote sensing data.

(ii) Impacts: It is understood that "impacts" may be positive or negative.

(iii) Hydropower development scenarios: Two development scenarios will be examined: (a) a scenario which represents the "current situation" as closely as possible, namely hydropower projects that are currently in operation, under construction or have received first stage environmental clearance; and (b) a scenario that captures "full development" of hydropower, assuming all projects with signed MOUs and financing committed or identified.

(vi) Economic scenarios: The scenarios should be based on a single, consistent set of forecasted key economic assumptions (e.g., population, economic growth), where possible drawn from existing government or other credible projections.

Specific Tasks

This phase encompasses a detailed analysis of impacts and options. It will describe different future scenarios, but not recommend or prioritize solutions. The Consultant should undertake the following tasks:

(i) Start-up and Review of Documents

The Consultant shall conduct start-up meetings with PEDO and its Planning Consultant's team to compile all relevant documents and up-to-date information on planned projects. The Consultant shall review all related documents, including due diligence report, feasibility studies, impact assessments as well as topographic survey, geological mapping, and geotechnical investigation, hydrology and sedimentation study, and any other study undertaken by the project proponents. The Consultant shall also familiarize himself with the World Bank safeguard operational policies. Such documents shall help the Consultant to acquire information and baseline data. Information on all existing schemes and planned interventions in the area shall be identified and as much information as possible shall be collected.

(ii) Interaction with Relevant Stakeholders including PEDO

The Consultant shall have meetings with all relevant stakeholders, including relevant national and provincial government departments, NGOs, communities, to present the project and seek cooperation in the project activities and data and information compilation.

(iii) Identification of Stressors and Valued Ecosystem Components (VECs):

The Consultant shall identify and describe all existing or reasonably foreseeable investments, facilities or activities ("stressors") that have impacts on the river ecology. This will be based on previous studies and areal information, of natural and regulated flows as a result of existing or planned hydropower plants and abstraction for other purposes. It will also include the identification of possible sources of contaminants including sediments that may potentially harm water quality in the two rivers (both collectively and individually). The Consultant will subsequently identify the potential receptors of negative impacts from the operation of the stressors in the two rivers in consultation with PEDO relevant staff along with relevant Provincial Govt departments. This would include all VECs which could be significantly adversely (or also positively) impacted. VECs may include flow regime, aquatic and

riverine ecosystems as well as economic activities and livelihoods depending on water from the two rivers (e.g. fisheries, irrigated agriculture). The nature of the impacts will be described and their scale assessed in a qualitative manner. For identification of VECs the following two aspects must be adhered to:

- **Water Flow/Balance Analysis**: The Consultant shall compile all available information on existing and planned HPP and other interventions that can impact river flows. Based on hydrological and sedimentation study as well as data on standard intake capacities, a set of scenarios shall be defined. As a minimum, these scenarios should include natural conditions, existing conditions and future conditions with or without the identified projects. If relevant, scenarios including major regulating facilities should be run during construction and operation mode as well as with or without environmental flow releases. Using the natural hydrological river flows as input, the consultant should simulate artificially influenced river flows to develop a water balance model under these scenarios. Flow series for the different scenarios for key points in the river basins (e.g. at the location of potential VECs) shall be simulated.
- **Land and Water Use**: Based on collected and available data, estimates of natural riverine sediment transport shall be made. It is recommended to compile data on soil characteristics and erodibility. The Consultant shall compile information on land use, land tenure system, livelihoods related to land, and land degradation in the river basins and submitted to PEDO concern department. The special emphasis should be given to the potential effects of access roads for increased landslides and erosion at the existing and planned HPPs. Based on these assessments, identification of potential artificial point or diffuse sources of riverine sediments and their magnitude shall be estimated under the scenarios defined in the bullet above. Similarly, potential point sources of contaminants from existing or planned HPPs, as well as other interventions to the river system, shall be identified and as much as possible quantified. Through integration with the calculated river flows and the order of magnitude for sediment and contaminant concentrations shall be established at key points in the river basins.

(iv) Site Visits and Qualification of Desk Study

Guided by the results of the desk study, the Consultant shall conduct site visits to all the existing and proposed sites. The site visits shall as a minimum, include visits to the major existing and planned hydropower plant sites and other essential interventions in the basins that may affect water flow and quality. Impacts such as flow requirements, increased erosion or possible contaminant sources shall be investigated. During the visits, potentially impacted VECs shall be assessed and as many consultations as possible should be made with the PAPs, local communities, governments and NGOs. Standard water quality measurements (pH, conductivity, DO, suspended sediments) should be conducted along the rivers during site visits and existing river flow gauging and water quality monitoring stations should be visited and evaluated. Based on the findings of the site visits the Consultant shall update and qualify the desk study results and conclusions must be shared with provincial EPA through PEDO.

(v) Description of Physical Cumulative Impacts:

The Consultant shall summarize the results of Task (v) to (vii) in a report including graphic descriptions of the physical characteristics (e.g., average flows, minimum flows, sediment concentrations, etc.) along

the rivers under the different scenarios. Results shall be quantified for key points along the river stretches.

(vi) Assessment of Environmental and Social Impacts:

Based on the estimated physical cumulative impacts in the river basins where detailed studies are required, stretches with a combination of VEC and significant effects on either flow regime or water quality shall be assessed in regard to environmental or social impacts. Potential effects on aquatic biodiversity should be estimated based on knowledge from previous national and regional studies. If necessary, sampling of fish and other aquatic species shall be conducted at key sites. In situ water quality measurements should be conducted as much as possible to complement the measurements done during the screening phase. In parallel, the use of the river and the aquatic life for ecosystem services by local communities should be assessed through consultations. The economic dependence on the rivers and the potential impacts of the simulated physical cumulative impacts, including physical and economic displacement, estimated total land area to be taken by the projects, value of land use benefits, total population affected and measures for sustainable livelihood and poverty under the different development scenarios should be estimated. The consultant reviews all available World Bank guidelines[37] relevant to hydropower projects to assess the potential impacts.

(vii) Mitigation Measures:

The Consultant shall suggest possible mitigation measures for identified negative cumulative impacts. As a first step, the Consultant shall propose improvements and mitigating measures to the cumulative impacts in the ESIA/EMPs. The mitigation measures should also include a proposal for monitoring and dissemination of key variables, such as river flows and standard water quality parameters, for self-monitoring and accountability. This monitoring should as much as possible be located at locations where water quality measurements have been conducted as part of this study. The consultants will provide recommendations on the institutional hierarchy to implement the mitigation measures along with indicative timelines and budgets.

(vii) Proposed/Indicative Structure of the CIA Report

A sample table of contents of the CIA report is given below; however the Consultant will propose the report structure in the inception report

- **Summary**: The report should contain a brief, precise & succinct summary in a simple language for facilitating the ease of understanding of even a non-technical person
- **Introduction**: The report shall consist of an introduction to the assignment, complete with the project description & the background information to the study, methodology, source of information and structure of the report.
- **Assessment of the environmental settings relevant to the study:** The Report should enlist the baseline status of the environmental and social parameters pertinent to the study i.e. Regional context, Environmental conditions, Socio-economic conditions, Hydro-power

[37] Key World Bank guidance documents include, GOOD PRACTICE HANDBOOK Environmental Flows for Hydropower Projects (2018): https://www.ifc.org/wps/wcm/connect/2c27d3d8-fd5d-4cff-810f-c6eaa9ead5f7/GPH_Eflows+for+Hydropower+Projects_Updated_compressed.pdf?MOD=AJPERES
And Environmental, Health, and Safety Approaches for Hydropower Projects (2017): https://www.ifc.org/wps/wcm/connect/cefc36ec-9916-4ec4-b5ac-1d99602a3ef3/GPN_EHSHydropower.pdf?MOD=AJPERES).

developments and Transmission lines. The information may be supplemented by all relevant maps & photographs, available to the consultant.

- **Scope for cumulative Impact Assessment**: Identification of VECs and their spatial & temporal boundaries, external activities and environmental stressors.
- **Assessment of Cumulative Impacts**: River Hydrology and geomorphology, water quality, fish resource and habitat, Terrestrial ecosystem and biodiversity, Socio-economic impacts, Micro-climates, and other potential VECs.
- **Prediction of Impacts**. The environmental impacts of the hydro modification project so enlisted in the report shall be based upon scientific/mathematical/Statistical analysis of the information gathered by the consultant.
- **Recommendation of Best Management Practices**: The Consultant shall, on the basis of the predicted impacts, suggest realistic best-management practices be adopted by the project proponents to ameliorate any such adverse impacts and suggest institutional arrangement necessary for the sustenance of the mitigation program.
- **Resource utilization by the study team**: The consultant shall provide the constitution of the study team & an inventory of all the resources utilized by the team towards the preparation of the report.
- **Appendices**: The Report shall be supplemented by all the applicable appendices.

The ESMP should follow the WBG EHS Labor Influx, GBV/SEA Guidelines.

Staff and Qualifications

The key staff and their qualification requirements, for carrying out the CIA study are given in the following table.

S.No.	Key Staff	Man-months	Qualifications
1	Team Leader and Environmental Specialist	8	An international specialist with a master's degree in environmental sciences, Environmental Management or similar fields. He/she shall have at least fifteen years of relevant work experience in environmental and social impact assessment and mitigation including experience related to hydroelectric projects. Experience in similar assignments, especially category A projects in the region would be highly preferred. The candidate should have experience working for the WB financed projects and familiar with World Bank operations procedure for investment lending especially its safeguards policies.
2	Social Specialist	8	The Consultant should have a master's degree in social sciences, social development or similar fields. He/she shall have at least fifteen years of relevant work experience in social impact assessment and mitigation as well as in resettlement planning. Experience in similar assignments, especially category A projects are highly preferred. The candidate should have experience working for the WB financed projects and familiar with World Bank operations

S.No.	Key Staff	Man-months	Qualifications
			procedure for investment lending especially its safeguards policies.
3	Terrestrial Ecologist	6	The Consultant should have a master's degree in ecological sciences or similar fields. He/she shall have at least ten years of relevant work experience in carrying out the baseline studies on flora and fauna. Experience in similar assignments, especially in development projects funded by international financial institutions are highly preferred.
4	Aquatic Ecologist	6	The Consultant should have a master's degree in ecological sciences or similar fields. He/she shall have at least fifteen years of relevant work experience in carrying out aquatic ecological studies. Experience in similar assignments, especially in development projects funded by international financial institutions are highly preferred.
5	Hydrologist	6	The Consultant should have an engineering degree related to water resources and hydrology. He/she shall have at least ten years of relevant work experience in carrying out hydrological studies for hydropower and water resources projects . Experience in similar assignments, especially in development projects funded by international financial institutions are highly preferred.
7	GIS Specialist	7	The Consultant should have a bachelor's degree or engineering with at least five years of experience in GIS analysis and preparation of maps.

Annex 6: List of Participants Participated in Consultation Meetings

Table 1: List of Participants of Disclosure Metring in Kalam at Golden Star Hotel (07-11-2019

Sr. No.	Stakeholders (Organization/Department)	Name of Participant	Designation	Contact Number and Email	Address
1	Revnue	Hazrat Ali	S.C	0313-9542434	Kas Kalam
2	Revnue	Saffer-ullah	T.D.K	0346-9439909	Tehsil Kalam
3	X-Tehsil Nazem Bahrain	Habib-ullah	X-Nazim	0314-9700899	Shah hor Kalam Swat
4	Local Government (Land Owner)	Amir Zeb	FWA(M)	0314-9696825	Bazar Kalam
5		Nasir-ullah	Ex-Tehsil Counselor	0313-9046443	Bazar Kalam Swai
6		Aziz-ur-Rahman	Driver	0313-9323400	Kali Abadi Kas
7		Najab-ullah	Shopkeeper	0314-9282892	Qazi Abad Kas
8		Amir Zada	Zamendar		Kas Kalam
9		Haji Gul Zada	Zamendar		Kas Kalam
10		Gul Zada Wali Nazim	Village Nazim	0313-4199599	
11		Aslam Khan			Kas Kalam
12	Education Department	Dildar Hussain	PST	0344-6378855 Dildar1135@gmail.com	Kannai
13	Education Department	Saddar Ali	PST	0345-6182076	Kannai
14	Wild Life	Farman Ali	Watch Man	0312-0919445	Ashoran
15	Wild Life	Muhammad Razaq	Watch Man	03456636863	Matalan
16		Muhammad Saber		0314-9704101	Kas Kalam
17		Hazrat Muhammad		0310-2103353	Kas Kalam
18		Muhammad Jan		0314-5594282	Hambal Abad
19		Harif –ullah		0314-9716131	Yah-gul Kalam
20		Muhib-ullah			Shukla Kalam Bazar
21	IDC-Lahore Zaffer Ali	Zaffer Ali	SSE	0300-4845531	Lahore
22		Khan dada		0314-9706180	Kas Kalam
23		Yaqoob Khan		0314-9799288	Asan Kalam
24		Fazal Hadier		0314-9076885	Kas Kalam
25		Momin Khan		0315-7722503	Asan Kalam
26		Afzal Khan		0346-2756115	Paller Kalam
27		Saif-ul-Salam		0313-7230849	Asan
28		Bahadar Saeed		0313-9207211	Rashnail
29		Zameen Khan		0314-5526566	Rashnail
30		Shah Jahan	Land lord	0314-9076703 0344-9584703	Rashnail Kalam
31		Shamem Khan		0315-9545281	Rashnail Kalam
32		Muhammad Yaqoob		0311-9202234	
33		Gul Mir Khan	Supplier	0315-9357505	Bandag
34		Musaber Rehman	Zamendar	0315-9677914	Rashnail
35		Zai-ul-Haq	Zamendar	0311-7804277	As an/ Rashnail
36		Abdul Wahab	Zamendar	0314-9202494	Kas
37	Forest	Gul Zada	SDFO	0314-9396538	Kalam

Sr. No.	Stakeholders (Organization/Department)	Name of Participant	Designation	Contact Number and Email	Address
38		Rasool Khan	Zamendar	0314-9704101	Kalam
39		Javed Iqbal		0314-7022922	Kalam
40		Shahi rehman	Zamendar		Kalam
41		Muhammad Rasool	Zamendar		Kalam
42	Social Activest	Abdul Aziz		0314-9663665	Ashoran Cherat Kalam
43		Iqbal Hussain		0314-9704520	Village Kannai
44		Noor Muhammad			Kas Kalam
45		Muhammad Yousef			Kas Kalam
46		Muhabbat Khan			Kas
47		M.Rehman	Local Community Leader	0314-5588808	Ashoran Kalam
48		Abdul Qayyam	G.Sectry A.N.P Kalam	0345-0515102	Matalan Kalam Swai
49		Baroz Khan		0345-3341136	Kannai
50		Shah Khizer Khan		0311-9531996	Badongh
51		Welayat Khan		0314-9276900	Kas
52	Muhammad Shafiq Afridi AGES Team Leader		Team Leader		AGES Office Peshawar
53	Wild Life Department KPK	Main 1292 Alam	Range Officer Wild Life		Range Office Wild Life Kalam
54		Yalatib Khan		0316-9558707	Rashnail
55		Haji Nawab			Rashnail
56		Haji Faqir Gul		0314-9730994	Kalam Kas
57	IDC	Ruby Iqbal	Environmentalist	0336-0094045	Islamabad
58		Zameen Khan		0312-9495444	Cherat Kalam
59		Abdul Hameed Khan		0314-9703328	Kas Kalam
60		Jhatrab		0313-2825222	Asan Kalam
61	KDF (NGO)	Abrar Ahmed	G.S	0315-6696688	Bazar Kalam
62		Habib Rasool		0313-9517836	Najab Land Kalam
63		Shariq –ullah		0313-4414111	Ghayal Kalam
64	AGES-Consultation	Assad Ali Khan	Environmentalist	0336-9555505	University Town Peshawar
65	IDC	Basharat Ali	Civil Engineer	0310-9400496	Malakand District
66	IDC	Dr. Waseem Ahmad	Wild Life Ecdogist	0333-5214333	Lahore
67	IDC	Ali Akbar	Resettlements Specialist	0331-9111406	Peshawar
68	IDC	Hina Batool	Environmentalist	0333-4817442	Lahore
69	IDC	Shukat Ali Shahid	Project Coordinator	0300-9499782 Shaukat275@yahoo.com	Lahore
70	PEDO	Zafar Ali	AD-Enviroment	0321-9876702	Peshawar

Table 2: Consultation with Officials

Sr. No.	Date	Location/ Venue	Category of Participant	Name /Designation	Contact No.
1	October 23, 2019	Communication and Works Department, Swat	Stakeholder	- Mr. Siyab Ali (Sub Engineer) - Mr. Hazrat Ali (Accounts Clerk)	0345-9270597 0345-9527704
2	October 23, 2019	Wildlife & Forest Department, Swat	Stakeholder	- Mr. Abdul Ghafoor (Divisional Forest Officer Wildlife)	0345-9452441
3	October 23, 2019	Office of the DFO Protected Area, Swat Forest Devision	Stakeholder	- Mr. Raees Khan (Divisional Forest Officer Forest)	0300-9328372
4	October 23, 2019	District Officer Fisheries, Swat at Gulkala	Stakeholder	- Mr. Ibrar Ahmed (Assistant Director Fisheries) - Mr. Mujeebullah (PHD Fisheries)	0313-9628638
5	October 23, 2019	Office of the Tehsildar Kalam, District Swat	Stakeholder	- Mr. Hazrat Ali (senior Clark)	0313-9542434
6	October 24, 2019	Office of the Kalam Development Foundation, Kalam, District Swat	Stakeholder	- Mr. Abrar Ahmad (General Secretary) KDF NGO - Mr. Habib Rasool (Member) - Mr. Shakarullaha (Member)	0315-6696688
7	November 19, 2019	Environmental Protection Department (EPD) Peshawar	Stakeholder	- Mr. Waheed Khan (Deputy Director)	091-9210263

Table 3: Record of Consultations with the PAPs/ Local Population

Sr. No.	Date	Location/ Venue	Category of Participant	No of Participants	Name of Main Participants/ Position Holds/Designation	Contact No.
1	August 31, 2019	Kannai 2	PAPs/ Local Community	5	- Mr. Umar Gul s/o Shezad Gul - Mr. Rahim Gul s/o Hazrat Gul - Mr. Shezad Gul s/o Hazarat Gul - Mr. Ahmad Nawaz - Mr. Pir Gul s/o Awaib Gul	0341-6651954 0344-9613805
2	August 31, 2019	Paler - Village	PAPs/ Local Community	8	- Mr. Laiquait Ali s/o Noor Ali. Driver) - Mr. Yousaf Gul s/o Kannai Gul (Labour) - Mr. Sardar Hussain s/o Nazir Gul (Labour) - Mr. Malang s/0 Shadam Khan - Mr. Zyarat Gul s/o Hawaidad Khan - Mr. Zaimin Khan s/o - Mr. Bakht Munir s/o M.Didar - Mr. Hazrat Gul s/o Hidab Khan.(Shopkeeper)	0313-9346333 0314-9063874 0349-7270331 0344-1581785 0313-0011566
3	August 31, 2019	Paler -II	PAPs/ Local Community	4	- Mr. Lal Zada - Mr. Amir Zeb - Mr. Afreen - M. Wazir Zada	0312-2060392 0313-9665222 0349-6508090 0312-5068100

4	August 31, 2019	Kannai Village	PAPs/ Local Community	6	- Mr. M.Nawaz s/o M.Amin - Mr. H.Muhammad s/o - Mr. Bahram Khan s/o Jallelman Khan - Mr. Malik-Rasul Khan s/o Fahim jan - Mr. Faqir Jan s/o Fahim Jan - Mr. M.Ayoub s/o Jamsheed	0346-7700844 0343-1304727
5	September 1, 2019	Mayai-Village	PAPs/ Local Community	8	- Mr. Abdul Jaleel s/o Faiz Muhammad - Mr. Abdul Wadood s/o Kamin Gul - Mr. Shahid Malik s/o Pir Muhammad. - Mr. Wali Khan s/o - Mr. Sher Azam s/o Shahroom. - Mr. Hafiz-ullah s/o Syed-ullah. - Mr. Muhmood Khan s/o Shah room - Mr. Shahroom	0315-8833488 0312-7083924 0335-9715901 0334-0538744
6	September 2, 2019	Chirat Village	PAPs/ Local Community	5	- Mr. Muheeb-ullah s/o Abdul Kareem - Mr. Ameer-ullah s/o Mir Zameen - Mr. Gul Zada s/o Saad Malook - Mr. Noor Muhammad s/o Hazrat Ali - Mr-Khan Zada s/o Jum khan.	0312-7693540
7	September 3, 2019	Chirat	PAPs/ Local Community	8	- Mr. Waris Khan s/o Amir Sahib - Mr. Zia-ur-rehman s/o Ajmal Khan - Mr. Muhammad Jan - Mr. Wazir - Mr. Hazrat Sher - Mr. Matab - Mr. Muhammad Sher - Mr. Kamaran	0312-5494077 0311-0938044 03137759082
8.	September 4, 2019	Chirat	PAPs/ Local Community	6	- Mr. Nawab khan s/o Shadoon Khan - Mr. Ahmad Zeb s/o Sher Zaman - Mr. Razi Gul s/o Mehboob Khan - Mr. Yaseen Ali s/o Razi Gul - Mr. Muhammad Zeb s/o Mehboob Khan - Mr. Razi Gul s/o Mubarak Khan -	0314-4032001 0315- 5660676 0314- 9077014 0314-5060630 0314-3930297
9.	September 5, 2019	Kannai	PAPs/ Local Community	7	- Mr. Sultan Zain s/o Dali Khan - Mr. Muhammad Hussain s/o Abdul Ghafar - Mr. Mirza Khan s/o Sher Khan - Mr. Iqbal Hussain s/o Muhammad Yousaf - Mr. Kashmir Khan s/o Shadon Malik	- 0348-8495132 - 0346-9464625 - 0341-9484013 - 0300-3253672 - 0342-8980337 - 0341-4982988 - 0313-0344244

					- Mr. Fareed Khan s/o Laal Khan - Mr. Shahid Hussain s/o Kasher Khan	
10.	September 5, 2019	Kannai	PAPs/ Local Community	4	- Mr. Umar Muhammad s/o Muhammad Faqeer - Mr. Jan Fakhar s/o Muhammad Faqeer - Mr. Taj Muhammad s/o Muhammad Bakher - Mr. Peer Gul s/o Habib Gul	- 0342-1946466 - 0341-9006181 - 0341-9033508
11.	September 5, 2019	Kannai	PAPs/ Local Community	7	- Mr. Hujjat Khan s/o Masoom Khan - Mr. Arshad s/o Anjum - Mr. Sher Muhammad - Mr. Bahadur s/o Sawal Faqeer - Mr. Muhammad Nawaz s/o Muhammad Amin Haji - Mr. Raheem Gul s/o Hazrat Gul - Mr. Umar Gul s/o Shahzad Gul	- 0349-5292087 - 0341-9033667 - 0346-1375948 - 0344-9613805 - 0341-6651954 - 0346-1701621
12.	September 5, 2019	Kannai	PAPs/ Local Community	8	- Mr. Dildar khan s/o Kasher Khan - Mr. Muhammad Nawaz s/o Kasher Khan - Mr. Khalil Hussain s/o Abdul Ghafar - Mr. Gul Namir s/o Sheron Malik - Mr. Sardar Ali s/o Gul Namir Khan - Mr. Mumtaz Hussain s/o Kushar Khan - Mr. Muhammad Zaib s/o Alhajj Muhammad Amin Malik - Mr. kashar Khan s/o Sheron Malik	- 0344-6378855 - 0349-9328047 - 0313-9373626 - 0344-5676442 - 0345-6182076 - 0344-8936361 - 0315-7899611 - 0344-5858938
13.	September 18, 2019	Kannai	DPs	8	- Mr. Abdul Razaq s/o Shahzad Gul - Mr. Raheem Gul s/o Hazrat Gul - Mr. Pir Gul s/o Habib Gul - Mr. Habib Gul s/o Hazrat Gul - Mr. Shahzad Gul s/o Hazrat Gul - Mr. Bahadur s/o Sawal Faqir - Mr. Sher Muhammad s/o Muhammad Faqir - Mr. Rasool Khan s/o Faheem Jan	- 0346-1701621 - 0341-6651954 - 0345-2334943 - 0345-2334943 - 0346-1701621 - -- - -- - 0314-9704101
14.	September 18, 2019	Kannai	DPs	9	- Mr. Sakhi haji s/o Ghulam Haider - Mr. Rasool Khan s/o Faheem Jan - Mr. Faqir Muhammad s/o Mia Gul Jan - Mr. Muhammad Jan s/o Faheem Jan - Mr. Faqir Jan s/o Faheem Jan - Mr. Omer Muhammad s/o Muhammad Faqir - Mr. Sher Muhammad - Mr. Amir Zeb s/o Faqir Jan	- 0314-9704011 - 0314-9704101 - 0314-9729700 - 0314-9706363 - 0314-9704030 - 0313-3037888 - 0314-9033667 - 0314-9696825 - 0314-9724430

					- Mr. Nasir Ullah s/o Rasool Khan	
15.	September 19, 2019	Chirat	DPs	16	- Mr. Muhabat Khan s/o Gul Sher Khan - Mr. Kamran s/o Mia Sher - Mr. Muhammad Sher s/o Mia Sher - Mr. Hazrat Sher s/o Mia Sher - Mr. Mehtab s/o Mia Sher - Mr. Zamin Khan s/o Gul Faqir - Mr. Gul Zada s/o Gul Faqir - Mr. Abdul Matab s/o Naron Khan - Mr. Muhammad Jan s/o Pir Gul - Mr. Jahan Zeb s/o Muhammad Jan - Mr. Ahmad Zeb s/o Muhammad Jan - Mr. Wazir Zada s/o Gujjar Khan - Mr. Roidar Haji s/o Guli Dar - Mr. Muhammad Dostan s/o Shah Muhammad - Mr. Shahi Rehman s/o Gulab - Khan - Mr. Gul Rehman s/o Mul Amin	- 0314-8077366 - -- - -- - -- - 0312-9495444 - 0314-9396538 - -- - 0314-3041188 - 0313-2825222 - 0315-6161081 - 0313-9496273 - -- - -- - -- - 0314-5526566
16.	September 19, 2019	Rashnail	DPs	9	- Mr. Haji Nawab s/o Masoom Khan - Mr. Pasheem Khan s/o Hujat Khan - Mr. Shah Nawab s/o Masoom Khan - Mr. Shahi Room/ Peer Muhammad - Mr. Iqbal Hussain s/o Muhammad Zareen - Mr. Wilayat Khan s/o Shahi Malik - Mr. Hazrat Hussain s/o Muhammad Zareen - Mr. Yaqoob s/o Sultan Zareen - Mr. Tariq	- 0313-5401342 - 0315-9545281 - 0314-9706770 - 0334-0538744 - 0310-7398150 - 0316-9558707 - 0314-3020884 - 0314-9742377 - 0314-5190017
17.	September 20, 2019	Kanai	DPs	15	- Mr. Hazrat Sher s/o Swal Malik - Mr. Hajoom Khan s/o Pasheem Khan - Mr. Faqir Gul s/o Gul Badshah - Mr. Gulbahar Khan s/o Hazrat Faqeer - Mr. Alam Zeb s/o Abdul Baqi - Mr. Gul Zada s/o Rajab Khan - Mr. Bakhta Noor s/o Mir Samad - Mr. Waris Khan s/o Dali Khan - Mr. Mir Zada - Mr. Bakhta Noor s/o Mir Samad - Mr. Muhammad Jan Haji	- 0312-9735857 - 0315-9154432 - 0314-9730994 - 0349-8820412 - 0318-0548630 - 0315-9288178 - 0310-2103353 - 0300-5565044 - 0311-9202234 - 0314-9706363 - 0314-9704520 - 0345-1543136 - 0346-9464625 - 0314-9282882

					- Mr. Iqbal Hussain - Mr. Rashid Ahmad - Mr. Muhammad Hussain - Mr. Bahadur Said	
18.	September 21, 2019	Chirat		16	- Mr. Muhammad Rafiq - Mr. Rehmat Ali - Mr. Zamin Khan - Mr. Haji Nawab - Mr. Wazir Zada - Mr. Muhammad Rasool - Mr. Amir Zada - Mr. Rasool Khan - Mr. Tariq Din - Mr. Shadoon Khan - Mr. Abdul Hameed - Mr. Rehmat Ali - Mr. Mujahid Abdul Hai - Mr. Fazal e Rabi - Mr. Muhammad Rabi - Mr. Shafi Rehman	- 0313-0781288 - 0131-9663400 - 0312-9495494 - 0312-9701342 - 0312-5068100 - 0315-9695449 - 0314-9622233 - 0314-9710333 - 0300-5317828 - 0316-9371838 - 0314-9703328 - 0314-5512444 - 0314-9734848 - -- - 0340-5183015 - 0314-9743243
19.	September 23, 2019	Mayai	Land owners	8	- Mr. Afsar Khan s/o Bali Naz - Mr. Baroz Khan s/o Abdul Mateen - Mr. Salamat Khan s/o Khushnoor - Mr.Habib Khan s/o Kabal Khan - Mr. Guldar Khan s/o Jandol Khan - Mr. Madar Khan s/o Faiz Muhammad - Mr. Shahi Mulk s/o Perrot - Mr. Shahbaz Khan s/o Dilawar Khan	- 0314-5594281 - 0312-2311656 - 0315-9607826 - 0314-4571624 - 0317-9685481 - 0314-5986681 - 0314-9282762 - 0314-9276688
20.	September 23, 2019	Mayai/ Badong	Land owners	7	- Mr. Shahnazar Khan s/o Manaras Khan - Mr. Nasar Khan s/o Manaras Khan - Mr. Shamroz Khan s/o Manaras Khan - Mr. Tawas Khan s/o Manaras Khan - Mr. Rayat Khan s/o Manaras Khan - Mr. Palas Khan s/o Manaras Khan - Ms. Zainab Bibi w/o Manaras Khan	- 0311-9531996 - 0315-9924204
21.	September 23, 2019	Palair		9	- Mr. Ajmeer Khan Chairman - Mr. Shabir Khan - Mr. Miandum Khan - Mr. Shah Hussain - Mr. Akhtar HHussain - Mr. Hazrat Hussain - Mr. Zahir Shah - Mr. Sher Alam - Mr.Taj Khan	- 0312-9496441 - -- - -- - -- - --- - 0312-9496441
22.	September 23, 2019	Palair		9	- Mr. Haji Hakeem Khan Chairman - Mr. Alamgir Khan - Mr. Aurangzeb Khan - Mr. Mehtab Khan - Mr. Gul Meer Khan - Mr. Waseem Akram - Mr. Arif Khan - Mr. Asghar Khan - Mr. Iqbal Hussain	- 0312-5749000 - 0302-8171648 - 0314-9056098 - 0312-5749000 - 0315-9357505 - 0315-9357505 - 0310-9347318 - 0310-9347318 - 0315-0159121

23.	September 23, 2019	Chirat		8	- Mr. Yousaf Khan s/o Wazir Zada - Mr. Jandol Zahid s/o Pasham Khan - Mr. Shah Wazir s/o Hadim Shah - Mr. Waris s/o Amir Sb - Mr. Kishwar s/o Ghazan Khan - Mr. Muhammad Faqir s/o Meer Muhammad - Mr. Abdul Manan s/o M. Ishaq - Mr. Amir Rehman s/o Musafar Shah	- 0312-9233597 - 0314-9282893 - -- - -- - -- - -- - 0314-9280602 - 0349-7564394
24.	September 23, 2019	Palair		7	- Mr. Ziarat Gul s/o Khushdad Khan - Mr. Muhammad Yousaf s/o Pasham - Mr. Hujat Khan s/o Mohib Ullah - Mr. Danish Khan s/o Said Badshah - Mr. Ameer Said s/o Haji Sakhe - Mr. Shahzad Gul s/o Ameer Shah - Mr. Parot Khan s/o Amin Khan	- 0313-0011566 - 0310-9023411 - 0348-5383405 - 0305-9397477
25.	September 24, 2019	Sher Kali	Land owners	8	- Mr. Sahib ullah s/o Karim ullah - Mr. Muhammad Din - Mr. Musa Khan s/o Kot Khan - Mr. Ghafor Ali s/o Musafer Khan - Mr. Hazrat Muhammad s/o Mir Salam - Mr. Muhammad Sabir s/o Ghulam Rasool - Mr. Nasir Ullah s/o Sharif Ullah - Mr. Arif Ullah s/o Gharib Ullah	- 0349-4025664 - - 0335-7000163 - - - -- - 0314-9704106 - 0314-9734499 - 0314-9716138
26.	September 24, 2019	Sher Kali		4	- Mr. Yousaf Ali s/o Musafer Shah - Mr. Fazal Akbar s/o Musafer Shah - Mr. Aziz Rehman s/o Gul Faqir - Mr. Muhammad Kamin s/o Ahmad	- 0314-2907744 - -- - 0313-9323400 - 0314-5594268
27.	September 25, 2019	Rashnail	Dp	1	- Mr. Muhammah Rehman s/o Wajat Khan	- 0314-9701880
28.	September 25, 2019	Mayai	DPs	3	- Mr. Habib Khan s/o Kabul Khan - Mr. Akhtar Hussain s/o Habib Khan - Mr. Shahi Malik -	- 0314-4571624 - 0314-4077877 -
29.	September 25, 2019	Kannai Village	DP	1	- Mr. Muhammah Hussain s/o Kashar Khan -	- 0348-9590482
30.	September 25, 2019	Kannai Village	DPs	2	- Mr.Aezool s/o Darwish - Mr. Muhammah Yousaf s/o Hassan -	-
31.	September 26,	Cheer	PAPs/ Local	2	- Mr.Khanzada s/o Jamal	- 0314-9406180

	2019		Community		Khan - Mr. Hyat Khan s/o Meher Shah -	- 0313-9373121
32.	September 26, 2019	Chi rat	PAPs/ Local Community	3	- Mr.Faqir Jan s/o Ajum Khan - Mr. I lyas s/o Ajum Khan - Mr. Zai Khan s/o Gul Zada	0311-9145308 0341-4242104
33.	September 26, 2019	Kannai	DPs	2	- Mr.Bahadur s/o Swal Faqir - Mr. Taj Momand s/o Swal Faqir	0315-2301555 0313-3037888
34.	September 26, 2019	Paleer	Dp	4	- Mr. Bahadar Sher s/o Shah Zarin - Mr. Hwsat Khan s/o Mehbob Shah - Mr. Ziyarat Gul s/o Hujdad Khan - Mr. Afzal s/o M. Issa	0315-1141877 0348-5382405 0313-0011566 0346-2756115
35.	September 26, 2019	Cheer	Dp	6	- Mr.Nasir s/o Shareet - Mr. Noor s/o Sher - Mr. Karim s/o Mir - Mr. Sahib s/o Karim - Mr. Najeeb s/o Saeed - Mr. Shahideen s/o Salamat	0314-9734499 0315-9083218 0315-9670107 0349-4025664 0314-9282892 0311-7598444
36.	September 28, 2019	Palair	Other (Contractor)	6	- Mr. Muhammad Musa Khan chairman - Mr. Aslam Khan - Mr. Faramooz Khan - Mr. Muhammad Ali - Mr. Muhammad Rukhmani - Mr. Afzal Khan s/o Muhammad Eissa - Mr.	- -- - 0313-9473399 - 0313-9696620 - -- - 0314-9133747 - 0313-9373011
37.	September 29, 2019	Rashnail		11	- Mr. Haji Nawab s/o Masoom Khan - Mr. Afsar khan s/o Baleenas - Mr. Muhammad Jan s/o Baleenas - Mr. Mujeeb Ur Rehman s/o Hikmat Khan - Mr. Habib ur Rehman - Mr. Muhammad Nawaz s/o Haji Nawaz - Mr. Atta ur Rehman s/o Ajmal Khan - Ihsan ul Haq s/o Habib ur Rehman	- 0312-9551342 - -- - 0314-5594282 - 0315-9677914 - 0311-1954808 - 0312-9701342 - -- - 0315-8116788 - 0314-9076778 - 0312-7181754 - 0314-5594268
38.	September 6, 2019	Kas Karuna	DP	3	- Ms. Jan zeba d/o Said Omar - Ms. Zaida d/o Shah Nawab - Ms. Shereen War d/o Muheeb-ullah	03(2-7693540)
39.	September 6, 2019	Char at	DP	4	- Ms. Nasreen d/o Wazir Zada - Ms. Shahi lal d/o Kameen khan - Ms. Pathani d/o Peer Gul - Ms. Shahida d/o Jan Muhammad	0314-5430840 0314-9150067

40.	September 6, 2019	Rash nail	DP	6	- Ms. Hayat Bibi d/o Omar faqeer - Ms. Shakeela d/o Haji Nawab - Ms. Zaida d/o Man Faheer - Ms. Zartash d/o Abdul Kareem - Ms. Bibi Hajra d/o Abdul Malik - Ms. Taj Mali d/o Madder Khan	0314-5190017
41.	September 6, 2019	Rash nail	DP	3	▪Ms. Fatima d/o Mera Jan ▪Ms. Razai d/o M.Yaqoob ▪Ms. Akhta Mena d/o M.Yaqoob	0314-4706855 0316-5454878 0314-9701880
42.	September 5, 2019	Kannai	Local community	7	▪Ms. Shaireen d/o Bahadar ▪Ms. Razia d/o Bawar Khan ▪Ms. Gulab Bibi d/o Bakht Munir ▪Ms. Shabnum d/o Kashar Khan ▪Ms. Marid D/O Atebar Khan ▪Ms. Sana d/o M.Hussain ▪Ms. Rehana d/o M.Nawaz	
43.	September 5, 2019	Kannai	Local community	7	- Ms. Bibi Hajra d/o Kashmir - Ms. Huns-Zeba d/o Mesa - Ms. Bakta bano d/o Welayat Khan - Ms. shireen bahar d/o Bahadar - Ms. Huro-omza d/o Sher Nawaz - Ms. Taj Mehal d/o Kashair Khan - Ms. Benazir d/o Abdul Qayyam	
44.	September 5, 2019	Kannai	Local community	5	- Ms. Bachy lal d/o Kashar Khan - Ms. Tasleem d/o Hayat-Ulla - Ms. Razia d/o Wazir Gul - Ms.. Yasmeen d/o Kashmir Khan - Ms. Israt d/o Atebar Khan	

Annex 7: Consultation Meetings - Photographs

Consultation at Palair village kalam on September 1, 2019

World bank visit at Rashnail village Kalam on September 4, 2019

Consultation at Rashnail village Kalam on September 16, 2019

Consultation at Kanai village kalam on September 18, 2019

Consultation at Sher kally village Kalam on September 26, 2019

Consultation at Mahai viialge Kalam on September 27, 2019

	
Consultation at Sher kally village Kalam on September 27, 2019	Consultation at Palair village Kalam on October 1, 2019
	
Stakeholder Consultation at Peshawar on Oct 21, 2019	Stakeholder Consultation at Peshawar on Oct 21, 2019
	
Consultation at Ashurun powerhouse kalam on Oct 18,2019	Gander consultation at Kalam on Oct 26, 2019

	
ESIA and RAP Disclosure at Kalam on November 7, 2019	ESIA and RAP Disclosure at Kalam on November 7, 2019
	
Meeting with District Officer Fisheries, Mingora (Oct 2019)	meeting with Divisional Officer - Forest, Mingora
	
meeting with Divisional Officer - Wildlife, Mingora (Oct 2019)	

Annex 8: Stakeholder Engagement Plan

1. Introduction/Project Description

The Government of Khyber Pakhtunkhwa (GoKP) through the Pakhtunkhwa Energy Development Organization (PEDO) is planning to develop the Gabral – Kalam Hydropower project (The Project) under the Khyber Pakhtunkhwa Hydropower and Renewable Energy Development Program (KPHREDP), with financial assistance from the World Bank (WB). This run-of-the-river project will be located on Gabral River, a tributary of Swat River, in between Kanai and Kalam villages of Swat. GKHPP will have an installed capacity of 88 megawatts (MW) and an annual energy generation of about 339-gigawatt hours (GWh).

The key elements of the project will include weir and its associated infrastructure (reservoir area, weir/dam and associated work, connecting channel, sand trap, tunnel inlet, and associated work, rerouting of existing road, cofferdam and working area), powerhouse (employer's facilities/colony area, road from colony to powerhouse, powerhouse and associated structures, road from powerhouse surge shaft, surge shaft area, access tunnel portal, disposal areas, construction camps) and transmission line (220kV Transmission Line (TL) having 12 towers over a length of 2.7 km and Right of Way (RoW) width of 30m). The total project cost for GKHPP is 230.15 million USD and the project implementation timeline is six (6) years.

This Stakeholder Engagement Plan[38] (SEP) has been prepared as a part of the Environment and Social Impact Assessment process for the Gabral Kalam Hydropower Project (GKH). This SEP has been prepared in accordance with the legal framework provided in Article 19 A of the constitution of Pakistan, Government of Khyber Pakhtunkhwa Right to Information Act 2013, World Bank Operational Policies (OPs) on the environment and social safeguards and international best practices.

The SEP includes: (i) the identification of stakeholders for the Project, (ii) analysis of relationships of the stakeholders with the Project, (iii) details of consultation methodologies, (iv) activities carried out to-date and those planned for the future stages of the Project, (v) details of the process for managing stakeholders' concerns and grievances, and explains how the stakeholder engagement process will be recorded, monitored, evaluated and reported.

2. Brief Summary of Previous Stakeholder Engagement Activities

Extensive consultation and information dissemination (also including women) were carried out during ESIA and RAP preparation and disclosure. A total of 58 consultation meetings, with 439 participants (373 male and 66 female), were conducted. These include 48 local village meetings, one provincial-level workshop at Peshawar on October 21, 2019, one disclosure workshop at Kalam on November 7, 2019, to share the draft ESIA and RAP, in which the local communities, including affected communities, district-level government agencies (including representatives forest and wildlife departments, union councilors, and district administration) participated. Feedback from the consultations was overall supportive of primary and secondary stakeholders of the Project, but a request was made to enhance the benefits of

[38] Stakeholder engagement is the process whereby those who are the program proponents/developers communicate and consult with those who are directly and indirectly affected by the program and those who may have an interest in it or have the ability to influence the Project, either positively or negatively. An effective stakeholder engagement helps to develop constructive and productive relationship with the stakeholders. Listening to stakeholder concerns and feedback is a valuable source of information that can be used to improve project design and outcomes, and helps to identify and monitor trends, challenges and perceptions over time with specific groups of stakeholders. It also helps to address the concerns of the stakeholders in a timely fashion.

the project to the local population through the provision of social services. The general concerns of the local community (also including women) focused minimization of impacts on private land, payment of compensation based on the market rates, forms of payment, employment in the construction activities, and adequate mechanism for grievance redress.

The ESIA and RAP along with their Executive summaries (including translations) have been disclosed on the PEDO and World Bank's external website.

3. National/Provincial Legal Framework for Stakeholder Engagement

Article 19 A Right to Information states that **Every citizen shall have the right to have access to information in all matters of public importance subject to regulation and reasonable restrictions imposed by law**. The Khyber Pakhtunkhwa (KP) Right to Information Act 2013 ensures transparency and accountability through a mechanism whereby citizens could seek information of public importance from public bodies as enshrined in Article 19-A of the constitution of Pakistan.

To oversee the enforcement of the law, the KP Right to Information (RTI) Commission was established in 2013 as an independent statutory body headed by KP Chief Information Commissioner, RTI Commission and two Commissioners with the primary function to receive and decide complaints of citizens who are denied information by the public bodies. The commission also has the responsibility to create awareness about the law and taking all other measures for the effective implementation of the law. The primary responsibility of the Commission is to ensure that the request of the citizens is processed in time by the public bodies. If the citizens file any complaint against a public body, the Commission after hearing the citizen and the public body, takes a decision.

In order to more effectively manage risks and impacts of projects, the PMO and all parties involved in project implementation are required to engage Project Affected People through:

- disclosure of information;
- meaningful Consultation and
- development and implementation of systems for responding to complaints and grievances commensurate to the level of social risk. The nature, frequency, and level of effort of this engagement will be commensurate with the project's risks and impacts and the project's phase of development".

4. Stakeholder Identification and Analysis

The three main categories of stakeholders are outlined below:

4.1 Affected Parties

Project Affected Persons (PAPs), who are directly affected by land acquisition live primarily in two villages. While the population of the nearby six villages is indirectly affected due to their proximity to the construction sites, and along the roads that will be used to supply goods and services to the project sites for construction and operations. The impacts of the private acquisition of agriculture land will cause environmental, social transformation in the Kanai, Ashuran and Palir villages. The PAPs are defined as a group of people who are directly or indirectly being affected by the project; both positively and negatively. The primary project affected persons are those who will be directly affected due to loss of arable lands, crops, fruit and wood trees, structures, income and livelihoods due to the construction of GKH.

4.2 Other Interested Parties

There are broader stakeholders who may be interested in the project because it indirectly affects their work or has some bearing on it. These include the following:

- Responsible Government Officials/Departments
- Planning Commission of Pakistan
- Planning and Development Department, Government of KP
- Energy and Power Department
- KP Environment Protection Agency
- Irrigation Department
- Office of the District Administration (Deputy Commissioner)
- Office of the Tehsil Administration (Assistant Commissioner, Bahrain, Swat)
- Forest, Environment and Wildlife Department
- Fisheries Department
- Pakistan Meteorological Department
- Communication and Works Department
- KP Archeological Department
- National Transmission and Dispatch Company
- Peshawar Electric Supply Corporation
- Project Financier (World Bank)
- Project Personnel
- Environmental and Social Experts
- NGO's/Civil Society Organizations
- Environment Conservation Organizations
- Academia
- Electronic and Print media
- Interest Groups

Project implementing Parties

There will be several parties that will assist PEDO in project implementation, and include:

- Project Implementation Consultants
- Project Planning and Designing Consultants
- Contractor
- Sub-Contractors
- Service Providers

- Suppliers
- Traders
- Individual Consultants
- Other consultancy firms

Provincial Regulatory Authorities

The following are the major relevant regulatory authorities to the project:

Board of Revenue: The Board of Revenue is responsible for acquiring land for the public purpose as per the procedures prescribed for the acquisition of private land in the Land Acquisition Act 1894 and Rules as well as the instructions issued by the Board of Revenue (BOR), Government of KP

Revenue Department: The Revenue Department responsible for providing information on land acquisition related matters to the Board of Revenue, GoKP.

KP Environment Protection Agency: In accordance with the requirements of the Environmental Protection Act (EPA) 1997 (Amended 2012), public participation is an essential legislative requirement for environmental authorization.

Local/District Government Swat

Pakistan is divided into provinces. The provinces are autonomous administrative units that are further divided into divisions and then districts, tehsils (sub-districts) and union councils, respectively. The Project area falls under district Swat, Tehsil Bahrain and Union council Ahsuran. A number of government agencies will be involved in project-related activities.

District-based agencies have jurisdiction over land acquisition and compensation through the application of the Land Acquisition Act 1894 and Rules, orders and notifications. Land acquisition functions rest with the Board of Revenue represented at District level by the District Collector (Deputy Commissioner) and Land Acquisition Collector (LAC). The LAC works under the powers of District collector/Deputy Commissioner as per LAA 1894. Other staff members of the Revenue Department, most notably Kanungo (Kanungo or Girdawar/expounder of law or Supervisor of Patwaris), Patwari (an official who keeps record regarding ownership of land/land record keeper) and Survey Khlasi (land surveyor) carry out specific roles such as land surveys, titles identification and verification of the ownership. Functions pertaining to the assessment of compensation of non-land assets (structures, crops, trees) lie with other line-agencies and their District offices support LAC in the valuation process.

Other Government Departments

The LAC requests the government departments to carry out detailed measurement surveys of (i) structures; (ii) crops; (iii) fruit trees; (iv) wood trees. The assessment of the affected structures pertains to the Works and Communication Department; the assessment of affected wood trees pertains to the Forest Department and the assessment of crops and fruit trees pertains to the Agriculture Department. The LAC will be responsible for payment of the compensation to the affected titleholders and registered sharecroppers, and cultivators of village common/gov't lands.

Renewable energy investors and producers

The renewable energy investors and producers involve:

- Public sector renewable energy organizations/institutions
- Investment banks

- Renewable energy investors
- Self-producers
- Independent producers
- Community-led micro-hydro power plant operators and investors, led by private sector companies/NGOs/community-based organizations/non-profit organizations

Public Utility/Service Agencies

A number of public utilities and services will be affected that need relocation and restoration soon after start of the project. The transmission line is also required from the powerhouse to the Matiltan transmission line. The details of relevant agencies that will be responsible for the restoration of the affected services/utilities are:

- Peshawar Electric Supply Company
- Communication and Works Department

Civil Society Organizations

The Civil Society Organizations (CSOs) role is to advocate for the sustainable management of the environment and social performance of the project, including improving people's lives and conserving natural resources. The key CSOs are:

- Sarhad Rural Support Program
- Kalam Development Foundation

Academic Institutions

The academic institutions help in educating citizens for development, offer insights on urgent challenges, reduce and manage the environmental and social footprints of the project operations. They provide sound advice and exchange views for the effective implementation of environment and social instruments. The academic institutions that show interest in the project is University of Swat having following branches in the district:

- Women Campus University of Swat
- Kanju Township Sector D Campus
- Kanju Town PTCL Campus
- Kanju Town Sector C Campus 1
- Kanju Town Section C Campus 2
- Sangota Campus

Print & Electronic Media

Printed, electronic and social media are the important stakeholders; they deliver messages to a wider audience within and beyond Project affected areas. The Project and the stakeholders who have an interest and positive or negative influence toward the Project may use the media to convey their messages and aspirations. Any information related to the Project might interest them and help in developing a positive image of the Project.

Financier

The World Bank is a multilateral development bank with a mission to improve social and economic outcomes in developing and poor countries by investing in sustainable infrastructure and other productive sectors. The Bank thus is working to better connect people, services and markets that, over time, will impact the lives of billions and build a better future. The WB environment and social Operational Policies are applicable to this project that includes:

- OP 4.01 Environmental Assessment;
- OP 4.11 Physical Cultural Heritage;
- OP 4.12 Involuntary Resettlement

4.3 Disadvantaged and Vulnerable Groups

The disadvantaged and vulnerable groups of affected people include the poor and marginalized, which include small landholders of arable land, agriculture tenants and affected households below the poverty line. The impacts on their social and economic conditions revealed that additional measures are required in terms of resettlement and rehabilitation assistance to mitigate impacts on their livelihoods.

5. Stakeholder Engagement Plan

5.1 Purpose and Timings of the Stakeholder Engagement Plan

The approach for the stakeholder engagement analysis will be underscored by three elements: belief in the primacy of qualitative data, commitment to participatory methods and flexible responsive methods. An inclusive and participatory approach will be followed, taking the main characteristics and interests of the stakeholders into account, as well as the different levels of engagement and consultation that will be appropriate for different stakeholders.

In general, engagement is directly proportional to the impact and influence of a stakeholder. The stakeholder analysis is used to classify stakeholders based on their level of interest and influence related to the project. Results of the analysis are used to recommend the level of engagement as under:

(i) High Interest and High Influence (to be engaged): These stakeholders are to be informed and engaged in the form of a formal interaction on the environmental and social aspects of the project. If they raise any concerns, they should be actively involved in identifying mitigation measures and developing subsequent plans. The aim of their engagement is to obtain their acceptance of Project activities and management plans. They are engaged at the stage of ESIA studies and in key decisions in project planning, implementation and operational phases.

(ii) High Interest and Low Influence (monitoring of their interest): These stakeholders have limited ability to directly influence the project, but have a keen interest in one or more aspects of the project. The recommendation is that the views of these stakeholders be tracked and monitored through communications.

(iii) Low Interest and High Influence (leverage): These stakeholders may not seriously be concerned about the environmental and social aspects of the project, but they are critical about project success. They are recommended to be engaged in active communication on key project activities throughout the project lifecycle. The approval of these stakeholders will be critical for the Project; and

(iv) Low Interest and Low Influence (to be informed): These stakeholders should be provided information on key Project activities through press releases, briefings, and other modes of communications during the project lifecycle.

Table 1. Preliminary Classification of Stakeholders

Engage	BOR/Revenue Department; Affected Persons, general public residing along the project area; public representatives; print and electronic media (provincial and federal), World Bank; Project Steering Committee
Leverage	Academia
Monitor	CSOs, Environment Protection Agency; Labor Department
Inform	Relevant Gov't departments

This SEP will be a living document and will need to be updated and refined throughout the lifecycle of the Project. During this process, the focus and scope of the SEP will be updated to ensure that PEDO addresses external changes and adheres to its strategy (which itself may change over time). The key life-cycle phases to be considered when implementing stakeholder engagement are briefly discussed below.

Engagement Phases

Stakeholder engagement throughout the project cycle safeguards the risks and impacts and mitigates them as soon as they are identified. This is to avoid or minimize potential adverse impacts, cost-effective project design, smooth running of project activities during the planning/designing, implementation and operational phases of the Project. Thereby, stakeholder engagement is an ongoing process throughout the project lifecycle to guarantee that the interests of the affected people and other stakeholders are safeguarded. The stakeholder engagement phases include:

- Engagement during ESIA and RAP Baseline
- Engagement during ESIA and RAP Disclosure
- Engagement during ESMP and RAP Implementation
- Engagement during the design and implementation of the Social Development Plan (SDP)
- On-going engagement during the operational phase

Engagement during Implementation of ESMP, RAP and SDP

A continued process of stakeholder engagement with PAPs and other stakeholders will be followed to ensure transparency in the implementation of ESMP, RAP and SDP and to keep the PAPs and other stakeholders informed. SDP will be designed and implemented with the full engagement of the stakeholders. The feedback would be received and incorporated at various stages of the Project implementation. It will provide a good measure to improve the social acceptability of the project and ensure the effective participation of the stakeholders in project implementation, especially to the PAPs in the process of RAP implementation and communities in case of SDP. Stakeholder engagement will assist in obtaining cooperation from informed PAPs and other stakeholders, to avoid cost and time in dealing with complaints and grievances. As per the requirements of the WB OPs, plans for the stakeholder engagement/consultation and participation during the implementation of ESMP and RAP are delineated in the ESIA and RAP. The PMO will continue stakeholder consultation process by following WB OPs (disclosure and exchange of information) by taking the following steps:

- The PEDO through the male and female Environment and Social Staff (ESS) of PMO, PIC and the Contractor will keep a close liaison with the stakeholders including male and female PAPs;

- Address stakeholder concerns, complaints and grievances, and keep their record;
- The Project will engage a couple of female social staff to ensure on-going consultations with women and address their concerns and to benefit the women and girls from the Project equally. During implementation, the PEDO and PMO will take into account the women and young girl's views and priorities, as a result of planned consultations;
- Organize periodic meetings with the stakeholders and appraise them about the implementation progress of the Project including implementation of environment and social instruments (ESMP/RAP/SDP);
- Detail and outcome of all stakeholder engagement activities will be included in monthly, quarterly, bi-annual and annual internal monitoring reports of PIC; and
- Disclose all monitoring reports in the same manner as that of the approved ESIA and RAP at PEDO and WB websites and to the PAPs and other stakeholders through appropriate means of communication.

Engagement during the Operational Phase

The PEDO and WB websites and other localized means of communication will be used for ongoing information dissemination to literate and illiterate via face-to-face meetings and consultations with the affected persons while Grievance Redressal Mechanism will be used for registration and redressal of complaints and grievances of the stakeholders, general public and PAPs.

5.2 Proposed Strategy for Information Disclosure

Multiple (at least four) consultative half-day workshops will be held one in Peshawar, Kalam each and two (2) in the project area where a representative sample of directly affected and other interested parties along with vulnerable groups will be invited. These platforms will be used to gather input on the project design/implementation and would also serve as information disclosure forums.

The SEP has also been disclosed on World Bank and PEDO website as a part of ESIA.

5.3 Proposed Strategy for Consultation

Affected Persons Committees (APCs)

In order to keep/formalize the process of communication, coordination and consultations with the PAPs, and make fair and timely compensation, and resettlement and rehabilitation assistance; two male and two females Affected Person Committees (APCs) are formed. The female committees are formed separately due to cultural sensitivities. These committees constitute representatives of all categories of PAPs that are titleholders of affected agriculture land, and their sharecroppers, tenants, and permanent and seasonal agriculture laborers. The APCs members are democratically elected to voluntarily perform the role. The APCs aim to disseminate the Project information to PAPs. These committees will act as a means of communication between the Project planning, executing and implementing parties and the PAPs. The APCs may be re-elected every six months. Each committee is comprised of 5 to seven (7) members, formed by the PAPs with the assistance of Environment and Social (ES) consultants, having members of 3 villages of the weir and powerhouse sites. Each APC comprises a president, secretary and 3-5 members nominated by various categories of PAPs of three villages.

- The APCs act as forum/platform for: a) disseminate project related information to affected population; b) facilitate communication and consultation mechanism by maintaining an on-going interaction between the PMO, PIC and Contractor ES staff, LAC and the PAPs; and c) identify

problems and undertake remedial/corrective actions in coordination and collaboration with PMO, PIC, LAC and relevant officials of other agencies before they turn into grievances;

- For the APCs to be effective, it would be important for elected members to participate in training capacity building workshops to effectively represent PAPs and perform APCs functions;
- Committee members would hold meetings with the PAPs on the project-related land acquisition and resettlement, and other environment and social issues;
- The venue for APC meetings will rotate amongst villages and affected households of using a pre-agreed schedule;
- The meetings will be held a minimum twice a month, however, during the process of ESMP and RAP implementation, APCs will hold more frequent meetings as and when required; and
- APCs will keep a record of attendance of the meetings in attendance registers, and provide access to PAPs to the minutes of the meetings, and will also provide copies on request.

Village Information Centers (VICs)

In order to ensure effective consultations and disclosure of information during the preparation of ESIA and RAP, the Village Information Centers (VICs) have been established in village Kanai and Ashuran. The Project stakeholders, particularly PEDO, PMO, PIC, the Contractor, sub-contractors and service providers will use the VICs to disseminate and disclose information related to the PAPs, project construction activities or any other issues.

Notice Boards

Notice boards will be provided at each of the VICs to inform literate audiences and can be used by PMO and other project implementing parties to inform PAPs about project activities in Urdu. The locations for the notice boards have been selected in consultation with affected persons. These notice boards will be regularly updated with project related information and to inform community members about employment opportunities in the Project and impact management measures including the updates on grievances. The PMO will fix grievance/suggestion boxes, close to the notice boards and place them at other appropriate locations in affected villages, to be selected in consultation with PAPs.

Engagement Activities with Women

Several cultural and economic obstacles exist for women's participation in public consultations in the affected villages; this is compounded by constraints due to limited interaction. The engagement activities were conducted with women separately during the ESIA and RAP preparation process, and will also be conducted separately with women during the Project implementation by ES staff of PMO, PIC and the contractor as well as during the operational phase by PEDO staff. These included females of AHs, general public and customers. The redressal actions against the concerns and issues raised by women are incorporated in the ESPM and RAP, and will also be addressed adequately at implementation and operational phases of the project.

Engagement with Vulnerable Groups

Special engagement efforts may be required to ensure that vulnerable stakeholders are reached and engaged meaningfully. Special measures to be taken by PEDO, PMO, PIC and other parties involved in Project implementation include home visits to their households to ensure that they receive resettlement and rehabilitation assistance in a timely and transparent manner, have access to income-generating interventions under livelihood restoration and improvement plan and project-related jobs at construction and operation phase of the Project and transportation to attend consultation meetings.

Stakeholder Consultation Methods

There are a variety of engagement techniques used to build relationships with stakeholders, gather information from them, consult them, and disseminate project information to them.

When selecting an appropriate consultation technique, culturally appropriate consultation methods, and the purpose for engaging with a stakeholder group should be considered. The technique which will be used are:

Table 2. Methods of Stakeholder Engagement

Engagement Technique	Appropriate Application of the Technique
Correspondences (Phone, emails)	▪ Distribute information to officials of government, district and tehsil governments, and parties involved in project implementation, financier, NGOs ▪ Invite stakeholders to meetings and follow-up
One-on-one meetings	▪ Enable stakeholder to speak freely about sensitive issues to seek views and opinions ▪ Build personal relationships ▪ Record meetings
Formal meetings	▪ Present the Project information to a group of stakeholders to allow the group to comment/provide opinions and views ▪ Build an impersonal relationship with high-level stakeholders ▪ Disseminate technical information ▪ Record discussions
Public meetings	▪ Present Project information to a large group of stakeholders, especially communities to allow the group to provide their views and opinions ▪ Build a relationship with the communities, especially those affected by the Project ▪ Distribute non-technical information ▪ Facilitate meetings with presentations, PowerPoint, posters, etc. ▪ Record discussions, comments, questions.
School Awareness Programs	▪ Awareness programs to school children on construction related health and safety aspects ▪ Raising interest to school children on the science and technology by explaining the hydropower development in the project area
Focus group meetings	▪ Present Project information to a group of stakeholders to allow them to provide their views on targeted information ▪ Build relationships with communities residing within the project AOI ▪ Record responses
PEDO/Project website	▪ Present project information and progress updates; ▪ Disclose ESIAs, ESMPs RAPs and other relevant project documents
Direct communication with affected persons, their committees and display at village information centres	▪ Share information on schedule and locations for distribution of compensation and resettlement and rehabilitation assistance ▪ Dissemination of notices for the vacation of affected land ▪ Share information about civil works schedule, the timing of land clearance and agree on removing assets from affected land and relocation of assets
Road signs	▪ Share information on project activities ▪ Reminders of potential impacts
Project leaflet	Brief project information to provide regular update Site-specific project information

Table 3. Proposed [39]Plan for Stakeholder Activities

Information to be Disclosed	Target Stakeholders	Method Proposed	Timetable/Locations/Dates	Proposed Location of Engagement
Information Dissemination, addressal of outstanding issues, complaints or grievance, resettlement planning and RAP/ESMP/SDP implementation	• Project Affected Households (PAHs) • Vulnerable Groups • Communities Leaders/Jirgas	Meetings	As and when required during updating of ESIA/ESMP/ESI/RAP, environment and social impact assessment of unanticipated additional impacts. Weekly during the planning and active implementation of RAP and ESIA/ESMP	Village information Centers (VICs) or locations agreed in consultation with PAHs
	• Project Affected Households (PAHs) • Vulnerable Groups	Meetings	Weekly during the planning and active implementation of RAP and ESIA/ESMP	Village information Centers (VICs) or locations agreed in consultation with PAHs
	• Local Communities • Leaders/Jirgas	Public meetings	Monthly	Locations identified in consultation with the stakeholders
	• Public representatives • Officials of relevant gov't departments	Meetings	As and when required during construction and RAP/ESIA/ESMP implementation	Respective Offices
	• PAHs • Local Communities in AOI Vulnerable Groups • Vulnerable Groups • Local Community Leaders/ jirgas • Local NGOs	Open public meetings	Annual through the operation and closure phase	Community center in powerhouse colony or in locations identified in consultation with the stakeholders
	• Contractor, Sub Contractors and service providers	As part of the GRM process	As and when required	As required in GRM
	• District Administration • EPA • Other relevant departments	Meetings with Officials	As and when required through the construction, operation and closure phase	Administration Offices

[39] This plan is for guidance only, the stakeholder engagement activities will be conducted extensively as and when required

Information to be Disclosed	Target Stakeholders	Method Proposed	Timetable/Locations/Dates	Proposed Location of Engagement
	• PAHs • Local Communities • Vulnerable Groups • Community Leaders/jirgas	Focus Group Discussions	At least six-monthly through the operation and closure phase	Locations identified in consultation with the stakeholders
	• PAHs • Affected communities	Questionnaires	At least 6-monthly through the construction phase and annual during the closure phase	Locations identified in consultation with the stakeholders
	• PAHs • Affected communities • All other stakeholders	As part of the GRM process	Regularly through the construction, operation and closure phase	As per GRM provisions
Training on occupational/community health and safety	• Contractors and Sub Contractors	Tool Box talks	Daily before the start of work	At construction sites
	• Contractors and Sub Contractors	Training	Monthly training programs on construction health and safety	At the project/construction campsite
	• Contractors and Sub Contractors	Training	Monthly training programs on community health and safety (including topics on code of conduct, GBV, SEA, etc.)	At the project/construction campsite
	• Hygiene and sanitation promotion	Posters	Awareness program to workers on personal hygiene and sanitation	At construction campsites
	• Code of conduct	Posters	Display of code of conduct in local language	At construction campsites
	• Emergency response	Drills	Monthly drills on fire safety and emergency response measures	At construction campsites
Monitoring of implementation of the RAP, SDP and ESIA/ESMP	• Project Affected households • Local Communities • Vulnerable Groups • Local Community Leaders/jirgas • institutional stakeholders	Focus Group Discussions	At least twice a month formally during the construction phase	At Village Information Centers (VICs) / PMO, office/ district and tehsil government offices/locations identified in consultation with the stakeholders
		Interviews with key informants	At least monthly; through the construction phase	
		Questionnaires	At least annually through the construction phase by TPMA or as and when required	
		As part of the GRM process	Regularly through the construction phase	As per GRM provisions
Monitoring of the project activities and regular engagement	• Project Affected households • Local	Open public meetings	Monthly and Quarterly	VICs or locations identified in consultation with the stakeholders
		Focus Group Discussions	At least annually through the construction phase	

Information to be Disclosed	Target Stakeholders	Method Proposed	Timetable/Locations/Dates	Proposed Location of Engagement
	Communities • Vulnerable Groups • Local Community Leaders/jirgas	As part of the GRM process	As and when required through the construction phase	As per GRM provisions
Project Status Update	• District Administration • Regulatory Authorities • Concerned departments	Meetings with Officials	As and when required through the construction, closure and operation phase	Administration/ Offices

6. Grievance Redressal Mechanism

A grievance redressal mechanism (GRM) has been developed. The aim of the grievance mechanism is to achieve a mutually agreed resolution of grievances raised by such stakeholders. The grievance mechanism is described in section 9.11 of the ESIA main report and Section 9 of the Resettlement Action Plan in more detail.

Resources and Responsibilities for Implementing Stakeholder Engagement Activities

7.1 Resources

An estimated cost of PKR 15 million/USD 0.1 million has been allocated in the budget of RAP of GKHPP for the consultations and GRM. A part of cost for these activities will also be contributed from administrative costs under the budget.

PMO will be responsible to hire and retain environment and social staff (ESS) as per details provided in Section 9 of ESIA and Section 10 of RAP. The ESS of PMO will be responsible for overseeing and coordinating all activities associated with stakeholder engagement in collaboration with ESS of CSC/PIC and the Contractor(s).

7.2 Management Functions and Responsibilities

The roles and responsibilities of stakeholder engagement activities have been described in this section as per management functions of PMO. PEDO may adapt the structures of environment and social staff (ESS) of PMO during its implementation. The head of PMO, Project Directors and ESS of PMO, PIC and Contractor(s) will be responsible to successfully implement the SEP:

- The head of PMO (Program Director) will be overall responsible for implementation of SEP;
- The Director Environment of PMO will be responsible for overseeing and coordinating all activities associated with stakeholder engagement in collaboration with Director Social Safeguards;
- The Deputy Directors ES of PMO will be responsible for implementing the stakeholder engagement activities in coordination and collaboration with PIC and Contractors' ESS including maintaining database and documents;
- Project Director of PMO will be responsible to manage all activities related to logistics which relates to the interaction with other departments or projects; and
- The Admin and Finance officials of PMO will be responsible for the timely and adequate provision of budget as per allocations and other related support as and when required.

Role of Director Environment and Director Social Safeguards

The Director Environment and Director Social Safeguards will oversee stakeholder engagement activities. Furthermore, they need to ensure that all stakeholder engagement aspects are a permanent item on all high-level management agendas, within PMO, and that all actions arising from management decisions are implemented. Responsibilities of the Directors include the following:

- Implement and monitor all stakeholder engagement strategies/plans for the Projects/ESIAs/RAP/SDP;
- Oversee all stakeholder engagement related activities for the Project;
- Manage the GRM;
- Act as mediator between PMO and stakeholders;
- Liaise with other Project Director(s) s to ensure that stakeholder engagement requirements/protocols are understood; and
- Proactively identify stakeholders, project risks and opportunities and inform the Program Director and Project Director(s) to ensure that the necessary planning can be done to either mitigate risk or exploit opportunities.

The Directors will play a critical role as internal change agent for social and stakeholder-related matters in PMO. This becomes important if social and environment and stakeholder risks identified need to be escalated for higher-level decision-making to identify a resolution. The Directors need to remain actively involved with the SDP, LRIP, land acquisition ad resettlement planning and implementation, ESIA and ESMP implementation in order to identify potential risks or opportunities and ensure that the needed administrative support is provided. Moreover, grievances submitted as part the ESIA/ESMP/RAP/SDP/LRIP planning and implementation are addressed under the GRM timely and efficiently.

Administrative Support

The stakeholder engagement activities will influence other departments/entities or require their inputs. The Directors will ensure the various directors are included or kept informed on the stakeholder engagement process. Decisions taken by directors might have a direct or indirect impact on affected people or local communities which would need to be communicated at the appropriate time. Anticipated stakeholder engagement roles for the various decision-makers are outlined below:

- **Program Director and Project Directors:** The Program Director and Project Directors will be responsible to sustain relationships and communicate with Government and other stakeholders. These engagements will be required throughout the Program and respective projects life cycles and decisions taken as a result of these engagements could potentially impact PMO relationships with communities e.g. agreements on compensation of land and other immovable properties.
- **Director Procurement/Contract Management/Director HR:** Opportunities for contractor/employment are a key concern for community members. The experience of hydropower development in Pakistan shows that local affected households and communities residing in the project AOI are very sensitive about appointing people from local villages opposed to villages located further away from the project site. This requires that a defined process of employment be developed and clearly communicated to affected households, APCs and community leadership, and local jirgas.

7. Monitoring and Reporting

8.1 Monitoring

Monitoring and evaluation of the stakeholder process is considered vital to ensure PEDO/PMO is able to respond to identified issues and alter the schedule and nature of engagement activities to make them more effective. Adherence to the following characteristics/commitments/activities will assist in achieving successful engagement:

- Sufficient resources to undertake the engagement;
- Inclusivity (inclusion of key groups) of interactions with stakeholders;
- Promotion of stakeholder involvement;
- Sense of trust in PEDO/PMO shown by all stakeholders;
- Clearly defined approaches; and
- Transparency in all activities.

Monitoring of the stakeholder engagement process allows the efficacy of the process to be evaluated. Specifically, by identifying key performance indicators that reflect the objectives of the SEP and the specific actions and timings, it is possible to both monitor and evaluate the process undertaken. Two distinct but related monitoring activities in terms of timing will be implemented:

- During the engagement activities: short-term monitoring to allow for adjustments/improvements to be made during engagement; and
- Following completion of all engagement activities: review of outputs at the end of engagement to evaluate the effectiveness of the SEP as implemented.

A series of key performance indicators for each stakeholder engagement stage have been developed. Table shows the indicators, and performance against the indicators will show successful completion of engagement tasks.

Table 4. Key Performance Indicators by Project Phase

Key Indicators	Responsibility
Planning for Construction Phase	
▪ Share updates on project activities ▪ Bill Boards displayed in allocated locations by time specified	PEDO/PMO
▪ Affected community stakeholders, with at least 30% women, have received and understand the ESIA and RAP information disclosed and attended the public meetings ; ▪ Communities provided feedback. ▪ No complaints about non-receipt of information dissemination material.	PEDO/PMO
ESIA / RAP Implementation Phase	
Confirmation that the ESIA/ESMP/RAP tasks are defined as specific individual or grouped environmental and social clauses in contract bid documents.	PEDO/PMO (Director Procurement) to draw on ESIA/ESMP/SEP/RAP for bidding documents
Confirmation that environmental and social management criteria are included as part of the contractor selection process, including their experience preparing and implementing ESIA/ESMPs, etc.	PEDO/PMO (Director Procurement) to draw on ESIA/ESMP/SEP for Contractor selection process

A Director Environment and a Director Social Safeguards hired and retained by PMO, providing assistance with ESIA/ESMP and RAP implementation, contractor ESIA/ESMP supervision (including observations during construction), and participation in meetings with community/affected persons, general public consultations and institutional stakeholder	PEDO/PMO safeguard strengthening
Compliance monitoring checklists prepared and being used by the contractor and SCS/PIC consultant relevant staff and due diligence notes, completed as defined in the ESIA/ESMP and RAP, and making the notes available in an easily accessible file for the contractor, ES and technical staff of PMO, PIC and others to use.	ESIA/ESMP/SEP/RAP to guide management and monitoring processes

The identification of GKHPP related impacts and concerns is a key element of stakeholder engagement that will occur over the complete Project life-cycle. As such, the identification of new concerns and impacts as the Project progresses will serve as an overall indicator for the utility of the stakeholder engagement process.

In the ESIA and RAP progress and monitoring reports, there will be a review of the engagement activities conducted; levels of stakeholder involvement (particularly for affected persons and affected communities, women and vulnerable groups); the issues discussed and outcomes; and the extent to which stakeholder issues, priorities and concerns are reflected in the ESIA ad RAP Reports, particularly with respect to mitigation and monitoring strategies contained in the Environmental and Social Plans.

8.2 Reporting

Weekly and Monthly Reports

The ESS of PMO, PIC, and Contractor will prepare brief weekly and monthly reports on stakeholder engagement activities to report to the PMO that will include:

- Activities conducted during each week and month;
- Public outreach activities (meetings with stakeholders, dissemination of information education and communication material i.e. leaflets, posters brochures, newsletters, local radio and TV channels, non-technical summary of documents and reports etc.);
- Number of feedback forms;
- Entries in stakeholder engagement activity register;
- Entries to the grievance register;
- Number of visitations to the Information Centers;
- Number of meetings with APCs;
- Monthly stakeholder engagement activity plans.

Six Monthly and Annual Reports

Monthly reports will be used to develop six monthly and annual reports; ES staff of PIC will compile a report summarizing stakeholder engagement activities and their results on an annual basis and will submit to the PMO and PEDO for review. This report will provide a summary of all public consultation issues, grievances, Corrective Action Plans and their implementation status/resolutions. The report will provide a summary of relevant public consultation findings from informal meetings held with APs and other stakeholders.

The external monitoring of SEP implementation will be done by a third-party monitoring agency. A midterm and end of the project evaluation will be conducted by a third-party consultant/firm using a perception survey, which will use same set of indicators over time to achieve continuity. The first survey to assess stakeholder perceptions should be conducted before major construction work to provide a baseline of APS and other stakeholder perceptions.

Reporting Back to the Stakeholders (Disclosure)

PEDO will provide opportunity to PMO to report back to the affected persons and other stakeholders on matters relating to:

- main findings from the annual monitoring;
- progress on implementation of the mitigation measures;
- Overall progress on the ESIA, ESMP, RAP, LRIP, SDP and SEP implementation;
- Corrective Action Plan to address any outstanding issues.

The exact reporting mechanism and formats will be finalized during initial stage of project implementation, and upon finalization, the SEP will be updated. The annual monitoring reports will be disclosed to the PEDO/Project and WB websites and will be accessible to all interested stakeholders.