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GOVERNMENT OF PAKISTAN
MINISTRY OF ENERGY (POWER DIVISION)

Dasu Transmission Line Project

Environmental and Social Impact Assessment (ESIA)
(Volume I: Main Report)

National Transmission & Despatch Company (NTDC)
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EXECUTIVE SUMMARY

The Dasu Transmission Line (DTL) Project (the Project) is being developed by the National Transmission & Despatch Company (NTDC, the Project Proponent) of Pakistan with funding from the World Bank (WB). The Project consists of a 250 kilometers (km) long, 765 kilovolt (kV), double circuit transmission line from the Dasu Hydropower Project (DHP) located in Dasu, Kohistan to the proposed Mansehra Grid Station (MGS), which is 140 km from DHP and then to Islamabad West Grid Station (IWGS), which is 110 km from MGS. The transmission line consists of 674 towers, among them 217 are angle or tension towers and the remaining 457 are suspension or tangent towers. The Dasu Hydropower Project is already under implementation by the Water and Power Development Authority (WAPDA) with the support of the World Bank and is expected to be commissioned by 2023. NTDC have undertaken the present environmental and social impact assessment (ESIA) of the proposed DTL Project including Mansehra Grid Station in accordance with the national regulatory requirements and the World Bank operational policies.

In addition to the present ESIA, NTDC has also prepared two Resettlement Action Plans (RAPs), one for the MGS and the second one for transmission line, to respectively address the social and resettlement impacts of the project. The RAPs are presented under separate covers.

The DHP[1] is the first large scale hydropower project being implemented by WAPDA on Indus River in the northern region of Pakistan. The DHP's first stage of 2,160 megawatts (MW) is expected to be on the grid by December 2023, while its full capacity of 5,400 MW is expected to be achieved by December 2025. Therefore, the DTL Project is required to be completed six months prior to the Commercial Operation Date of the first stage of DHP. No transmission lines exist in the area that can evacuate the power to be generated by DHP. Therefore, the power evacuation from DHP will be fully dependent upon the completion of DTL.

Regulatory and Policy Frameworks

In consideration of the likely impacts of the Project and in discussion with the World Bank, it is concluded that the Project falls into Category A or under Schedule II (as per national regulations). The project is expected to have significant adverse social and environmental impacts that are diverse, irreversible or unprecedented and also due to its association with the DHP. The national/provincial legislation and regulations require the Project Proponent to conduct environmental and social assessment of the proposed project and obtain approval from the relevant provincial environmental protection agency, before initiating the project. Similarly, the WB environmental and social safeguard policies require the project proponent seeking the Bank's financing to carry out environmental and social assessment of the proposed project and obtain the Bank's clearance. In addition, World Bank Group's Environmental, Health, and Safety (EHS) Guidelines are applicable to the proposed project, in particular, General Guidelines (April 2007), Guidelines for Electric Power Transmission and Distribution (April 2007), and Guidelines for the Construction Materials Extraction (April 2007). The present assessment has been carried out in response to these requirements.

[1] A separate environmental and social impact assessment has been carried out for DHP in 2013-14.

Analysis of Alternatives

The analysis of alternatives carried out as part of this ESIA concludes that the 'no-project' alternative is not acceptable since there is no other possibility of evacuating power from the DHP and future hydropower plants that are planned to be constructed along the Indus River. There is no other transmission line in the area to evacuate power.

Alternates for the DTL route were considered at two levels. First, two broad routing options were considered. One of these routes started from Dasu and followed the Indus River up to Pattan, and from there it turned east and crossed the Palas valley, passed through Battagram and Mansehra districts, circumvented the Tarbela reservoir and reached the grid location site in Attock district of Punjab. The main advantage of this route was the shortest length of the proposed transmission line. However, the Palas valley is an internationally recognized biodiversity hotspot, with good population of Western Tragopan pheasants and other sensitive species and stands of pristine moist temperate forest. The selected alignment avoided the Palas valley and followed the Indus river up to Thakot, from where it also turned east to Battagram and reached to the proposed Mansehra Grid Station, from where it followed more or less the same route as for the earlier option and reached the proposed site of Islamabad West Grid Station in Attock district. This route is longer in length than the first option, however, it has been preferred over the first option because it avoids the Palas valley and its important habitat. At the second level of evaluating routing options, the entire route was divided in several segments and for each segment, several options were considered. Here the main criterion for selecting the final alignment was to avoid large settlements and towns. Further, the tower locations were also selected in a way to minimize impacts on houses and farm lands.

The site for Mansehra GS was carefully selected among three alternatives. The location in Sawan Maira was selected due to the availability of required land, and flat terrain, with no resettlement requirements, as the area selected is barren and located away from the settlements.

During the design phase, various voltage levels for the proposed DTL were also considered. One option was to use 500kV as the voltage level of the transmission line. The main advantage of this option was that the 500kV system already exists in Pakistan and NTDC has a lot of experience of operating such lines. Another advantage was that the RoW of this voltage level is 70m as against 80m for the 765kV transmission line. However, the main disadvantage of this system is that two transmission lines of 500kV would be needed to evacuate power generated by the DHP and other future power generating plants. The second option considered was to use 765kV as the voltage level of the transmission line. The advantage of this option is that only one transmission line would be needed and hence its cost as well as its footprint would be much smaller and hence the environmental and social impacts (and the associated costs) would also be less than the first option. The only disadvantage of the 765kV system is that the Country lacks any prior experience of installing and operating such a system. Finally, on the basis of lesser cost and smaller footprint, the 765kV system has been selected for the DTL.

For Mansehra Grid Station (circuit breakers and switchgears), air insulated (AIS), gas insulated (GIS), and hybrid models are three possible alternatives. All substation configurations have pros and cons. Industrial practice suggests that when space is available, AIS is the usual choice, on the basis of lesser costs of equipment; while in urban settings where land is scarce and expensive, GIS is preferred. In the case of Mansehra, where the setting is rural and space is available, the AIS configuration has been chosen. AIS also allows for more flexibility in view of planned future expansion.

Project Overview

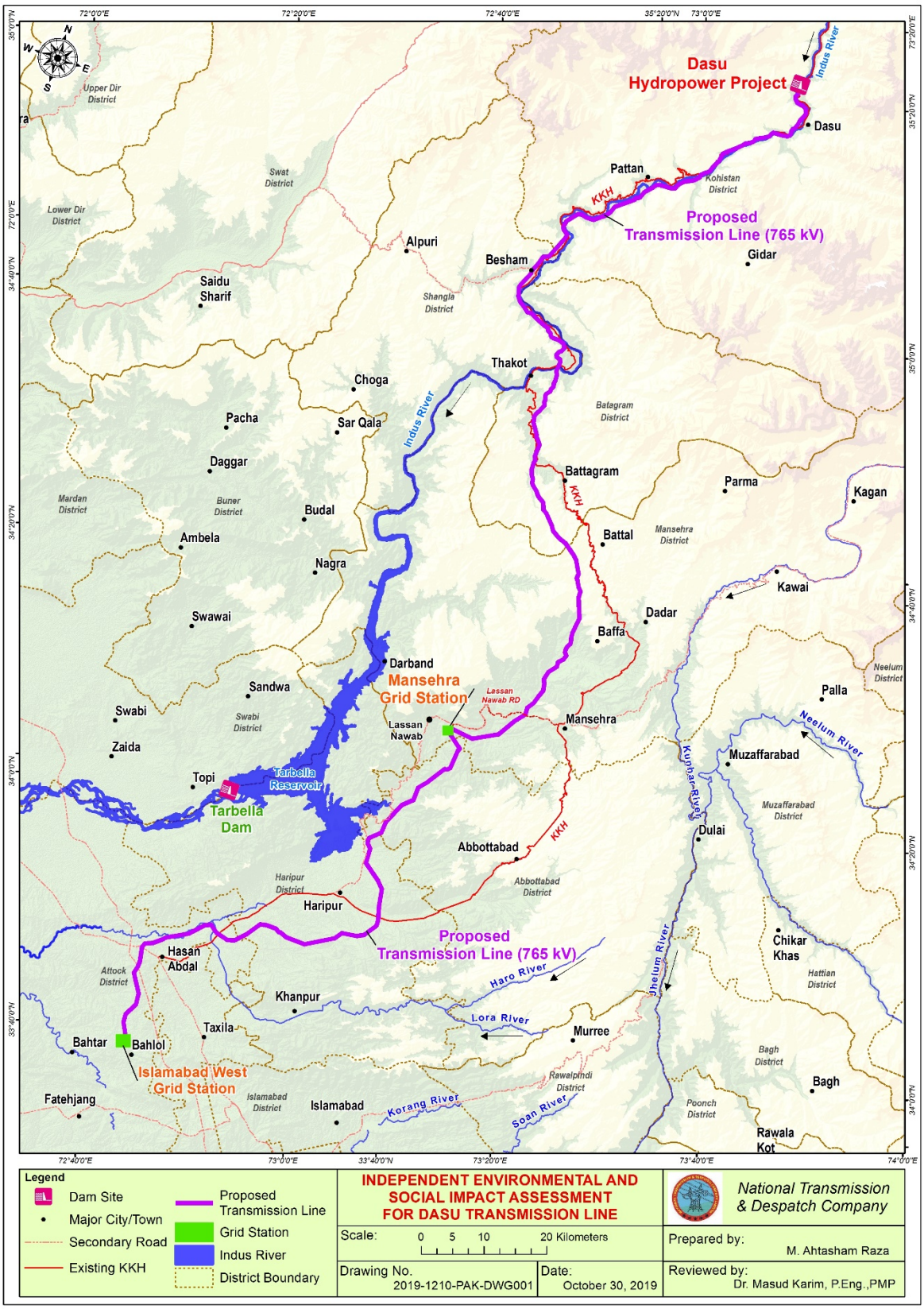
The proposed 765 kV Dasu TL Project, which will evacuate power generated from DHP and other future hydropower plants, comprises a double circuit transmission line from Dasu to Mansehra then to Islamabad via Pattan, Besham, Thakot and Mansehra and two Grid Stations one in Mansehra and the last one is in Islamabad West. The total length of the transmission line is about 250 km. See **Figure ES.1** for the DTL alignment.

The proposed transmission line requires about 674 towers, in which 217 will be angle or tension towers and remaining 457 will be suspension or tangent towers. The average size of each tower footing will be 20m x 20m (400 square meters). Typically, four concrete foundations about 3-6 m depth will be constructed for each tower. The average height of each tower will be about 83 m. The right of way (RoW) of the transmission line will be 80m wide. On average about 200 m long access track will be used for each tower during the construction phase.

Mansehra GS, a 765/500 kV AIS grid station will be constructed on 158 acres of land at Sawan Maira village. The grid station will house bay and other substation equipment, such as, transformers, circuit breakers, feeder bay, reactors, isolators, bus bars, wave trapper, loop-in-out lines, and telecommunication mast. It will also have control building to house protective relays, control devices, battery banks for primary control power, and remote monitoring equipment and residential colony for the operation staffs and families.

The DTL will pass through two provinces and they are Khyber Pakhtunkhwa and Punjab, runs through eight districts, (a) Upper Kohistan, (b) Lower Kohistan, (c) Shangla, (d) Battagram, (e) Mansehra, (f) Abbottabad, (g) Haripur, and (h) Attock. Kohistan districts further has six union councils and 28 villages from which the line is passing; Shangla district has four union councils and 18 villages; Battagram district has nine union councils and 32 villages; Mansehra district has eight union councils and 22 villages; Abbottabad has three union councils and seven villages; Haripur district has seven union councils and 22 villages; and lastly the Attock district has four union councils and 13 villages through which the Transmission line is passing..

A total of six construction camps are likely to be established, five for transmission line contract and one for MGS during the construction phase. The construction camps will include residential quarters, washing areas, kitchen, toilets, construction materials, fuel storage, water storage, sewage disposal arrangements, firefighting arrangements, electric generators, ambulance, construction machineries, and others. Estimated man power needed for the proposed project is about 1,450. In total six construction teams will be operated having two working groups in each team for the TL and one for MGS, each working group will comprise of 20 engineering staffs and 50 workers.



ES.1: Project Location

Baseline Conditions of the Project Area

Physical Environment. Physiography of Dasu-Besham section of the DTL route comprises of high mountains with elevation of towers ranges between 850 to 960 m amsl.

Among these high peak mountains, deep valleys provide space for human settlements and fields for terraced agricultural practices. The main drainage system for this area is the Indus River and Yango Gah and Chor Nullahs from the surrounding valleys. Summer is usually very hot in the lower Kohistan and extremely cold in winter season, while at high altitude, the weather remains pleasant even in summer, and due to the intensive snow fall in winter these valleys remain closed. The maximum height of the DTL route in this segment is about 1,300m above mean sea level (amsl) and average height is about 930m amsl.

Physiography of the Besham-Mansehra segment of the route comprises high altitude mountains with average of snow creeps to low relief mountains. The elevation of the tower's footprint is in between 822 m amsl and 1,449 m amsl. The project area from Besham- Mansehra lies in the monsoon range; however, rain has been reported in the winter season. The altitudinal decrease from Besham to Mansehra forms a natural drainage pattern mainly of Indus along with its tributaries, Chanjal and Nandhar, in Thakot and Battagram area, while Siran River and its tributaries in Mansehra. The vegetation shows a continuous scrub that mainly consists of plants and small trees at the middle to lower parts and pine and kale trees at higher altitudes. Cultivation is common in the valleys and on mountain slopes, usually in a terrace pattern.

The proposed Mansehra Grid Station is located in Tehsil Sawan Maira east of the town Lassan Nawab Sahib and is situated on a plateau at an average altitude of 700 m amsl. The access to the site location is from Lassan Nawab road. Based on the site visit, the area planned for the new MGS is sufficient for sitting all the equipment. The total area of MGS is about 158 acres.

The Mansehra-Islamabad section of the DTL route exhibits dual physiographic characteristics. The area from Mansehra to Islamabad is of hilly terrain with average tower's elevation in between 406 to 841 m amsl. The comparatively low relief mountains are mostly covered with vegetation. The vegetation cover thickness varies and is composed of grass, bushes, and small trees while some pine tree population also exists on the high relief peaks of Mansehra.

Biological Environment. Currently there are 61 protected areas established in the northern Pakistan, comprising nine wildlife sanctuaries, 15 national parks, and 37 game reserves. These protected areas cover 19% of landmass in the northern Pakistan, as compared to about 11% for the entire country's protected area coverage. A higher coverage of protected areas in northern Pakistan reflects the greater importance of the biodiversity of the area. The northern Pakistan is a particularly important stronghold for the globally endangered snow leopard (*Panthera uncia*, EN on the IUCN Red List; Appendix I of CITES; Appendix II on CMS/Bonn Convention). Other important species within northern Pakistan include: markhor (*Capra falconeri*; Near Threatened); Marco Polo sheep (*Ovis ammon polii,* Near Threatened; Kashmir musk deer (Moschus cupreus; Endangered); Himalayan lynx (*Lynx lynx,* Least Concern); blue sheep (*Pseudois nayaur,* Least Concern); brown bear (*Ursus arctos*); Indian wolf (*Canis lupus*); and Himalayan ibex (*Capra sibirica*). Ibex, markhor and wild sheep are all key prey species of snow leopard (Panthera uncial, Endangered) and are therefore important to the species' survival.

There are no protected areas along the project corridor. However, 4 community managed game reserves (Khawajgan, Sheikh Abad, Jalio, Bhali Ghatti, and Lassan Thurkal) and one government managed game reserve (Mang) have been reported along the project corridor.

Out of the 215 species found in the Study Area, most are considered in the IUCN "Least Concern" category. Four species are listed as Threatened: Sociable Lapwing (*Chettusia*

gregaria, CR), Steppe Eagle (*Aquila nipalensis*, EN), the Common Pochard (*Aythya ferina*, VU), and the Western Tragopan (*Tragopan melanocephalus*, VU). Observed range-restricted species were Koklass Pheasant (*Pucrasia macrolopha biddulphi*), Himalayan Monal Pheasant (*Lophophorus impejanus*), White-cheeked Tit (*Aegithalos leucogenys*), White Throated Tit (*Aegithalos niveogularis*), Brooks's Leaf Warbler (*Phylloscopus subviridis*). The global population trend is stable or increasing for most species found in the Study Area; however, nearly a third of the species found in the Study Area are decreasing globally.

An avian risk assessment was conducted under Detailed Ecological and Biodiversity Management Plans (DEBMP) along the DTL corridor. Collision risks are identified as the most pronounced in the vicinity of the Indus River and its tributaries, as many collision-prone species are closely associated with riverine, lacustrine, and wetland habitats. Study team of DEBMP identified a relative risk (1-12) category for each line span based on the numerical ranking or linear scoring system. Higher-priority spans are likely to have the greatest effect and were prioritized for the proactive measures. The 12 highest-risk spans (i.e., relative risk index 9 through 12) are sections of line that are perpendicular to migration corridors (n=9), and/or are near sensitive species (n=6). These lines also cross major drainages/waterbodies (n=7) and/or ridgelines (n=4).

Socioeconomic Environment. The DTL route traverses through eight districts of KP and Punjab provinces as described earlier. Socioeconomic aspects of the Project area complement with physical features of the proposed DTL, which include gradual but very noticeable changes in the landscape and social scenario. These aspects include the people and their culture and customs, housing patterns, population density, nature of agriculture, availability of social infrastructure and amenities, livelihood opportunities, and economic wellbeing.

The initial parts of the route in Kohistan and Shangla districts can be characterized by conservative people having very strong tribal bonding and affiliation, mostly pastoral lifestyle, cultivation limited to very small tracts of flat land that is hard to find in these areas, very small villages mostly in the form small clusters of a few houses and hence a very low population density, mostly *katcha*[2] houses, difficult road access, limited availability of social infrastructures, such as, schools and hospitals, and limited livelihood opportunities.

The Battagram and Mansehra districts and to some extent Abbottabad district can be characterized, in varying degrees, by conservative people with not so strong tribal affiliation, more agriculture-based lifestyle, cultivation being practiced mostly on terraces that have been cut along mountain slopes in Battagram and in wider valleys and plain areas in Mansehra, comparatively larger villages primarily because of presence of wider valleys, mostly *pacca*[3] houses, easier access to roads, better availability and quality of social infrastructure, and finally more livelihood opportunities.

In the same manner, the Haripur and Attock districts can be characterized by weak if at all tribal affiliations, vast cultivation fields because of the flat terrain, larger villages and towns, mostly *pacca* houses, extensive network of roads including highways and motorways, more urbanized lifestyle, greater and easier access to education and healthcare facilities, and much better livelihood opportunities compared with the initial parts of the DTL route.

[2] *Katcha*: a structure made of materials such as mud, stone, wood, and thatch.

[3] *Pacca*: a structure made of brick and mortar

Mostly rural population is located along the project alignment from Dasu to Islamabad. This is primarily because no major population centers exist in the initial parts of the route in Kohistan and Shangla districts, while for the remaining parts, the route has been selected in a manner to avoid large towns and population centers to minimize technical as well as social issues during project construction and operation.

As indicated before, RoW of the DTL is 80 m wide. Hence the total area of the RoW of the 250 km long DTL is 20 million square meters (250,000 m x 80 m), or about 4,942 acres. On the other hand, Mansehra GS requires a total of 158 acres of land. Of this total area, cultivated land covers about 2,315.6 acres, barren land covers about 2,189.9 acres, residential and commercial land covers about 3.5 acres, forests land cover about 532.87 acres, and others are about 69.2 acres.

Potential Environmental Impacts and Hazard Risks

The potential significant impacts of the project's construction phase on physical and biological environment could include rock fall and land sliding particularly in the mountainous and hilly areas having steep slopes; dust emissions caused by blasting and operation of machinery and running vehicles on earthen tracks within the RoW and along the access routes; management of spoils at tower locations, especially at high altitude and steep slopes, collision of birds during stringing operation, loss of natural vegetation and trees in the RoW; natural habitat destruction and fragmentation caused by vegetation clearance and felling of trees; disturbance to wildlife species; hunting, trapping, and or catching of wild species by the project personnel at the site.

Occupational health and safety (OHS) hazards for the construction staff and other project site personnel during transportation and storage of explosives; impact of drilling at tower location; impact of blasting operation; transportation of heavy loads in difficult terrain; working at height along the slope, for tower erection and grid station assembly; and stringing conductors at road, river, and existing transmission line crossings. The provision of personal protective equipment (PPE) is identified and an estimate is made for the total number of PPEs required for Contractor, Consultant and PMU staffs during the entire construction period. Contractor will be responsible to provide, ensure usage by 100% staffs, and maintain in a sanitary and reliable condition. The Contractor shall provide training to each staffs who is required to use PPE.

The potential hazards of the transmission line during the operation and maintenance stage are limited to collision of migratory birds, OHS hazard risks of handling of faulted SF6 in circuit breakers and transformers maintenance and electrical contact.

Potential Social Impacts

The most significant social impacts of the project is acquisition of 158 acres of land for Mansehra GS; for DTL, impacts on about 2,313 acres of cultivated land, relocation of 50 structures with 3.5 acres land. Impact on 1,381 households (consisting of 9,820 affected persons) including 318 vulnerable households. Impact on 1.94 km local road to access Sawan Maira, Nakkah, and Bareela villages. Felling of 50,185 trees due to the clearance of land for Mansehra GS, installation of towers and clearing along the TL RoW. Potential of 900 employment opportunities for local communities in un-skilled and semi-skilled category. Other potential impacts of the project's construction on the local communities include temporary blockage of local routes, project-related traffic on local roads, noise generation from blasting causing nuisance and disturbance to local population, additional load on local resources, risk of social tension, illicit behavior and privacy of women, crime, burden on and competition for public service provision, increased risk of communicable

diseases and burden on local health services, water resources, inadequate waste disposal and illegal waste disposal, camp related land use, access roads, noise and lights. Mobility of local women for working in the field, herding livestock, picking fuel wood, etc. may be compromised due to the migrant labors' unawareness of local customs and norms and may create social and gender issues. The potential impacts of the project's operation and maintenance activities on the local communities could include diminution of land value at the tower location and risk of electrocution and occasional crop damage.

Cumulative Impact

Three valued environmental components were considered for cumulative impacts and they are traffic movement in the existing KKH, project induced labor influx, and bird migration.

Mitigation

To address the potentially negative environmental and social impacts of the project, appropriate mitigation measures have been included in this ESIA. These include implementing properly engineered slope protection and landslide and rock fall control measures at the tower locations where needed; control blasting and use of blast mats, water sprinkling to suppress dust emissions particularly near the settlements, using properly tuned vehicles and machinery to minimize exhaust emissions; utilization of spoils generated due to blasting operation in the backfilling of slope protection; will be utilized for back filling and disposal of excess materials to designated locations approved by the CSC; minimizing disturbance to natural habitats; making adjustments in the route alignment as well as tower location selection to avoid thick forests and sensitive habitats; enforcing 'no hunting, no trapping, no catching' policy for the wildlife; and preparing and implementing an OHS plan. Design of explosive storage in compliance with the regulatory requirements; training and education will be provided to all workers involves in drilling and other related works; effective PPE's will be provided and ensured to use during all works; machines will be checked and maintained to efficient level to ensure risk free operations; prepare method statements for transportation of heavy loads in difficult terrain, identify site specific hazards and accordingly devise preventive measures, especially fall protection; and ensure access to safe drinking water and places for rest during exposure to extreme heat during summer.

To address the risk of bird collision and electrocution, bird markers will be installed to the upper wire of the transmission line in 12 high risk spans for a total length of 14,533 m with a cost of $0.193 M. Furthermore, the spacing between transmission line conductors is such that there are little chances of electrocution of birds found in the area (including migratory birds) owing to the size of their wing span.

Two separate RAPs – one for DTL and one for Mansehra GS – have been prepared to address the resettlement impacts presented earlier. No land acquisition will be required for DTL; land would be temporarily taken for the construction of the transmission line and tower sitting. All losses such loss of crops and trees will be compensated at market value for two seasons required for construction. Owners of land for the tower sitting will be paid up to PKR 1,120,000 as allowance for reduced access to land under the tower sittings; however, land title will remain with the owner(s). In addition, RAPs have provisions for livelihood allowances, training for livelihood restoration programs, special assistance for women and vulnerable groups so that PAPs can at least maintain their pre-project standards and improve as well. In addition, the RAPs have allocated a dedicated budget of USD6 million as benefit sharing programs in the form of community support programs such as

rural roads, water supply and similar other projects to be determined by the community during project implementation.

For the remaining potential impacts of the project such as labor influx and potential negative socio-cultural impacts such as gender-based violence and sexual exploitation and abuse of women and children, adequate measures have been taken following the WB recommended guidelines – for instance, to raising awareness and engage all stakeholders (e.g., project management, contractors, consultants, community groups/leaders, local NGOs) in responding to the social and cultural risks to local communities and development of code of conduct for locals and in-migrant workers. Other construction related mitigation measures include maintaining liaison with the local community during the construction phase to ensure that local routes are not blocked in the first place, however, if it is unavoidable, then alternate routes are identified in consultation with the affected community. For mitigating the impacts of noise generation, the contractor will use machinery and vehicles equipped with standard noise reduction arrangements (such as silencer and canopy), will avoid nighttime work to the extent possible, and will maintain liaison with the communities. For increased traffic on local roads, the contractor will prepare and implement a traffic management plan.

The contractor will also prepare and implement a safety management plan to ensure that safety hazards for the communities are minimized. To address the risks of any social tension, a code of conduct will be prepared and all site personnel will be required to follow that. The contractor will be required to obtain supplies such as water, fuel and other commodities in a manner that the local communities are not negatively affected; liaison with the local community will also be maintained for this purpose in addition to establishing a grievance redress mechanism. The contractor will also be required to avoid any damage to places such as graveyards and shrines. Finally, to protect privacy of women, the code of conduct described above will be enforced at the site.

Environmental and Social Management Plan

An Environmental and Social Management Plan (ESMP) has been prepared as part of the present ESIA in order to define the implementation mechanism for the above-described mitigation measures and preventive actions. The ESMP includes contractor's certification in ISO 9001 Quality Management, ISO 14001 Environmental Management and OHSAS 18001 Occupational Health and Safety Management, preparation of Construction Environment and Social Action Plan (CESAP) and Occupational Health and Safety (OHS) Plan by the Contractor, requirement of Job Hazard Analysis (JHA) at all construction sites to identify hazard risks, inclusion of Environment, Safety, and Health (EHS) Chapter in each Method Statement, requirement of Request for Inspection (RFI) for temporary structures, as a pre-requisite for the readiness of site, field engineer's EHS Oversight, description of institutional arrangements, mitigation and prevention plans, monitoring plan, a training and capacity building plan, documentation protocols, and a grievance redress mechanism (GRM). ESMP also includes the provision of the PPEs and training how to use them for the Contractors', PMU, and Consultants' staffs. The detail estimates of PPEs will be included as separate line items in the bidding documents. Contractor will ensure that all required PPEs are supplied to 100% workers and staffs at all worksites.

The Project Management Unit (PMU) has been established within NTDC and mandated to manage the design, procurement, and construction activities of the DTL project. The PMU is also responsible to ensure compliance with the national as well as WB environmental and social safeguard requirements including preparation of environmental and social assessment documents including the present ESIA. The PMU will also ensure

implementation of the ESIA in line with the national as well as WB safeguard policy requirements. The PMU is headed by the Chief Engineer/Project Director. The Environment and Social Impact Cell (ESIC) within PMU has been mandated to spearhead the ESIA implementation. An Assistant Manager for OHS and five EHS supervisors has been recommended to strengthen the capacity of ESIC. A number of training programs are recommended in the ESMP for ESIC staff including an overseas training to strengthen their capacity. Construction Supervision Consultant (CSC) will elaborate these training needs and submit to PMU in consultation with ESIC during project implementation.

The PMU will set up a field level Construction Camp Office (CO) for facilitating land acquisition and implementation of RAP and monitoring the implementation of CESAP and OHS Plan. The PMU will engage Construction Supervision Consultant (CSC), who will be responsible for supervising the contractor during the construction phase. CSC will also be responsible to supervise the implementation of CESAP and OHS Plan at the field level, with the support of ESIC.

Two tiers of monitoring and evaluation (M&E) is envisaged for the ESIA implementation. At the first tier, internal monitoring will be carried out by PMU and ESIC, whereas as the second tier, external monitoring will be carried out by the M&E Consultant. The purpose of these monitoring activities is to ensure that ESIA is implemented in a timely manner, in accordance with the procedures described in the present document, and in compliance with the national as well as WB safeguard policies.

A two-tiers GRM will be established, one at the NTDC headquarter and the other at the PMU-Level at the project sites to facilitate amicable and timely resolution of complaints and grievances of the communities including APs regarding the environmental and social issues including resettlement aspects.

Total ESMP implementation cost is estimated as USD 41.89 million including the RAPs budget, which is USD 30.99 million (Table ES1). This cost includes the implementation of mitigation measures and preventive actions and implementation of RAP, along with supervision services and advisory services by the consultants, capacity building and training, and institutional support for NTDC.

Table ES 1: Budget for Implementation of ESMP

Sr. No.	Items	Unit	Quantity	Unit Rate (USD)	Amount (USD)
1	**Civil Works**				
	Camp Management				2,071,688
	Preparation & Submission of CESAP	No	3	15,625	46,875
	Revision of CESAP	No	9	3,125	28,125
	Preparation and Submission of OHS Plan	No	3	18,750	56,250
	Revision of OHS Plans	No	9	4,688	42,192
	Dust management by Water Sprayer/Watering	Veh-day	270	150	40,500
	Top Soil Stripping, Storage and Reuse	m3	28,667	2	57,334
	EHS Staff (Contractor)				3,948,000

Sr. No.	Items	Unit	Quantity	Unit Rate (USD)	Amount (USD)
	Environmental Quality Monitoring				231,000
	Skill Development of Locals				115,469
	Personal Protective Equipment				500,006
				Sub-Total	**7,137,439**
2	**Environmental Management and Monitoring Plan**				
	Trees Plantation Program				307,085
	Environmental Quality Monitoring ESIC				10,500
				Sub-Total	**317,585**
3	**Institutional Arrangements**				
	Construction Supervision Consultant				1,912,000
	ESIC (9 Staff for 7 years)				341,918
	Capacity Building & training of NTDC Staff				116,750
	Monitoring and Evaluation Consultant				650,500
	Independent Review Consultant				366,000
	Grievance Redress Management				54,210
				Sub-Total	**3,441,378**
4	**Social Management Plan**				
	Resettlement Action Plan				30,990,00
				Sub-Total	**30,990,000**
				Grand Total	**41,886,402**

Consultations and Disclosure

Three separate teams conducted the community consultations individually covering social, resettlement, and environmental aspects of the project along the DTL corridor and in Mansehra Grid Station. Consultation meetings were held in 2016 and also in 2019 by three separate teams individually covering social, resettlement, and environmental aspects of the project. The environmental assessment team conducted consultations in a total of 34 villages of the project area. A total of 170 people participated in these consultation meetings. The social assessment team conducted consultations in 17 villages with a total of 295 community members to obtain feedback particularly on social issues. Separate consultations were held with women in the project area in 17 separate focus group discussions (FGDs) involving 248 participants, making a total of 713 participants. During 2019 updates of the ESIA, both environment and social team conducted consultations in 70 locations with 1,357 participants.

In addition, consultations were also conducted with district level government departments and institutional stakeholders such as Environmental Protection Agency (EPA), National

Highway Authority (NHA), Wildlife, Forestry, and International Union for Conservation of Nature (IUCN) to obtain their views on the project. In 2016, one national stakeholder consultation in Islamabad and two Public Hearings, one in District Attock and the second one in District Battagram were also organized. This ESIA draft was disclosed in two locations (Mansehra and Besham) during October 29-30, 2019 with 81 participants. A total of 2,151 people were consulted during the entire project preparatory stage.

The ESIA and the RAPs for DTL and Mansehra GS will be disclosed through NTDC and in World Bank websites, once finalized. The executive summary of ESIA and short brochures featuring the main elements of the RAPs will be translated in to Urdu and will be disclosed through NTDC website and made available to the affected communities.

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LIST OF ABBREVIATIONS

AAAC	All Aluminum Alloy Conductor	ESMP	Environmental and Social Management Plan
ACSR	Aluminum conductor, steel reinforced	EQS	Environmental Quality Standards
AIS	Air Insulated Substation/Switchgear	ESIA	Environmental and Social Impact Assessment
amsl	Above mean sea level	ESIC	Environment and Social Impacts Cell
AOI	Area of Influence	ESMP	Environmental and Social Management Plan
AP	Affected Person	FGD	Focus group discussion
ARMP	Avian risk management plan	GBV	Gender based violence
BCM	Billion Cubic Meter	GHG	Greenhouse gases
BoQ	Bills of quantities	GIS	Gas Insulated Substation/Switchgear
BP	Bank Procedures	GoP	Government of Pakistan
BTP	Billion trees project	GRC	Grievance Redress Committee
CBD	Convention on Biological Diversity	GRM	Grievance Redress Mechanism
CESAP	Construction Environment and Social Action Plan	GS	Grid Station
CIA	Cumulative impact assessment	GT	Grand Trunk
CITES	Convention on International Trade in Endangered Species	HPP	Hydropower Plant
CO	Camp Office	HRAC	Hazard Risks Assessment Code
COC	Codes of Conduct	IBA	Important Bird Area
CO_2	Carbon dioxide	ICIN	International Commission on Non-Ionizing Radiation Protection
CPEC	China Pakistan Economic Corridor	IEE	Initial Environmental Examination
CR	Critical	IGS	Islamabad Grid Station
CSC	Construction Supervision Consultant	ILO	International Labor Organization
CSP	Community Support Program	IPC	Instruction of Payment Certificate
dB	Decibel	IPCC	International Panel of Climate Change
DEBMP	Detailed Ecological and Biodiversity Management Plans	IWGS	Islamabad West Grid Station
DHP	Dasu Hydropower Project	JHA	Job Hazard Analysis
DTL	Dasu Transmission Line	KKH	Karakoram Highway
EHS	Environment, Safety, and Health	KP	Khyber Pakhtunkhwa
EMF	Electro-magnetic Field	LAA	Land Acquisition Act
EN	Endangered	M	Million
EHS	Environment, Health, and Safety	M&E	Monitoring and Evaluation
EMP	Environmental Management Plan	MGS	Mansehra Grid Station
EPC	Engineering Procurement and Construction	MMT	Main Mantle Thrust
ESCP	Environmental and Social Code of Practice	NCR	Non-compliance Report
ESIA	Environmental and Social Impact Assessment	NCS	National Conservation Strategy
ESIC	Environment and Social Impact Cell	NEP	National Environmental Policy
NEQS	National Environmental Quality Standards	RAP	Resettlement Action Plan
NFP	National Forest Policy	RFI	Request for Inspection
NGO	Non- Governmental Organization	RoR	Run-of-river

NHA	National Highway Authority	RoW	Right of Way
NRP	National Resettlement Policy	SEA	Sexual Exploitation and Abuse
NTDC	National Transmission & Despatch Company	SF6	Sulfur Hexa-fluoride
NWP	National Water Policy	STD	Sexually transmitted disease
OHS	Occupational health and safety	T5HP	Tarbela 5th Expansion
O&M	Operation and maintenance	TL	Transmission Line
OP	Operational Policy	ToR	Terms of Reference
OPGW	Optical ground wire	UIB	Upper Indus basin
OPL	Official Poverty Line	UN	United Nation
PIRAPO	Project Implementation and Resettlement of Affected Persons Ordinance	USD	United States Dollar
PEPA	Pakistan Environmental Protection Act	VU	Vulnerable
PLC	Programmable Logic Controller	WAPDA	Water and Power Development Authority
PMDC	Pakistan Medical and Dental Council	WB	World Bank
PMU	Project Management Unit	WBG	World Bank Group
PPE	Personal Protective Equipment	WHO	World Health Organization

Measuring Units

C	Celsius
$	US Dollar
GWh	Gigawatt Hour
km	kilometer
kg	Kilogram
kph	Kilometer per hour
kV	Kilo-volt
kW	Kilowatt
kWh	Kilo Watt Hour
m	Meter
µg/m^3	Microgram per cubic meter
MHz	Mega hertz
mm	Millimeter
MW	Megawatt
MWh	Mega Watt Hour
PKR	Pakistani Rupee
t	Ton

1 INTRODUCTION

1.1 Overview

The National Transmission and Despatch Company (NTDC) of Pakistan with funding from the World Bank (WB) plan to undertake Dasu Transmission Line (DTL) Project by constructing a 250 kilometers (km) long, 765 kilovolt (kV), double circuit transmission line from the Dasu Hydropower Project (DHP) to the proposed Islamabad West Grid Station. The Dasu Hydropower Project is already under implementation by the Water and Power Development Authority (WAPDA) with the support of the World Bank and is expected to be commissioned by 2023. NTDC have undertaken an environmental and social assessment of the proposed Dasu transmission line including the Mansehra Grid Station (MGS) Project in accordance with the national regulatory requirements and World Bank operational policies.

The present environmental and social impact assessment (ESIA) presents the environment and socioeconomic baseline conditions of the project area, identifies potential impacts of the DTL Project on environment and people, recognizes occupational health and safety (OHS) hazard risks during construction and operation and maintenance (O&M) phases, proposes appropriate mitigation measures and preventive actions to address the identified impacts and hazard risks, and also includes details on consultations and disclosures. An environmental and social management plan (ESMP) is also included in this ESIA to address potential impacts and occupational hazard risks, as well as to enhance the environment and social benefits of the project. In addition, NTDC has also prepared two Resettlement Action Plans (RAPs), one for the transmission line and the second one for the MGS to address the resettlement and social impacts of the project. The RAPs are presented under separate covers; however, major findings are included in this ESIA.

1.2 Background

The DHP[4] is the first large scale hydropower project being implemented by WAPDA on Indus River in the northern region of Pakistan. The DHP's first stage of 2,160 megawatts (MW) is expected to be on the grid by December 2023 while its full capacity of 5,400 MW is expected to be achieved by December 2025. Therefore, the DTL Project is required to be completed six months before the Commercial Operation Date of the first stage of DHP. No existing transmission lines are present in the area that can evacuate the power to the national grid and therefore, implementation of DHP will be totally dependent upon DTL to be completed in time.

This project is being considered under additional finance of DHP by the World Bank. All the Bank policies triggered under original project, DHP would remain applicable to this additional finance as well. Furthermore, no new policy has been triggered for this additional finance of DHP.

1.3 Proposed Project

The proposed project under additional finance of DHP consists of two main components as listed below:

- Dasu Transmission Line
- Mansehra Grid Station

[4] A separate environmental and social impact assessment has been carried out for DHP.

Dasu Transmission Line: The proposed 765 kV line, which will carry power generated by DHP, comprises a double circuit transmission line from Dasu to MGS via Pattan, Thakot and Mansehra, then to Islamabad West GS. The total length of the transmission line is about 250 km. The transmission line route from Dasu -Mansehra - Islamabad is presented in **Figure 1.1**.

The proposed transmission line requires about 674 towers, in which 217 will be angle or tension towers and remaining will be the suspension or tangent towers. The average size of each tower footing will be 20m x 20m (400 square meters). The average height of each tower will be about 83m. The right of way (RoW) of the transmission line will be 80m wide.

Mansehra Grid Station: A 765/500 kV AIS grid station will be constructed in 158 acres of land at Mansehra to receive power from Dasu Hydropower Project (from 765 kV transmission line). The grid station will have 765 kV AIS switchgear, 220 kV AIS switchgear and 11 kV GIS switchgear. Further details of the project are presented in **Chapter 4** of this document.

1.4 Environmental and Social Impact Assessment Study

1.4.1 Study Objectives

The present ESIA aims to address the potentially adverse impacts of the project and its activities on the physical and biological as well as socioeconomic environment – in order to make the project environmentally sustainable and socially acceptable. The ESIA also addresses occupational hazard risks and preventive actions both during construction and O&M stages to reduce work related incidents. The present study has been carried out in response to the requirements defined by the national/provincial regulations as well as WB safeguard policies.

1.4.2 Influence Area

The area likely to be affected by the project include ancillary services such as access roads, borrow and disposal areas, construction camps as well as unplanned developments induced by project. An overall baseline analysis of the project was carried out for the identification of areas that may be potentially impacted when the TL has been erected and grid station has been constructed. The area of influence may include, for example, (a) the watershed within which the project is located; (b) off-site areas required for resettlement or compensatory tracts; (c) the airshed (e.g., where airborne pollution such as smoke or dust may enter or leave the area of influence; (e) migratory routes of humans, wildlife, or fish, particularly where they relate to public health, economic activities, or environmental conservation; and (f) areas used for livelihood activities (fishing, grazing, gathering, agriculture, etc.) or religious or ceremonial purposes of a customary nature.

For the purpose of the environmental and social assessment and baseline data collection (except avian effects), generally a one-kilometer-wide corridor (500 m either side from the center line of the transmission line) along the proposed transmission line route has been considered as the influence area. A 500 m influence area on both sides of the Lassan Nawab Road (26 km) to access the grid station from Mansehra to and 500 m from the property line of the MGS is also considered under the influence area.

Figure 1-1: Proposed Route of Dasu Transmission Line

The area of influence will also include local access roads and trails which will be taken for construction materials transportation to tower locations and stringing operations. Similarly,construction camps will be set up along the TL and GS and approved quarry sites

will also be used for the construction purpose. Preferences will be given to use the existing sites of under construction 132 kV transmission line.

Area of influence is presented in Figure 1.2.

Figure 1-2: Area of influence

1.4.3 Study Methodology

This ESIA study was prepared based on field level primary data, review of secondary information, discussions with areas of experts, consultations with the affected communities, lessons learnt from other mega-projects in the country and the region. The study methodologies are described below.

Scoping and Screening. During this first step of the study, the spatial and sectorial dimensions of the study were determined. This included defining and demarcating the study area and determining the environmental and socioeconomic aspects to be studied. In addition to reviewing the project details, a reconnaissance field visit was also carried out as part of this step by the design consultant. The independent review consultant also made a reconnaissance visit on October 4, 2019.

Alternative Assessment. Alternative assessments were done for the site and technology selection of Mansehra GS, alignment for the transmission line avoiding Pallas valley, alternative TL voltage selection. Alternative analysis was done using various criteria, such as, technical robustness, cost, environment friendly and socially benign, maintenance ease, etc.

Review of Secondary Data. Available secondary data on various aspects of physical, biological, and socioeconomic environment were identified and reviewed. These included published and unpublished reports and books of private and government organizations, gazetteers, research articles, popular articles, and newspapers. The physical environmental aspects included geology, topography, water resources, and meteorology. The biological aspects included presence and condition of various species and their habitat in the study area and information about species of concern. The socioeconomic aspects included administrative setup, demography, literacy and education, agricultural data, land holdings, land use, gender, and poverty.

Baseline Condition: Based upon the review of secondary resources discussed above, need of the primary data collection was determined and the design consultant prepared detailed checklists and methodologies developed for each aspect of physical, biological, and socioeconomic environment. Subsequently, separate field teams were deployed to collect primary data on physical environment such as land form and land use, air and water quality; biological aspects such as vegetation cover, habitat condition and prevailing trends as well as threats to the key floral and faunal species, and identification of key biological receptors (species, habitats) likely to be affected by the project; and socioeconomic aspects such as land holdings, agricultural practices, earning levels, household size, education status, common infrastructures, and others. Secondary information related to the baseline environmental conditions in the project area was also collected from the district level government agencies. Current practices of occupational health and safety (OHS) of various contractors working in Pakistan (e.g., Dasu Hydropower Project) and in the region were also considered as the baseline OHS status in the country. Lessons learnt from other projects are also taken into consideration in the design of preventive actions in this ESIA.

Stakeholder Consultations: Stakeholder consultations were done in carried out in two stages. In the first stage consultations were carried out with local communities, through village level meetings (68 villages) to share the project information, to obtain feedback from the communities about the project and its perceived impacts, and to collect anecdotal information on environmental, ecological, and socioeconomic baseline in the study area. Separate consultations were carried out with women of the study area to obtain their views and concerns regarding the project. Consultations were also conducted with district level

government departments and nongovernment organizations (13 organizations) to obtain their views on the project. One national stakeholder consultation in Islamabad and two Public Hearings, one in District Attock and the second one in District Battagram were also organized. A total of 2,151 people consulted in different courses of the project preparation. The second stage consultations were carried out after public disclosure of the ESIA was conducted in Mansehra and Besham on October 29-30, 2019.

Impact Assessment. This was the most important step of the entire study and involved using standard methodology to identify and characterize each potential impact of the project on various aspects of physical, biological, and socioeconomic environment and occupational hazard risks during construction and operation and maintenance phases. Based on its nature and likelihood of occurrence, significance of each potential impact was assessed as severe, moderate, mild, or negligible. Subsequently, appropriate avoidance, mitigation, or compensatory measures were identified, in this order of preference, to address each potential impact. On the other hand, potential hazard risks and their likelihood and consequence was determined as high, serious, medium, low or eliminated. Finally, significance of residual impacts and hazard risks, i.e., significance of impact and hazard risks after the implementation of mitigation measures and preventive actions, was determined.

Environmental and Social Management: An environmental and social management plan (ESMP) has also been prepared to define prequalification criteria and obligation of the Contractors, institutional arrangements of all stakeholders, monitoring mechanism, and capacity building arrangements to effectively implement the mitigation measures and preventive actions identified during the ESIA study. The ESMP also considered a project induced labor influx management to address cumulative impacts, skill development for the local population as a pre-requisite for the contractors prior to employ them, and a plantation program (planting of saplings five times the number of trees cut) to compensate the trees cut.

1.4.4 Study Team

The Consultant report was reviewed/written and finalized by Independent Review Consultants consisting of Dr. Mohammad Zaman (Social and Resettlement Expert) and Dr. Masud Karim (Environment, Health & Safety Expert).

Baseline information was collected by a team lead by Ahtasham Raza and comprised of Ibrahim Atiq Raza (Environmental Engineer), Hassan Ilyas (Social and Environmental Baseline Expert), Adnan Sharif (Social and Environment Survey Exert), Sami Ullah Khan (Ecological Survey), Syed Hasnain Raza (Wildlife and Ecological Survey), Zarak Khan (Social Survey), Naveed Ali (Social Survey), Zeeshan (Socioeconomic Baseline) and Asim Rizwan (GIS Expert).

NTDC's Environment and Social Impact Cell provided additional assistance and support including the disclosure of ESIA and RAP documents at the district level.

1.4.5 Document Structure

Chapter 2 reviews the prevailing national and provincial regulatory requirements and World Bank policies and guidelines relevant to environmental and social assessment. Analysis of alternatives considered during project planning and design are explained in **Chapter 3**. **Chapter 4** presents a simplified description of the project, its various components and other salient information relevant to environmental and social and hazard risks assessment. Description of the environmental, biological, and socioeconomic baseline conditions is presented in **Chapters 5** and **6**, respectively. Potential impacts of the project

on environment and people and OHS hazard risks as well as their appropriate mitigation measures and preventive actions have been discussed in **Chapter 7**. Cumulative impacts of DTL project along with other future projects in the project area are covered in **Chapter 8**. **Chapter 9** presents the environmental and social management plan (ESMP) including, occupational health and safety. Finally, **Chapter 10** describes the consultations that were carried out with the stakeholders during the ESIA study and disclosure of the draft ESIA.

2 REVIEW OF POLICY AND REGULATORY FRAMEWORKS

This Chapter provides an overview of the federal and provincial legislation and regulations as well as the related institutional frameworks relevant to environment and social assessment, occupational health and safety, and workers' rights of the proposed DTL project. Also discussed are the World Bank's environmental and social safeguard policies and General Environmental, Health and Safety Guidelines relevant to the proposed project.

2.1. Constitution of the Islamic Republic of Pakistan, 1973

The Constitution ensures the "right to life" and the "right to dignity" under Articles 9 and 14. According to these Articles, the right to clean environment is a fundamental right of all citizens of Pakistan, as defined by the Supreme Court of Pakistan. In addition, the Constitution also supports the "promotion of social justice and eradication of social evils" (paragraph 37) and requires that the state makes "provision for securing just and humane conditions of work, ensuring that children's and women are not employed in vocations unsuited to their age or sex, and for maternity benefits for women in employment" (Paragraph 37(e)).

Article 24 clearly addresses the protection of property rights that it includes "no person shall be compulsorily deprived of his property in accordance with law" and "no property shall be compulsorily acquired or taken possession for a public purpose, and by the authority of law which provides for compensation" therefore and either fixes the amount of compensation or specifies the principles on and the manner in which compensation is to be determined and given. Further, Article 4 (sub-clause/a of 1) reiterates the legislative right of the people by stating that: "No action detrimental to the life, liberty, body, reputation or property of any person shall be taken except in accordance with law.

2.2. Applicable National and Provincial Acts

2.2.1. 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).

2.2.2. Khyber Pakhtunkhwa-EPA 2014 and Punjab-EPA 1997 (Amended 2012)

The Khyber Pakhtunkhwa Environmental Protection Act 2014 (KP-EPA 2014) and Punjab Environmental Protection Act of 1997 (Amended 2012) are the provincial versions of the Pakistan Environmental Protection Act, 1997 (PEPA) relevant to the proposed project. Responsibility for PEPA was transferred from the federal government to the provincial governments by an amendment to the Constitution of Pakistan in 2010. The provincial versions continue to remain materially the same as the PEPA except where governmental bodies are referred. The following key features of the provincial Acts have a direct bearing on the proposed project:

Section 11 (Prohibition of Certain Discharges or Emissions) states that "Subject to the provisions of this Act and the rules and regulations made there under, 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 12-I (Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA)) requires that "No proponent of a project shall commence construction or operation unless he has filed with the EPA 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."

Section 12-2b (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 14 (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 15 (Regulation of Motor Vehicles): Subject to provision of this clause of the Act and the rules and regulations made there under, 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 17 (Penalties): Whoever contravenes or fails to comply with the provisions of section 11, 12, 13, or section 16 or any order issued there under 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 18 (Offences by Bodies Corporate): Where any contravention of this Act has been committed by a body corporate, and it is proved that such offence 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 officer of the body corporate, such director, partner, manager, secretary or other officer of the body corporate, shall be deemed guilty of such contravention along with the body corporate and shall be punished accordingly.

2.2.3. 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 office in Haripur that no such areas are present within the Project Area of Influence (AOI).

2.2.4. Khyber Pakhtunkhwa Wildlife Protection, Preservation, Conservation and Management Act (1975) (the KP Wildlife Act) and Punjab Wildlife (Protection, Preservation, Conservation and Management) Act, 1974

The provincial Wildlife Acts have been established to provide direct protection to the provinces' wildlife resources and indirect protection to other natural resources. Wildlife is categorized by degree of protection, i.e. animals that may be hunted on a permit or special license, and species that are protected and cannot be hunted under any circumstances. Restrictions are also established for hunting and trade in animals, trophies, or meat. Categories of wildlife protected areas are also formalized and include National Parks, Wildlife Sanctuaries, and Game Reserves. These Wildlife Acts. Although no protected areas are present in the Project area, species captured in the scope of the legislation are present and include Grey Partridge (Grey francolin) and Black Partridge (Black Francolin), the hunting and poaching of which is prohibited.

2.2.5. 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 prior permission of the Forest Department is obtained. ESIA has been prepared in consistence with this Act. Contractor will have to comply with this Act.

2.2.6. Mineral Development Act (1948)

This legislation provides regulatory procedures for the quarrying and mining of construction material on public as well as private lands. The contractor will have to comply with this Act.

2.2.7. Antiquity Act (1975)

The Antiquities Act of 1975 ensures the protection of cultural resources in Pakistan. The act is designed to protect defined "antiquities" from destruction, theft, negligence, unlawful excavation, trade and export. Antiquities have been defined in the Act as ancient products of human activity, historical sites, or sites of anthropological or cultural interest and national monuments. The law prohibits new construction in the proximity of a protected antiquity and empowers GoP to prohibit excavation in any area which may contain articles of archaeological significance. The guideline procedure for Environment Assessment recommended by the KP-EPA reads as follows: **"**If the proponent or the consultant identifies an archaeological site that appears to be of importance but the site is not listed they should discuss the site with the relevant conservation authority**"**.

"The relevant conservation authority should inform the Responsible Authority of their assessment of the significance of the likely impact of the proposed development early in the process, in order for the Responsible Authority to determine the level of documentation required. The KP-EPA will then be in a position to review the level of reporting required in the light of advice from the Archaeology Department**"**. There are no known antiquities in the project area. Chance Find procedures have been included in this ESIA. Contractor will have to comply with this Act.

2.2.8. Factories Act, 1934 (as amended to 1997)

The clauses relevant to the project are those which concern 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 DTL 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 impurity 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 impurity, 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 there from 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 whole-some drinking water.

2.2.9. Punjab Occupational Safety and Health Act, 2019

This Act covers occupational safety and health of the persons at workplace and to protect them against risks arising out of the occupational hazards; to promote safe and healthy working environment catering to the physiological and psychological needs of the employees at workplace and to provide for matters connected therewith or ancillary thereto.

2.2.10. Punjab Industrial Relations Acts (2010)

These Acts seek to regulate 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.

2.2.11. KPK Factories Act, 2013

This act provides regulation for labor rights in factories of the Province of KPK and for matters connected to their safety, basic welfare facilities including living, food, occupational health including infectious diseases and protection from those infectious diseases; it also covers the work related hazards and protection from those hazards, shelters facilities during rest time, restriction of working hours and holidays rules etc.

2.2.12. Pakistan Explosives Act (1908)

The Pakistan Explosive Act of 1908 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. The contractor will have to comply with this Act.

2.2.13. KPK Explosive Act, 2013

This Act is expedient to regulate the manufacture, possession, use, sale and transportation of explosives in the Province of the KPK.

2.2.14. KPK Workers Compensation Act, 2013

This act is expedient to provide for the payment by certain classes of employers to their workers or their legal heirs of compensation for injury or death by accident.

2.2.15. Employment of Children Act (1991)

Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mines or any other hazardous employment. In accordance with this Article, the Employment of Child Act (ECA) 1991 disallows child labor in the country. The ECA defines a child to mean a person who has not completed his/her fourteenth years of age. The ECA states that no child shall be employed or permitted to work in any occupation set forth in the ECA (such as transport sector, railways, construction, and ports) or in any workshop wherein any of the processes defined in the Act is carried out. The processes defined in the Act include carpet weaving, beeri (type of cigarette) making, cement manufacturing, textile, construction and others).

2.2.16. KP Bonded Labour 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.

2.2.17. 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.

2.2.18. Telegraph Act, 1885

The first is the Telegraphic Act of 1885. This law was enacted to define the authority and responsibility of the Telegraph authority. Under this Act, the land required for the towers is not acquired from the owner, nor the title of the land transferred. Compensation is only paid to the owner for any structure, crop or tree that exists on the land. NTDC has been installing the transmission lines and their towers, and determining the associated compensation, on the basis of this Act.

2.2.19. Land Acquisition Act, 1894

The LA Act of 1894 is the principal legal instrument for land acquisition for public purpose project in Pakistan. The Act lays down detailed procedures for acquisition of land and payments of compensation, but short fall of the standards required in terms of replacement costs and other support such as resettlement and livelihood aspects associated with displacement. The Act has 55 sections with a long-drawn process that requires, as experiences suggest, two or more years for land acquisition. Further, the Act does not provide for equal or enhanced living standards to the project affected persons. Due to the challenges encountered during the application of the Law, NTDC authorities are becoming also more cognizant of the limitations of the law and its coherence with other international standards and the need to ensure its consistency with the provisions of the World Bank policies.

2.2.20. WAPDA Act, 1958

The WAPDA Act of 1958 is the other relevant legal framework, which allows "right of entry" for the purpose of construction - for instance, (i) survey of any land, erect pillars erect pillars for the determination of intended lines of works, make borings and excavations and do all other acts which may be necessary for the preparation of any scheme; and (ii) pay or tender payment for all necessary damage to be done as aforesaid. The Act further states that "in case of dispute as to the sufficiency of the amount so paid or tendered, the dispute shall be referred to the Deputy Commissioner (DC) of the district whose decision shall be final."

The Telegraphic and the WAPDA Act mentioned above provide the basis for the legal framework used in the DTL Project. The use of the Telegraphic Act of 1885 as the legal instrument is justified by the fact that there is no land acquisition foreseen for the DTL project. Compensation is paid for loss of structures, crops and trees, allowances are foreseen to restore the livelihood of affected people and vulnerable groups but no land ownership change takes place. Past WB transmission line projects in Pakistan have also used the Telegraphic Act of 1885 as the basic legal framework for access to land for construction and maintenance purposes.

2.2.21. NTDC Practice, Framework for LA and Valuation

For transmission line projects, NTDC uses the 1885 Telegraphic Act and avoids any acquisition of land; instead of permanent acquisition, land is required temporarily and all kinds of losses are considered for compensation. The Dasu Transmission Line Project (DTL) has taken this approach. However, for substation such as the Mansehra GS, there is need for permanent land acquisition. Therefore, as evident, NTDC as a public entity used two modes or models to require and/or acquire land as needed.

For the Mansehra GS that involves land acquisition, NTDC will follow the national legal framework (i.e. LA Act of 1894) to acquire and "freeze" the land area by Section 4/1894 Act for project development through the use of "eminent domain." The application of the Act helps to secure the availability of land without dispute. The rest of the processed – for example, compensation rate etc. are determined through consultation and negotiations, taking into consideration of the market value and other associated costs. The application of the LA Act (1894) remains limited to notification by the District Collector of the intend for acquisition for public purpose project. The rest is carried out through private negotiation after invoking Sect 4 of LAAA of 1894.

Following the notification, NTDC will constitute, as per the NTDC Guidelines, a five-member committee to purchase private land through negotiation for the Mansehra GS (The

same practice was applied in the Islamabad West Sub-station funded by the World Bank, see No.MD/NTDC/3837-47). The processes work out as follows.

- First, the NTDC Committee engages with the land owners.
- Second, NDTC has qualified technical and field staff mostly on deputation from the revenue department to carry out valuation of assets.
- Third, once the land is identified, the value of land is determined by the Committee through a series of meeting and negotiations with individual owners and community-level meetings.
- Fourth, if there is any building, crop, fruit bearing trees or any other immovable structure on the land, then its value assessed is referred to the concerned departments/agencies.
- Fifth, NTDC/ PMU employs patwaris (surveyors) to assist the Committee to determine boundaries, location, size and area of the land to be purchased. Patwari will prepare land record including ownership genealogy, rights and interests held in the land, and, estimated value of improvements to land in consultation with the landowners. This is typically done over a period of several months.
- Sixth, following the completion of the valuation of assets for negotiation (includes land, crops, trees, and other assets as well as compensation package and entitlements, the compensation payment is deposited in the DC office.
- Finally, in case the negotiations fail, and parties do not agree on rates, the LA Act (1895) will be used fully to complete the entire acquisition process. The land which will be acquired under this policy will be registered in the name of NTDC.

2.3. National Policies

Pakistan has in place a comprehensive constitutional, policy, and legislative framework for the protection of the environment and people. This section is structured around the constitutional foundation and legislative hierarchy. An overview of relevant national policies is presented, followed by separate discussion of national and provincial environmental and social legislation applicable to the Project and supporting guidance documents. National and provincial regulatory authorities with mandate to oversee implementation of and compliance with, environmental and social legislation are introduced at the end of the section.

2.3.1. National Conservation Strategy (1992)

The Pakistan National Conservation Strategy is the principal policy document for environmental issues in the country and was developed and approved by the Government of Pakistan on March 01, 1992.

The NCS deals with 14 core areas:

- Maintaining soils in cropland
- Increasing irrigation efficiency
- Protecting watersheds
- Supporting forestry and plantations
- Restoring rangelands and improving livestock
- Protecting water bodies and sustaining fisheries
- Conserving biodiversity

- Increasing energy efficiency
- Developing and deploying material for renewable energy
- Preventing/abating pollution
- Managing urban wastes
- Supporting institutions for common resources
- Integrating population and environmental programs
- Preserving cultural heritage

This ESIA considers impacts on all relevant environmental issues specified in this Strategy.

2.3.2. National Environmental Policy (NEP) (2005)

The NEP was implemented in 2005 to provide an overarching framework for addressing Pakistan's environmental issues. It provides directions for addressing sectorial issues and provides a means for promoting conservation and environmental protection in water, air and waste management, forestry, and transport. The NEP aims to promote protection of the environment, the honoring of international obligations, sustainable management of resources and economic growth. The present ESIA has been prepared in consistence with this Policy**.**

Objectives of the NEP include, amongst others, efficient management and conservation of existing water resources, optimal development of potential water resources and improved flood control and protective measures. Protection of water resources has been considered in this ESIA.

2.3.3. National Forest Policy 2010 (NFP)

The NFP establishes the policy framework for the restoration, development, conservation and sustainable management of forests and allied natural resources. It seeks to ensure the sustainability of ecosystem functions, services and benefits for present and future generations.

Protection of forest resources has been considered in this ESIA.

2.3.4. National Resettlement Policy (NRP) (drafted 2002; not adopted to date)

Resettlement and compensation rights of people affected by development projects are presently covered by the Pakistan Land Acquisition Act which dates from 1894. The NRP is being developed to update Pakistan's policy on resettlement and compensation and bring it into line with international standards. The aims of the NRP include:

- To ensure the consistent treatment of resettlement issues throughout Pakistan
- To ensure project affected persons (APs) are appropriately compensated for lost assets and income
- To provide development opportunities to all vulnerable groups
- To ensure that APs share the social and economic benefits of projects.

The NRP will be supplemented by the Project Implementation and Resettlement of Affected Persons Ordinance (PIRAPO) which is to be enacted by provincial and local governments. However, the draft NRP specifies that the PIRAPO shall be supplementary to rather than a replacement for, the Land Acquisition Act and other established laws relevant to land acquisition and resettlement. A RAP has been prepared for the proposed project, broadly consistent with this Policy.

2.3.5. National Climate Change Policy, 2012

In September, 2012 Government of Pakistan launched its National Climate Change Policy. Environmental assessment is integrated in the preamble of the policy. The policy commits for taking appropriate measures for mitigation and adaptation to climate change through tools of environmental assessment. The present ESIA has been prepared in consistence with this Policy.

2.3.6. Punjab Labour Policy, 2018

This Policy deals with labor standards, social dialogue, improvements in workplace safety, living wages, child/ bonded labor, awareness raising, excellence in labor inspections regime, imparting quality technical trainings through well-improved Training Centers, simplification of labor laws, medical facilities for secured workers even after retirement, establishment of labor colonies and schools for workers' children, efficient disbursement of welfare grants and gradual extension of labor protection frame-work.

2.3.7. National Power Policy 2013

The policy aims to build a power generation capacity that can meet Pakistan’s energy needs in a sustainable manner. It further envisages creating a cutting edge transmission network, minimizing financial losses across the system and aligning the ministries involved in the energy sector and improving governance. The project is being implemented in pursuance with the core objectives of this Policy.

2.3.8. National Water Policy 2002 (NWP)

Objectives of the NWP include, amongst others, efficient management and conservation of existing water resources, optimal development of potential water resources and improved flood control and protective measures. Protection of water resources has been considered in this ESIA.

2.3.9. Punjab Labour Policy, 2018

This Policy deals with labor standards, social dialogue, improvements in workplace safety, living wages, child/ bonded labor, awareness raising, excellence in labor inspections regime, imparting quality technical trainings through well-improved Training Centers, simplification of labor laws, medical facilities for secured workers even after retirement, establishment of labor colonies and schools for workers' children, efficient disbursement of welfare grants and gradual extension of labor protection frame-work.

2.3.10. Policy and Procedures for the Filing, Review and Approval of Environmental Assessments (1997)

These Guidelines define the policy context and the administrative procedures that govern the environmental assessment process, from the project prefeasibility stage to the approval of the environmental report. Requirements for the preparation of an Environmental Management Plan (EMP) are also covered. An EMP is defined as a “document designed to ensure that the commitments in the Environmental Report, subsequent review reports, and Environmental Approval conditions are fully implemented” and is “usually finalized during or following detailed design of the proposal, after Environmental Approval of the development application”. The ESIA has been prepared in compliance with this policy.

2.4.Regulations

2.4.1. Pakistan EPA (Review of IEE and 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 includes 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. Under the IEE/EIA Regulations 2000, hydropower projects with a generation capacity more than 50 MW and transmission line projects of more than 11 kV fall into Schedule II. The proposed project is therefore classified as a Schedule II project and hence an EIA is required to be carried out.

National guidelines for undertaking EIA in accordance with the IEE/EIA Regulations 2000 include the Policy and Procedures for Filing, Review and Approval of Environmental Assessments, 1997 and Guidelines for the Preparation and Review of Environmental Reports, 1997.

2.4.2. Guidelines for Sensitive and Critical Areas, 1997

These Guidelines establish environmental assessment procedures (including formal checklists) that are to be followed by projects that are located within or near to officially protected areas in Pakistan. Officially protected areas include those designated to protect critical ecosystems such as biosphere reserves, national parks, wildlife sanctuaries and preserves, and archaeological sites. No protected areas are located within or in the vicinity of the Study Area (1 km wide corridor along the DTL route).

2.4.3. Guidelines for Public Consultation, 1997

The Guidelines for Public Consultation cover approaches and techniques for effective public consultation. An effective consultation strategy is considered to be one that captures the views of all major stakeholders, allowing for the incorporation of concerns in the impact assessment.

Consultations have been carried out during EIA preparation in accordance with these Guidelines

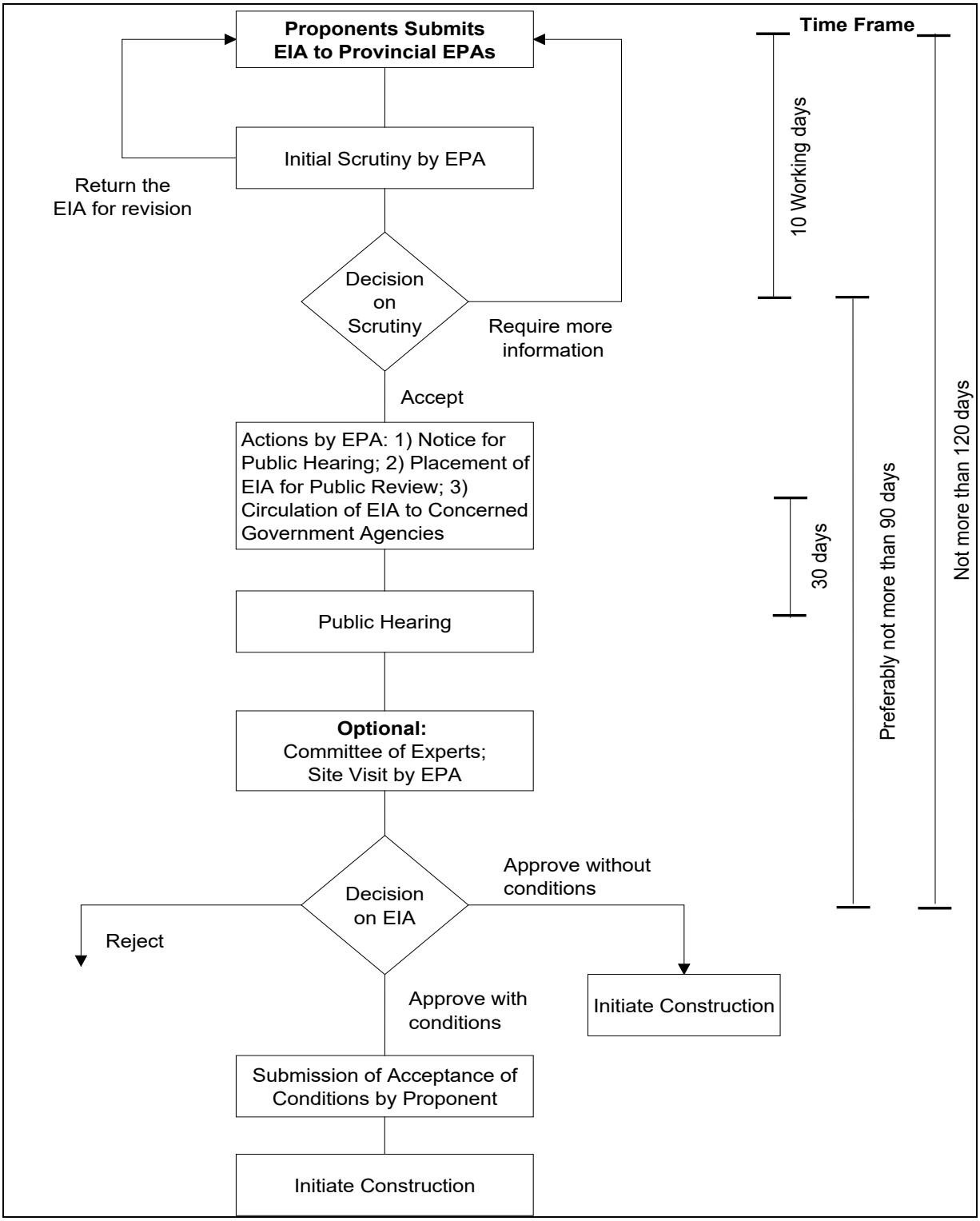

Figure 2-1: EIA Review and Approval Process in Pakistan

2.4.4. KP/Punjab Minimum Wages for Unskilled Workers ordinance (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.

2.5.National Environmental Quality Standards, 2012

Powers for regulating Environmental Quality Standards (EQS) transferred from the national government to the 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). The proposed project will comply with these standards.

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.

2.6.International Treaties and Conventions

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

- Convention on the Conservation of Migratory Species of Wild Animals
- Convention on International Trade in Endangered Species (CITES),
- Convention on Wetlands of International Importance
- 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 and 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.

2.6.1. Convention on Conservation of Biological Diversity

The Convention on Biological Diversity (CBD) known informally as the Convention, is an international legal binding treaty. The Convention has three main goals:

a. Conservation of biological diversity,

b. Sustainable use of its component, and

c. Fair and equitable sharing of benefits arising from genetic resources.

The CBD objective is to develop national strategies for conservation and sustainable development. Pakistan ratified the Convention during July 1994 and become part of the treaty with national responsibility to abide by its obligations. Its overall objective is to encourage actions that will lead to a sustainable future.

2.6.2. Aichi Biodiversity Targets

Aichi Targets are commitments within the Strategic Plan for Biodiversity 2011– 2020, which has a mission to "take effective and urgent action to halt the loss of biodiversity" (CBD 2017b). In the avian risk, urgent actions during construction and operation phases with special reference to DTL are required to minimize the loss of biodiversity.

2.6.3. Convention on the Conservation of Migratory Species

The Convention on the Conservation of Migratory Species 3 of Wild Animals also known as CMS or Bonn Convention, aims to conserve terrestrial, aquatic and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nation Environment Program concerned with the conservation of wildlife and habitat on global scale. Since the convention's entry into force in 1983, its membership has grown to include 199 parties. Pakistan became member of the Convention during September 1987. Migratory species threatened with extinction are listed in Appendix A of the Convention. The parties strive towards strictly protecting these animals, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them.

2.7. World Bank Safeguard Guidelines and Policies

2.7.1. World Bank Environmental, Health and Safety Guidelines

World Bank Group's Environmental, Health, and Safety (EHS) Guidelines are applicable to the proposed project. In particular, contractors will be required to implement the General EHS Guidelines (April 2007)[5], the EHS Guidelines for Electric Power Transmission and Distribution (April 2007)[6], and the EHS Guidelines for Construction Materials Extraction (April 2007).

The World Bank has also produced environmental and social publications relevant to project financing. Those relevant to the Project are:

- Environmental Assessment Sourcebook, Volume I: Policies, Procedures, and Cross-Sectoral Issues (1991)
- Environmental Assessment Sourcebook, Volume II: Sectoral Guidelines. Technical Paper 140. (1991)
- Social Analysis Sourcebook.

2.7.2. World Bank Safeguard Policies and Requirements

The project proponents seeking financing from the World Bank are required to comply with the applicable environmental and social safeguard policies. A summary of the key objectives of the relevant safeguards policies considered for the Project is provided in the sub-sections below.

2.7.2.1. OP 4.01 - Environmental Assessment

The World Bank requires environmental assessment (EA) of projects proposed for Bank funding and thus to improve decision-making. The OP 4.01 defines the EA process and various types of EA instruments. The OP 4.01 defines the requirements for environmental (and social) assessments for World Bank funded projects. It describes environmental screening processes in order to define projects as category A, B, or C, where category A projects are likely to have significant impacts, category B projects are likely to have less significant impacts, and category C projects have minimal impacts. The OP includes a range of environmental assessment and management tools relevant to different impact category projects and defines the requirements for public consultant and disclosure.

In consideration of the likely impacts of the Project and in discussion with the World Bank, it is concluded that the Project falls into Category A[7] due to its association with the DHP. It therefore requires a detailed environmental impact assessment and development and implementation of an environmental and social management plan (ESMP).

The present ESIA has been carried out in accordance with this Policy, to identify the extent and consequences of these impacts and to develop an ESMP for their mitigation.

2.7.2.2. OP 4.04 - Natural Habitats

The policy recognizes the importance of natural habitat in sustaining biodiversity, and requires that projects strictly avoid their significant conversation or degradation

[5] World Bank Group EHS Guidelines are available at: http://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES

[6] These are under revision and the ESA team will monitor draft documents to anticipate any future requirements that may be applicable.

[7] Projects expected to have significant adverse social and/or environmental impacts that are diverse, irreversible or unprecedented.

(particularly for critical natural habitat), and minimize and mitigate impacts to them including, as appropriate, through creation of offsets and restoration measures. This policy is triggered by the project.

This policy is triggered in the original DHP and is also relevant to the DTL as the transmission line route passes through some diverse and sensitive habitats and the project has a potential to affect these habitats, associated key species, and also migratory birds. In response to the requirements of this OP, detailed baseline studies have been carried out along the DTL alignment, detailed assessment of potential impacts on these resources has been carried out including Avian Risk Assessment as part of this ESIA, and appropriate mitigation as well as control measures included in the ESMP.

2.7.2.3. OP 4.09 - Pest Management

This OP aims to minimize and manage the environmental and health risks associated with pesticide (agro-chemicals) use and promote and support safe, effective, and environmentally sound pest management.

This OP is not triggered since no agro-chemicals will be procured and or used as part of this project. NTDC does not use pesticides/agro-chemicals for clearing ROW of TL

2.7.2.4. OP 4.10 - Indigenous Peoples

This OP requires that any development project must fully respect the dignity, human rights, economies, and cultures of Indigenous Peoples.

The 'Indigenous Peoples' refer to a distinct, vulnerable, social and cultural group possessing the characteristics in varying degrees, such as (a) self-identification as members of a distinct indigenous cultural group and recognition of this identity by others; (b) collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories; (c) customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and (d) an indigenous language, often different from the official language of the country or region. Thus, the indigenous people refer to a group that has lost "collective attachment to geographically distinct habitats or ancestral territories in the project area.

No Indigenous Peoples as defined in the Policy are known to exist in the study area therefore this OP is not triggered.

2.7.2.5. OP 4.11 - Physical Cultural Resources

This OP seeks to preserve physical cultural resources (PCRs) and avoid their destruction or damage. It encompasses resources of archaeological, paleontological, historical, architectural and religious (including grave yards and burial sites), aesthetic, or other cultural significance.

This policy is also triggered in the original DHP and is also applicable to this additional finance for DTL and Manshera Grid Station. However, no known PCRs are known to exist in the study area nor identified during the field investigations and consultations. Furthermore, since excavation is involved in this project, discovery of any 'chance finds' cannot be ruled out. Chance Find procedures included in the ESMP.

2.7.2.6. OP 4.12 - Involuntary Resettlement

This OP establishes requirements of the World Bank for managing involuntary resettlement. Involuntary resettlement should be avoided where possible. Where the

acquisition of land or other assets is necessary, the Policy sets out requirements for participation in resettlement planning, mandates compensation for assets at replacement cost, and expects to see that incomes and standards of living of affected persons are improved or at least restored to what they were prior to displacement.

The DTL construction works will result in resettlement impacts including damage to assets such as crops and structures; hence this OP is triggered and a RAP has been prepared (provided under separate cover).

2.7.2.7. OP 4.36 - Forests

This policy recognizes the need to reduce deforestation and promote sustainable forest conservation and management in reducing poverty. Pakistan has forests only covering 2.0 percent of its territory and annually the forested area decreases with 2.5 percent. North Pakistan (including Kohistan) is covered for 29 percent by forests.

This policy is triggered in the original DHP project. Therefore, this policy is also applicable to this project.

2.7.2.8. OP 4.37 - Safety of Dams

The OP 4.37 requires competent design and construction supervision to implement dam safety measures through the project cycle. The policy applies to projects that depend on the safe functioning of existing dams as well as to projects that involve construction of new dams. The policy also recommends measures to strengthen the institutional, legislative, and regulatory frameworks for dam safety programs.

This OP is triggered in the original DHP project and so is applicable for additional finance as well. However, it is not relevant to the different components of the additional finance.

2.7.2.9. OP 7.50 - Projects on International Waterways

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.

This OP is triggered in the original DHP project and so is applicable for the proposed additional finance as well.

2.7.2.10. OP 7.60 - Projects in Disputed Areas

The World Bank will only finance projects in disputed areas when either there is no objection from the other claimant to the disputed area, or when the special circumstances of the case support financing notwithstanding the objection.

This OP is not triggered since no disputed areas as defined under this OP exist within or adjacent to the study area.

2.7.2.11. BP 17.50 - Public Disclosure of Information

The BP 17.50 sets out the World Bank policy on disclosure of information. It is a mandatory procedure to be followed by the borrower and Bank and supports public access to information on environmental and social aspects of projects.

In response to these requirements, the present ESIA (and other safeguard documents including RAP and SIA) will be disclosed internationally as well as locally.

2.7.3. Applicability of World Bank Safeguard Policies

The applicability of environmental and social safeguard policies of the World Bank is summarized in **Table 2.1**.

Table 2-1: Applicability of WB Safeguard Policies

WB Operational Policies		Triggered		Justification/Action Taken or to be Taken/Relevance to the Project
		Yes	No	
Environmental Assessment	OP/BP/GP 4.01	✓		The project has a potential to cause widespread and significant impacts hence this OP is triggered and project is assessed as Category A. The present ESIA (and also RAP provided under separate covers) has been prepared in response to this OP.
Natural Habitats	OP/BP 4.04	✓		This policy is triggered since the DTL route passes through some diverse and sensitive habitats and the project has a potential to affect these habitats, associated key species, and also migratory birds. In response to the requirements of this OP, detailed baseline studies have been carried out along the DTL alignment, detailed assessment of potential impacts on these resources has been carried out including Avian Risk Assessment as part of this ESIA, and appropriate mitigation as well as control measures included in the ESMP.
Pest Management	OP 4.09		✓	The Project does not require the use of pesticide (or other agro-chemicals). This includes maintaining of the RoW beneath the power evacuation lines. NTDC does not use pesticides to maintain RoW.
Indigenous Peoples	OP 4.10		✓	There are no distinct, vulnerable, social and cultural groups in the project/study area which could qualify as indigenous.
Physical Cultural Resources	OP 4.11	✓		No known PCRs are known to exist in the study area nor identified during the field investigations and consultations. The Chance Find procedures are included in the ESMP.
Involuntary Resettlement	OP/BP 4.12	✓		The DTL construction works will result in resettlement impacts including damage to assets such as crops and structures; hence this OP is triggered and a RAP has been prepared (provided under separate cover).
Forests	OP/BP 4.36	✓		There will be no disruption to forests as a result of the Project.
Safety of Dams	OP/BP 4.37	✓		The Project does not include any dam construction or maintenance.

WB Operational Policies		Triggered		Justification/Action Taken or to be Taken/Relevance to the Project
		Yes	No	
Projects on International Waterways	OP/BP/GP 7.50	✓		No project activities will be carried out inside or associated with any international waterways nor will the project impact any of such waterways.
Projects in Disputed Areas	OP/BP/GP 7.60		✓	The Project is not located in or near any disputed area.
Access to Information	BP 17.50	✓		Consultations with various stakeholders including affected communities were carried out during ESIA study. The draft ESIA (and other safeguard documents) was disclosed at NTDC and World Bank website on November 22, 2019 and through two public consultations at Mansehra and Besham during October 29-30, 2019. The executive summary of this ESIA will be translated into Urdu and will be disclosed at NTDC website and will be made available to the local communities.

3 Analysis of Alternatives

This chapter describes the alternatives considered during project planning and design phase and analyzes their technical robustness, economic, social, and environmental consequences.

3.1 Without Project Alternative

It is obvious that with the increase in population, the demand for electricity also increases. An annual population growth rate of about 3.4 percent may well depict the pressing need of a larger electrical system. Moreover, the power evacuation from the Indus river hydro power projects (i.e., Dasu HPP, T5HP) is of major concern. All the development projects in general and industrial and agriculture development projects in particular, demand a sustainable and strong electrical system. In order to achieve the economic growth and reduction in poverty, it is essential to ensure a reliable power supply to an increasing number of industrial, agricultural, commercial, and domestic consumers. The proposed project has therefore been prepared to meet the requirement which will also result in overall power efficiency and stability to deliver adequate and quality power to the consumers and also sustainable power evacuation from the Indus river power cascade.

The Dasu Hydropower Project (DHP) of 5,400 MW capacity and Tarbela 5 Expansion of 1,410 MW are under implementation and there are no existing transmission lines and grid stations to evacuate generated power to the national grid. Hence, it is essential to have a new transmission line to evacuate the power from DHP to the nearest grid station and connect to the national grid.

In the light of above discussion, it can be easily assessed that “No Project Option” will not only be an impediment in the national economy but will also have a negative effect on local and regional development and quality of life.

3.2 Alignment Alternatives for the Transmission Line

3.2.1 Alignment Proposed in Master Plan Feasibility Study

The feasibility study (also known as master plan study) commissioned by NTDC for power evacuation from cascade of hydropower projects on Indus River, a tentative alignment of transmission line from Dasu to Pathar Garh near Islamabad was proposed. The alignment is shown in **Figure 3.1**.

This alignment travels over a distance of about 250 km and runs parallel to the Indus River till Pattan. From there, the proposed corridor proceeds through the lower Palas valley and passes the districts of Battagram, Mansehra, Abbottabad, Haripur passing east of Tarbela Dam towards Pathar Garh, situated near Hasan Abdal in District Attock, Punjab. The crossing through Palas valley could be environmentally sensitive, since this area is an Important Bird Area (IBA) declared by Bird Life International. Palas valley is also known for its rich biodiversity and is considered to be an environmental hotspot.

To mitigate the above impacts, the alignment of the proposed transmission line has been adjusted to avoid the Palas valley and pass along the Indus River.

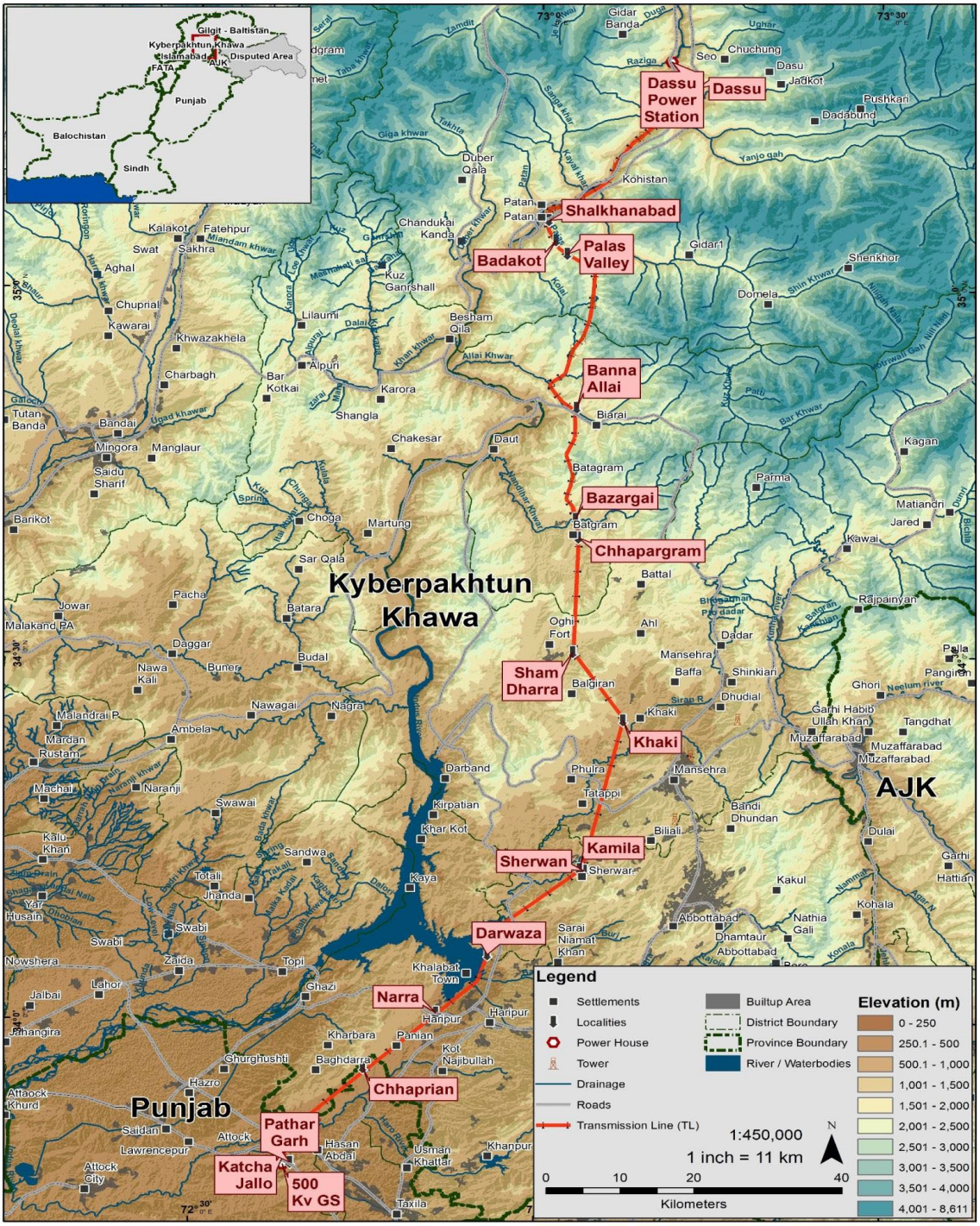

Figure 3-1: DTL Alignment as per Master Plan

3.2.2 Alternatives of 765 kV DTL Alignment Considered during Design

For selection of final alignment for 765 kV transmission line, various alignments were studied. For the purpose of analysis of alternatives, the alignment has been divided into three sections as follows:

1. Dasu to Besham
2. Besham to Mansehra
3. Mansehra to Islamabad

This division has been done primarily with respect to the type of terrain that exists along the DTL route. A brief description of these DTL sections is provided below.

3.2.2.1 Dasu - Besham

The Dasu to Besham area consists of very high elevation and steep mountains. The tower footprint elevations ranges from 850 to 950 m amsl. The design team has tried to keep the DTL alignment at low elevations along the Indus River and Karakoram Highway to ensure easier access to the RoW. Though this section has less population Issues, but this is the most difficult part with respect to the constructability of the transmission line primarily because of the steep slopes where most of the towers are located.

3.2.2.2 Besham - Mansehra

The Besham to Mansehra section of the DTL route consists of high elevation but less steep mountains in comparison to Dasu to Besham section. The tower footprint elevations vary in between 822 to 1,449 m amsl. The highest elevation of the DTL route exists in this section. The presence of densely and scattered population areas is likely to create some obstacles for transmission line routing and construction. Also, the agricultural land and forest trees are present in this DTL section. Especially, the 40km long part of this DTL section between Besham and Battagram will pose difficulty during construction primarily because of high mountains, as well as scattered population.

3.2.2.3 Mansehra - Islamabad

This DTL section consists of low hills and plain areas and therefore the terrain is not likely to cause any constructability issues. The tower footprint elevations ranges from 406 to 841 m amsl. However, the presence of scattered as well as densely populated areas will pose difficulty during construction.

3.2.2.4 Routing Options for Dasu – Besham Section of DTL

Three options were considered for this section of the DTL as shown in **Figure 3.2**. Comparison of these three alignment options is given in **Table 3.1**. For this comparison, Dasu to Besham section is further divided into two sub-sections for better analysis and understanding of the routing options.

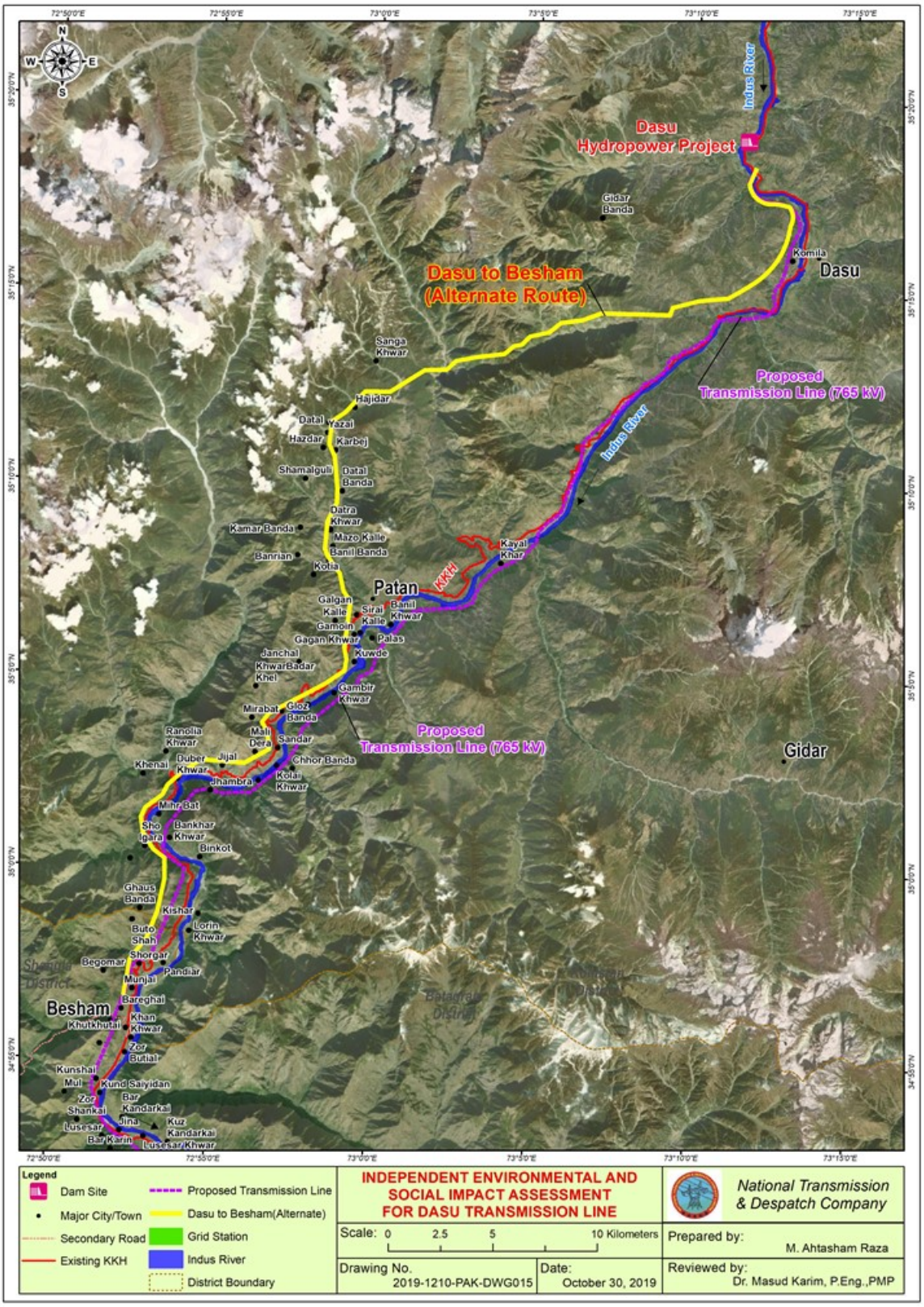

Figure 3-2: DTL Route Options for Dasu – Besham Section

Table 3-1: Comparison of Route Options for Dasu – Besham Section

Aspects	Option 1	Option 2	Option 3
Dasu to Pattan/Palas			
Description	This line route travels along the Indus River up to Pattan taking the possible spots for tower locations on either side of the Indus River.	This route travels along the left bank of Indus River up to Yanjo Gah nullah. After that, it moves to the left and right banks of Indus River depending on suitable location of towers up to Chor nullah. After Chor nullah the route remains on the left bank.	This route emerges from the DHP on the left bank of Indus River and crosses the Indus River to the right bank towards Seo village. It remains on the right bank up to Zatkhara nullah. From there the route enters the right bank valleys crossing the Madraza nullah, Chawa nullah, Pattan Banit nullah and reaches Pattan.
Economical Aspects	Total Length of this option is around **35 km.** The tower locations have been selected to be generally near the existing roads and tracks. It has been done to make the line route economical.	Total length of this option is around **36 km**. Most parts of this option remain on the Indus left bank where accessibility is an issue. The cost will be higher than that of the Option1.	Total Length of this option is around **40 km**. This option faces extreme challenges with respect to the constructability of the transmission line. Transporting the material to the RoW with no access will increase cost; higher than the other two options.
Construction related issues	The access to this line route is through the DHP's Right Bank Access Road (RAR-1), Karakoram Highway and Palas Valley Road. Maximum elevation in this section is **1221m amsl** with average elevation of about 900m amsl.	The access to this option is through the KKH, Jalkot Road and Palas Valley Road. The portion of line route which is on the left bank of Indus River between Yanjo Gah nullah and Chor nullah has no access road available and it is also very difficult to construct any access track in this portion.	The access to this option is through the KKH up to the Zatkhara nullah. However, between Zatkhara nullah and Chawa nullah, a span of about 20 km, there is no access road. Maximum elevation in this line route is **2700 amsl** and approximately 24

Aspects	Option 1	Option 2	Option 3
	There are four crossings of Indus River along this section. The area from Dasu to Pattan poses extreme construction issues. This option takes the route that is the most suitable for tower spotting and accessibility.	Maximum elevation in this line route is **1320m amsl** and the average elevation is 950m amsl. There are six crossings of Indus River in this section. This option poses extreme difficulties with respect to the construction on steep slopes. The spotting of towers is very difficult in this section.	km is above 1300 amsl and about 13 km is above 2000 amsl. There is one Indus River crossing. This route poses extreme construction difficulties with respect to high elevation, steep slopes, inaccessibility, snow, and forest clearances.
Social Aspects	This route passes in the vicinity of Seo, Komila, Mandraza, Kiru, Sigel Kan and Palas areas. Some portion of the route passes over the scattered population or small agricultural areas of Seo and Kiru villages.	This route passes in the vicinity of Kashai, Shal, Tial, Dasu, Jalkot, Shekbir and Pattan. Some portions of the route pass over the scattered population and agricultural area of Tial and Pattan.	This route passes in the vicinity of Seo, Zatkhara, Dur Banda, Sameo, Hajdara, Yazai, Chawa, Dotol Banda, Mazo Kela, Banil Banda and Pattan. The route crosses the agricultural land area and scattered population from Zatkhara nullah onwards to Pattan.
Environmental Aspects	This route does not pose any risk to forests. There is no snow along this section. Maximum effort has been made to avoid land slide areas by taking the route on high elevations or to the other bank of Indus River.	This route does not pose any risk to forests. There is no snow in this line route. The land slide areas are present along the Indus River and route avoids such areas by taking the route on high elevations.	The route poses extreme challenges relating to forest area after entering through the Zatkhara nullah. Deodar trees exist along this option. This route also faces the issues of snow and small glaciers at elevations of above 2200m amsl. This option also poses landslide and snow avalanche risks.

Aspects	Option 1	Option 2	Option 3
Pattan/Palas to Besham			
Description	This route starts from Pattan, travels along the Indus River to Besham city. The route from Pattan City maintains the left bank of Indus River up to the Shamalgul village. After that, the line route crosses the Indus River and takes the right bank slopes towards Besham.	This route starts from the Pattan, travels along the Indus River to Besham. The route from Pattan remains on the left bank of Indus River up to the Shamalgul village at high elevations above the Option-1. After Shamalgul, the route crosses the Indus River and takes the right bank slopes towards Besham.	This route starts from the Pattan and travels along the Indus River on the right bank at high elevations above the KKH.
Economical aspects	The total length of this option is around **25 km.** The major portion of the route has nearby access or major roads available. Therefore, the transportation of materials to the site locations will be easier/economical.	The total length of this option is around **25 km.** This route remains on the left bank of Indus River at high elevations above the Route-1 up to Shamalgul. In the area near Shamalgul it crosses the high elevations where access will be difficult. The cost will be higher than that of the Option1.	The total length of this option is around **25 km.** This line route remains on the right bank steep mountains at high elevations above the KKH. The cost will be higher than that of the Option1.
Construction issues	About 7 km of the route does not have any road though local paths are available. The access from Palas to Kotal village can be made through the Kotal road. Also, the route on the Indus right bank can be accessed through the KKH.	About 7 km of the route does not have any road though local paths are available. The access from Palas to Kotal village can be made through the Kotal road. Also, the route on the Indus right bank can be accessed through the KKH.	The route travels at high elevations much above KKH. It is difficult to access some portions of route because of the steep slopes. Maximum elevation in this route is approximately **1400m amsl** while the average elevation is 1000m amsl.

Aspects	Option 1	Option 2	Option 3
	Maximum elevation in this route is **1460m amsl** while the average elevation is approximately 900m amsl. The route has one Indus River crossing and one 220kV transmission line crossing. The route takes the ridges of mountains for tower spotting which are also accessible through nearby roads/tracks.	Maximum elevation in this route is approximately **1570m amsl** while the average elevation is 970m amsl. There are two Indus River and one 220 kV transmission line crossings in this section. This route also takes the ridges of mountains at high elevations for tower spotting.	The route crosses the Dubair Khwar only. This route faces extreme constructability issues due to the steep slopes and inaccessibility.
Social aspects	The route passes near settlements of Palas, Gambir, Kotal, Mahran, Shamalgul, Munjai and Besham. Very few portions of route are crossing through agricultural land and scattered populated areas near Mahran and Shamalgul villages. Some scattered agricultural areas are also present before Besham.	Route passes near settlements of Palas, Gambir, Kotal, Mahran, Shamalgul, Kuz Kalai and Besham. The route crosses small agricultural and scattered populated areas near Mahran and Shamalgul villages. Some scattered agricultural areas are also present before Besham.	The route passes near settlements of Pattan, Golgan, Malidera, Jijal, Dhup, Khen, Shorgara and Besham City. The route crosses scattered settlements and agricultural areas near Pattan, Jijal, Dhup, Khen and Shorgara.
Environmental aspects	This route crosses mostly barren land covered by shrub vegetation and sparse trees. No natural forests are affected. Small part of the route (approx. 2 km) crosses agricultural land. As the elevation is relatively low, no snow in this section of the line route is expected.	The route is similar to Option 1 but on generally higher elevation. Barren land is mostly crossed covered by shrub vegetation and sparse trees. No natural forests are encountered. As the elevation is higher than Option 1, there is more inclination and higher risks for soil erosion.	Despite the same length with the other two options, the route uses the right side of Indus river which is steeper and less accessible, with high soil erosion risks. The land is generally barren with less cover than Options 1 and 2. No forest areas are affected.

3.2.2.5 Recommendations

Option 1 is preferred primarily based on the ease of construction and accessibility. Option 3 is the least preferred option: in the section Dasu to Pattan it is the longest one and it climbs up to 2,700 m amsl where ice, snow and difficulty of the terrain are anticipated to affect project construction; in the section Pattan to Besham it runs along the right side of Indus river where the terrain is steeper, construction is more difficult and soil erosion risks are higher. Option 2 is largely similar to Option 1 but it climbs at larger altitudes thus exhibiting worse constructability and access characteristics. In terms of environmental performance, all three Options cross mostly barren land and small agricultural patches close to villages. No natural forests are affected. Option 1 presents the least soil erosion issues due to better terrain.

3.2.2.6 Routing Options for Besham – Mansehra Section

Three options were considered for analysis for this section of the DTL as shown in **Figure 3.3 and** comparisons are made using different criteria and presented in **Table 3.2**.

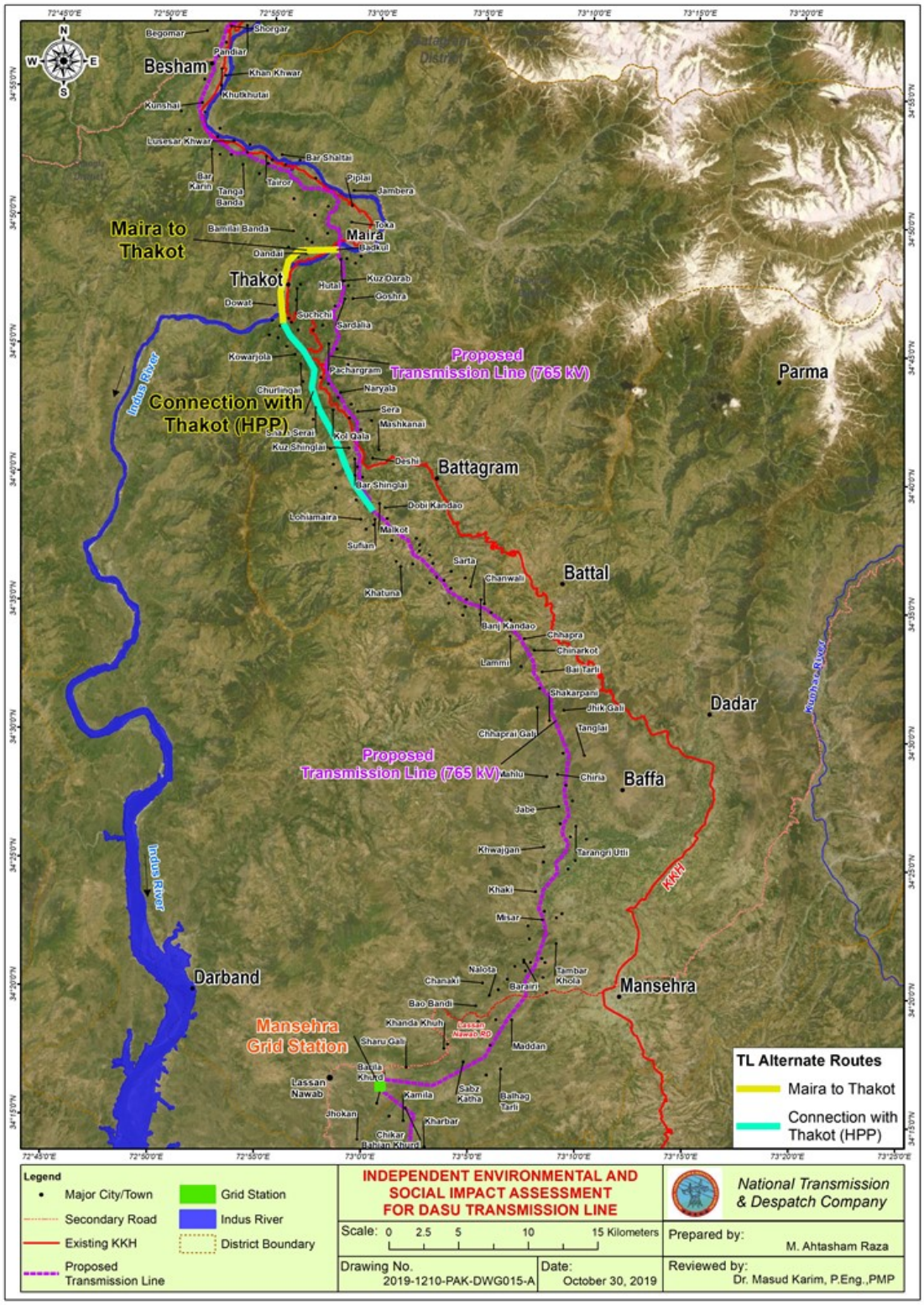

Figure 3-3: DTL Route Options between Besham and Mansehra

Table 3-2: Comparison of Route Options between Besham to Mansehra

Aspects	Route 1	Route 2	Route 3
Besham to Battagram			
Description	This section starts from Besham town and passes close to Shung, Maira, Badkul, Chanjal, and Peshora. It crosses the Battagram area at Char Gali Feroz.	This section starts from the left bank of Indus River from Bandai while the Besham city is on the right bank. The route passes close to Jambera, Maira, Badkul, Pamel Shareef, Karwar, and Ajmera. It crosses the Battagram area at Char Gali Feroz.	This section takes the same path as of Option 1 up to Maira. From there it bypasses the populated areas of Dandai and Thakot and runs along the right bank mountains of Indus River. Near Thakot it crosses the Indus River from right bank to left bank and moves along Nandihar Khwar passing close to Chanjal and Kanhar and moves to Char Gali Feroz near Battagram. This Option is also useful for connecting the future Thakot HPP with the DTL.
Economical Aspects	Total length of this route is around **40 km.** The major portion of this route is accessible from KKH and its link roads.	The total length of this route is around **41 km**. The major portion of the route has access through the link roads.	Total Length of this Route is around **44 km.** The major portion of the line route has access through the existing roads.
Construction related aspects	Steep areas along the route are mostly avoided. The route crosses high elevation mountains between Badkul and Chanjal.	The route crosses the high elevations between Badkul and Pamel Shareef. Efforts have been made to avoid the populated areas by taking the route to left bank of Indus River up to Maira. The area near the Pamel Shareef may	The route moves along high elevations above the KKH. Efforts have been made to avoid the populated areas by taking the route to high elevations which are at some

Aspects	Route 1	Route 2	Route 3
	Efforts have been made to avoid the populated areas. Maximum elevation in this section is approximately **1,435m amsl** while the average elevation is about 890m amsl. There is one Indus River crossing and one 220 kV transmission line crossing near Char Gali Feroz in this section.	create problem due to scattered population. Maximum elevation in this section is about **1700m amsl** while the average elevation is about 900m amsl. There are six Indus River crossings and three 220 kV transmission line crossings in this option.	points difficult to reach due to the steep mountains. Maximum elevation in this section is about **1335m amsl** while the average elevation is about 850m amsl. There is one Indus River crossing in this section.
Environmental aspects	The route crosses forest area of approx. 1 km (20 acres) near Chanjal. Soil erosion issues are anticipated at crossings in high inclination between Badkul and Chanjal.	The route crosses forest area near Pamel Shareef and Battagram, at an approx. length of 1.6 km (32 acres). Soil erosion issues are anticipated at crossings in high inclination between Badkul and Pamel Shareef.	The route crosses approximately 2 km (40 acres) of forest area near Thakot and Battagram. Soil erosion issues are anticipated in areas of high inclination after Thakot.
Social aspects	The route passes close to Besham, Shung, Maira, Badkul, Chanjal, Peshora, Ajmera, Battagram and Char Gali Feroz. Due to the dense and scattered population from Besham to Battagram, the maximum effort has been made to cross the populated areas at some height if unavoidable. The route also crosses some cultivated areas.	The route passes close to Bandai, Besham, Shung, Jambera, Maira, Badkul, Pamel Shareef, Karwar, Ajmera, Battagram, and Char Gali Feroz. To avoid the dense and scattered populated areas from Besham to Maira on the right bank of Indus River, the route mostly moves through the difficult left bank mountains while also crossing the River several times. Near Pamel Shareef the route passes through populated area.	The route passes close to Besham, Shung, Maira, Dandai, Thakot, Chanjal, Peshora, and Char Gali Feroz. Due to the dense and scattered populated areas from Besham to Battagram, efforts have been made to cross the populated areas at some height if unavoidable. The route also crosses some cultivated areas.

Aspects	Route 1	Route 2	Route 3
Battagram to Mansehra			
Description	This section starts from Char Gali Feroz (near Battagram) and passes close to Gijbori, Banrian, Qaim Gali, Bhati, Lammi, Chupra and Chinarkot. After Chinarkot the route crosses the high elevation mountains and moves towards Trangri and Malakpur. After that the route moves along the Siran River through Khaki Town to Mansehra.	This section starts from Char Gali Feroz (near Battagram) and moves towards Chinarkot while passing through the Banrian, Qaim Gali and Chupra. After that, the route moves towards Sabir Shah by crossing through the high elevation mountains with forest. From there the route moves towards Mansehra along the Siran River bypassing the populated areas of Upper and Lower Tarha and Bher Khurd.	This section starts from Char Gali Feroz (near Battagram) and passes close to Gijbori, Banrian, Qaim Gali, Bhati, Lammi, Chupra and Chinarkot. After that, the route crosses the high elevation mountains and moves towards Trangri and Malakpur. After that the route moves along the Siran River through Khaki Town to Mansehra.
Economical aspects	The total length of this section is around **42 km.** This section of the route can be accessed mostly through the link roads from the KKH.	The total length of this section is around **44 km** This section of the route can be accessed mostly through the link roads from the KKH.	The total length of this section is around **42 km.** This section of the route can be accessed mostly through the link roads from the KKH.
Construction related aspects	The route mostly moves on the high elevation mountains in order to avoid dense and scattered populated areas. The major portion of the line route can be accessed through existing roads, while some portions at high elevations	The route moves on the high elevation mountains in order to avoid the dense and scattered populated areas. The major portion of the line route can be accessed through existing roads, while some portions at high elevations	The route mostly moves on the high elevation mountains in order to avoid the dense and scattered populated areas. The major portion of the line route can be accessed through existing roads, while some portions at high elevations

Aspects	Route 1	Route 2	Route 3
	can be accessed through Jeep-able tracks. The maximum elevation in this section is **1,830m amsl,** while **the** average elevation is **1200m amsl.** This route crosses through the agricultural land and forest area which may create problem during construction. Maximum efforts have been made to avoid the forest area as much as possible. After Trangri Town the route moves along the Siran River and crosses it three times in order to avoid the populated areas.	can be accessed through Jeep-able tracks. The maximum elevation in this section is **1,860m amsl** while the average elevation is **1,230m amsl.** This route crosses through the agricultural land and forest area which may create problem during construction. Maximum efforts have been made to avoid the forest area as much as possible. From Sabir Shah the route moves along the Siran River crossing it three times in order to avoid the populated areas.	can be accessed through Jeep-able tracks. The maximum elevation in this section is **1,830m amsl** while the average elevation is **1,200m amsl.** This route crosses through the agricultural land and forest area which may create problem during construction. Maximum efforts have been made to avoid the forest area as much as possible. After Trangri Town the route moves along the Siran River and crosses it three times in order to avoid the populated areas.
Social aspects	This line route passes close to populated areas of Ajmera (near Battagram), Char Gali Feroz, Banrian, Qaim Gali, Bhatti, Lammi, Chupra, Chinarkot, Tarangri, Malakpur, Khaki, and Mansehra. The route avoids the dense population of these towns but does cross over some scattered houses. The route also crosses some cultivated areas.	This route passes close to Ajmera (near Battagram), Char Gali Feroz, Banrian, Qaim Gali, Chupra, Chinarkot, Sabir Shah, Upper Tarha, Lower Tarha, Bher Khud to Mansehra. The route avoids the dense population of these towns. The route also crosses some cultivated areas.	This route passes close to Ajmera (near Battagram), Char Gali Feroz, Banrian, Qaim Gali, Bhatti, Lammi, Chupra, Chinarkot, Tarangri, Malakpur, Khaki to Mansehra. The route avoids the dense population of these towns but does cross over some scattered houses. The route also crosses some cultivated areas.
Environmental aspects	The route crosses some forest areas though maximum efforts have been	The route crosses some forest areas though maximum efforts have been	The route crosses some forest areas though maximum efforts have been

Aspects	Route 1	Route 2	Route 3
	made to avoid such areas. The approx. length of forest crossing is 3.2 km (63 acres)	made to avoid such areas. The approx. length of forest crossing is 3.2 km (63 acres)	made to avoid such areas. The approx. length of forest crossing is 3.2 km (63 acres)

3.2.2.7 Recommendations

Route 1 is preferred, especially in section Besham to Battagram, it is shorter than Route 3 while it crosses at lower elevation than Route 2. As a result soil erosion issues are less with Route 1. In addition, forest crossing is shorter in Route 1 for Besham to Battagram than other alternatives. In section Battagram to Mansehra, all routes cross similar terrain and their differences are small, if any.

3.2.2.8 Routing Options for Mansehra – Islamabad Section

Three options were considered for this section of the DTL as shown in **Figure 3.4 and** comparisons are made in **Table 3.3.**

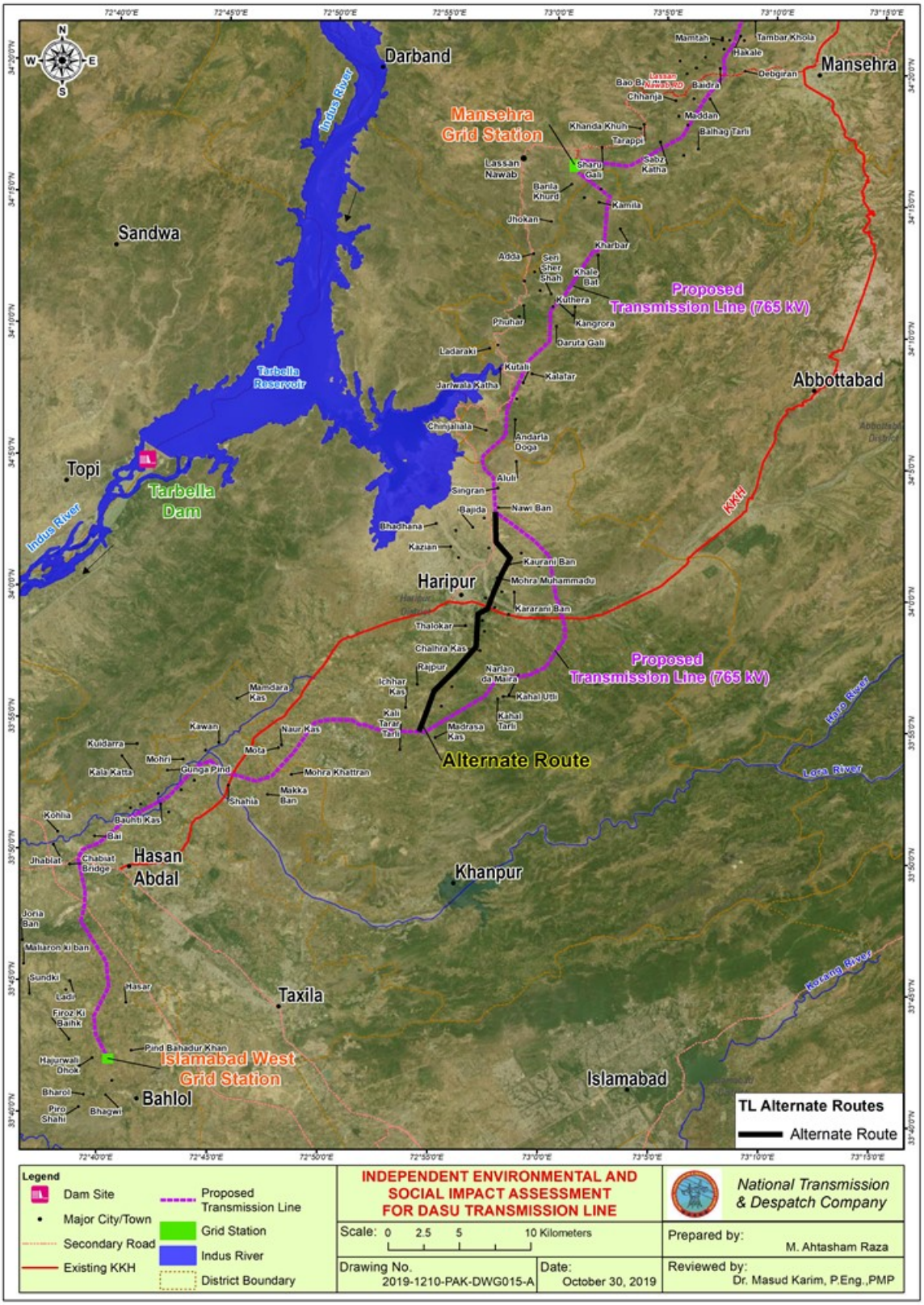

Figure 3-4: Route Option between Mansehra to Islamabad

Table 3-3: Comparison of Route Options between Mansehra and Islamabad

Aspects	Option 1	Option 2	Option 3
Mansehra to Kag Town (Located 5 km North of Haripur City)			
Description	This route starts near Mansehra and passes through Lassan Thakral, Lakhala, Soha, Chatti Gali, Darwaza and lastly avoiding populated areas of Kag.	This route starts near Mansehra and passes through Thathi Syedan, Kachhi, Darwaza and ends at Kag.	This route passes through the same area as of Route-1 or Route-2 up to the Kag area.
Economical aspects	Total length of this section is around **39 km.** Most parts of this route are near existing roads thus making this option economical. Also the route bypasses the densely populated areas.	The total length of this section is around **40 km**. Some portions of this route are away from the roads and some portions have access through the Jeep-able tracks. Also the line route bypasses the densely populated areas.	Total Length of this section is around **39 km.** Most parts of this route are near existing roads thus making this option economical. Also the route bypasses the densely populated areas.
Construction related aspects	Access to this route is through small roads which connect with the KKH. The area from Mansehra to Kag is mountainous. Maximum elevation in this route is about **1,230m amsl** while the average elevation is 770m amsl. The route avoids the densely populated areas by taking it through the mountainous areas.	Access to this route is through small roads or Jeep-able tracks which connect with the KKH. The area from Mansehra to Kag is mountainous. Maximum elevation in this route is about **1,187m amsl** while the average elevation is about 700m amsl. The route avoids the densely populated areas but at some portions of the line route access is difficult.	Access to this route is through small roads or Jeep-able tracks which connect with the KKH. Maximum elevation in this route is about **1,230m amsl** while the average elevation is about 770m amsl. The route avoids the densely populated areas by taking it through the mountainous areas.
Social aspects	This route passes close to the populated areas of Lassan Thakral, Lakhala, Soha, Chatthi Gali, Darwaza and Kag and also	This route passes close to Thathi Syedan, Beer, Kachhi, Darwaza and Kag areas. Some portion of the route	This route passes close to Lassan Thakral, Lakhala, Soha, Chatthi Gali, Darwaza and Kag areas. Some portion

Aspects	Option 1	Option 2	Option 3
	some scattered houses. The line also passes through cultivated areas.	passes over/near scattered populated areas and cultivated areas.	of the route passes over/near scattered populated areas and cultivated areas.
Environmental aspects	The route crosses some forest areas near and south of Mansehra (approximately 3.4 km or 67 acres) although maximum efforts have been made to avoid such areas.	The route crosses some forest areas near and south of Mansehra (approximately 3 km or 60 acres) although maximum efforts have been made to avoid such areas.	The route crosses some forest areas near and south of Mansehra (approximately 3.4 km or 67 acres although maximum efforts have been made to avoid such areas.
Kag to Islamabad Substation Location			
Description	This route from Kag moves towards Sarai Saleh, bypasses the populated areas of Sarai Saleh and Haripur. Then, it passes near Kahal Payin, Mang, Hattar industrial state, Dingi, Sultanpur, Kalo Pind, Mano Nagar, Bahol and finally up to the Islamabad Grid Station location.	This route from Kag moves along the Tarbela Reservoir to Pandori. Then, it passes through Kalakhata, Burhan Motorway Interchange, and finally moves to Bahol and terminates at Islamabad Grid Station location.	This route has two alternatives for the crossing of densely populated area of Haripur **Alternate-1**: This alternate route moves along the same path as of Option 1 up to Pharala. From there, it crosses through Mohra Mohammad, Gehr Khan, moves to Mang on Khanpur Road and joins again with Route-1 up to Islamabad Grid Station location. **Alternate-2**: This alternate route from Kag passes near Dobandi, Qzaian, Khalabat Town, Malikyar, Chohar, Meelum, Panian, Bhera Sharif, and joins with the Option 2 near Gudwalian.
Economical aspects	The total length of this section is around **73 km.**	The total length of this section is around **63 km.**	The total length for Alternate-1 is around **67km** and Alternate-2 is around **68 km.**

Aspects	Option 1	Option 2	Option 3
	This section of the route is mostly in the plain areas having access to the existing road network.	About 12 km of the route after Kag passes through the maximum reservoir level of Tarbela Lake where some towers may need pile foundations. But by passing through the reservoir area decreases the route length as well as decreases the need of acquisition of expensive land near the Haripur and also before Burhan Motorway Interchange area. It also bypasses the densely populated areas.	Both alternates of Option 3 pass through the populated areas.
Construction related aspects	This line route is mostly in the plain areas where the high density and scattered populated areas may create great problems during the construction phase. Maximum efforts have been made to avoid the populated areas resulting in the increase in the route length. The route crosses one 500 kV, three 220 kV and eleven 132 kV transmission lines. Maximum elevation of this route is around **852m amsl** while the average elevation is about 500m amsl. The route has two KKH, one under construction Expressway (E-35), one	Some portion of the route would be under water during the maximum filling of the Tarbela Reservoir. Populated areas have been avoided by going through the reservoir area of Tarbela Lake and also by taking the route through some hilly areas near Kala Katha. The route crosses one 500 kV, two 220 kV and three 132 kV transmission lines. Maximum elevation of this line route is around **660m amsl** while the average elevation is about 470m amsl. There are one Motorway (M-2) and one GT Road crossings along this route.	**Alternate-1:** This route passes near the very densely populated areas. There are many fruit orchards near Mohra Muhammad, Gher Khan and Talokar. The route also crosses some scattered houses. **Alternate-2:** This route passes over the populated areas near the Dobandi, Khalabat Town and Meelum. The route avoids the fruit orchards. The Alternate 1 crosses one 500 kV, one 220 kV and nine 132 kV transmission lines. The Alternate 2 crosses one 500 kV, two 220 kV and three 132 kV transmission lines.

Aspects	Option 1	Option 2	Option 3
	GT Road (N-35) and one Motorway (M-2) crossings.		Maximum elevation of alternate-1 is about **570m amsl** while maximum elevation of alternate-2 is about **660m amsl.** The Alternate 1 has two KKH, one under construction Expressway (E-35), one GT Road (N-35) and one Motorway (M-2) crossings. The Alternate 2 has one Motorway (M-2) and one GT Road crossings.
Social aspects	The major population centers in the vicinity of line route include Haripur, Hattar Industrial Estate, Kot Najibullah, Hassan Abdal, Mano Nagar and Bahol. The route passes through the agricultural areas. Maximum efforts have been made to avoid the populated areas.	The major population centers in the vicinity of the route include Haripur, Afghan Refugees Camp, Koliya and Bahol. The route passes through the agricultural areas. Maximum efforts have been made to avoid the populated areas.	The alternate-1 passes near the densely populated areas. The major population centers in the vicinity of line route include Haripur, Hattar Industrial Estate, Kot najibullah, Hassan Abdal, Mano Nagar and Bahol. The alternate-2 also passes through the very densely populated areas near Haripur. The major population centers in the vicinity of route include Haripur, Khalabat Town, Koliya and Bahol. Alternate-1 passes through some fruit orchards as well as cultivated land. Alternate-2 passes through cultivated areas.
Environmental aspects	The route crosses mostly agricultural area with low environmental value. No forest area is affected.	The route crosses mostly agricultural area with low environmental value. No forest area is affected. The proximity	The route crosses mostly agricultural area, including orchards, with low

Aspects	Option 1	Option 2	Option 3
		to Tarbela dam, creates risks to avifauna.	environmental value. No forest area is affected.

Recommendation

The first section of the alignment is mostly similar for all three routes, as they generally move to higher elevations to avoid the densely populated areas of the plains. After Kag, Option 2 crosses for 12 km the high elevation of Tarbela dam and thus it is significantly shorter than the other two Options. However, the construction costs and the stability risks are significant, while higher impacts to birds due to the proximity with Tarbela dam are anticipated; therefore Option 2 in not preferred. Option 3, although shorter than Option 1, crosses populated areas and orchards and hence, social impacts are expected to be higher. As a result, Option 1 is considered the preferred Option.

3.3 Alternative Voltages of the Proposed Transmission Line

The earlier studies on power evacuation from DHP have recommended two 500kV transmission line alignments. During detailed design of DTL project, an additional alternative of evacuating the power through a single 765kV transmission line has been studied. The routes of two 500kV lines are shown in **Figure 3.5**, while for 765kV transmission line, only one of these routes will need to be used.

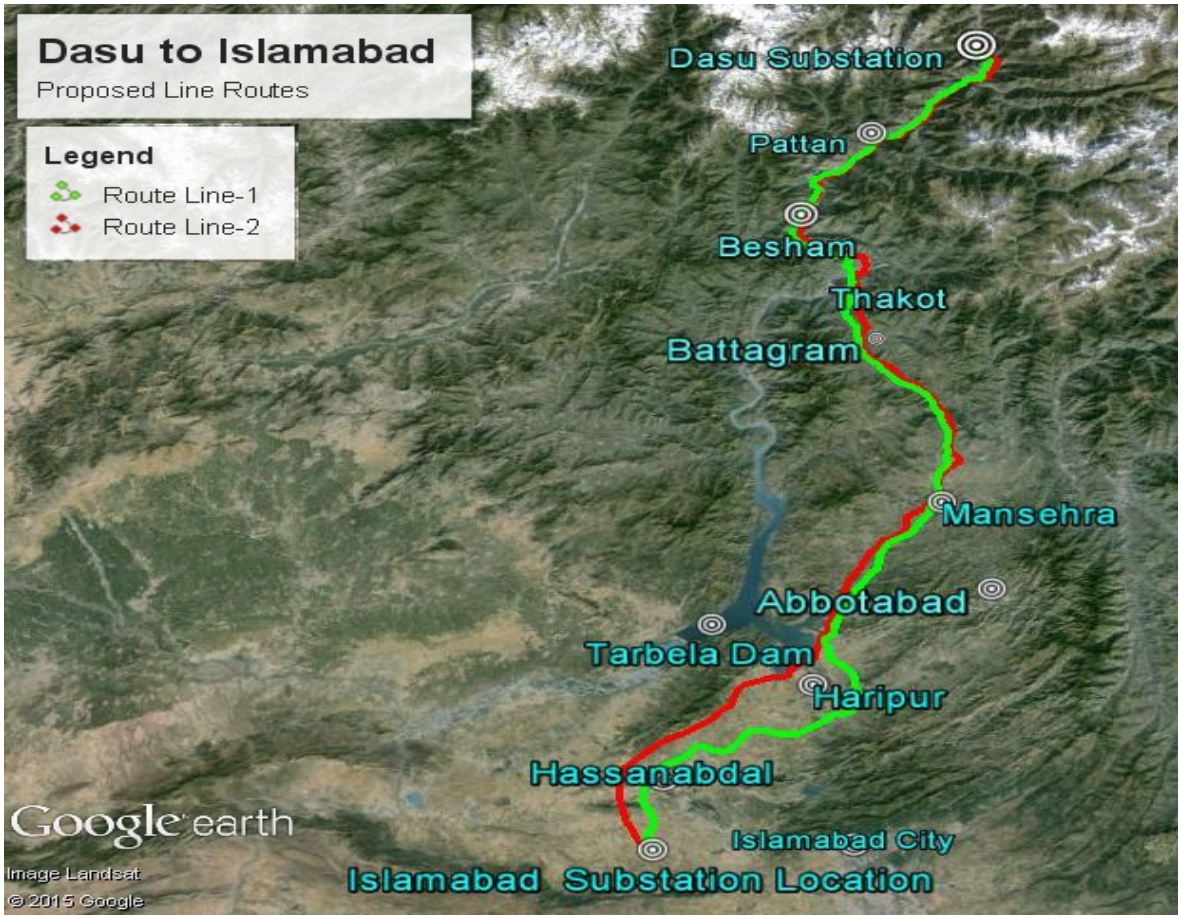

Figure 3-5: Location of two 500kV Alignments for Dasu TL

A comparison of both the options is given in **Table 3.4**. Technically both the options are feasible, however 765kV system has a distinct edge over 500kV system due to its higher load carrying capacity, and lesser transmission losses. From environmental and social perspective, a single 765kV transmission line will have a comparative advantage over two 500kV transmission lines due to smaller foot print. Comparison of right of ways for both 500kV and 765kV is shown in **Figure 3.6**.

The single 765kV line requires a right of way of 80 m wide while two 500kV transmission lines require a right of way of 140 m (each line require 70 m wide right of way). Hence the land requirement and related land acquisition and resettlement impacts for 500 kV transmission line would be comparatively higher for 500 kV lines. Environmental impacts from the land clearing (loss of vegetation and resulting impacts on habitat) and life cycle impacts from material (steel and aluminum) would also be comparatively higher for 500 kV lines due to wider right of way and higher material requirements.

Furthermore, building two transmission lines in the narrow Indus valley, particularly from Dasu to Pattan, is challenging from constructability perspective due to steep terrain and land slide problems. Economically also, the 765 kV line is a better option. The only disadvantage of 765 kV line is that Pakistan has no past experience in installing and operating the 765 kV line. However, considering the technical, economic, environmental and social criteria, 765 kV line has been selected for the DTL project.

Table 3-4: Comparison of 500 kV and 700 kV Options

Criteria	500 kV	765 kV
Technical Suitability	Load Flow Studies show the National Grid remains stable with 500kV system	Load Flow Studies show the National Grid remains stable with 765kV system
Number of Lines	TWO Double Circuit 500 kV Transmission Lines are required to evacuate 5400 MW from DHP	ONE Double Circuit 765 kV Transmission Line is sufficient to evacuate 5,400 MW from DHP`
System losses, estimated	147 MW	124 MW
Name of Conductor	ACSR Martin	ACSR Rail
Number of Conductors per Phase	4	6
Length of Conductors	12,000 km	9,500 km
Weight of Conductors	31,200 tons	14,400 tons
Type of	Lattice Steel Structure	Lattice Steel Structure
Average Span	400 m	350 m
Average Height of Tower	54 m	83 m
Number of towers	1,400	674
Type of Foundation	Spread type foundations for plain/ hilly areas Pile type foundations for river area	Spread type foundations for plain/ hilly areas Pile type foundations for river area
Total Capital Cost, million USD	745	523
Social Impacts	The right of way for this option is 140m, about 60 m more than 765kV option, and hence land acquisition and resettlement impacts are higher	The right of way is 80 m, about 60 m less than 500 kV option, and hence land acquisition and resettlement impacts are lesser
Environmental Impacts	Environmental footprints for this option is high due to wider right of way and greater resource (material) requirements	Environmental footprints for this option is less due to narrower right of way and lesser resource (material) requirements
Other technical considerations	Two transmission lines between Dasu to Thakot are not feasible due to	One 765 kV line is more feasible between Dasu to Thakot section.

Criteria	500 kV	765 kV
	topographic (steep slopes) and geotechnical (landslides) constrains.	
Completion period	Nine years. The first line can be completed in four years, but completion of second line may take another five years due to the more difficult terrain.	Four years
Recommendation	-	765 kV is the recommended option considering lesser cost, and environmental and social benefits.

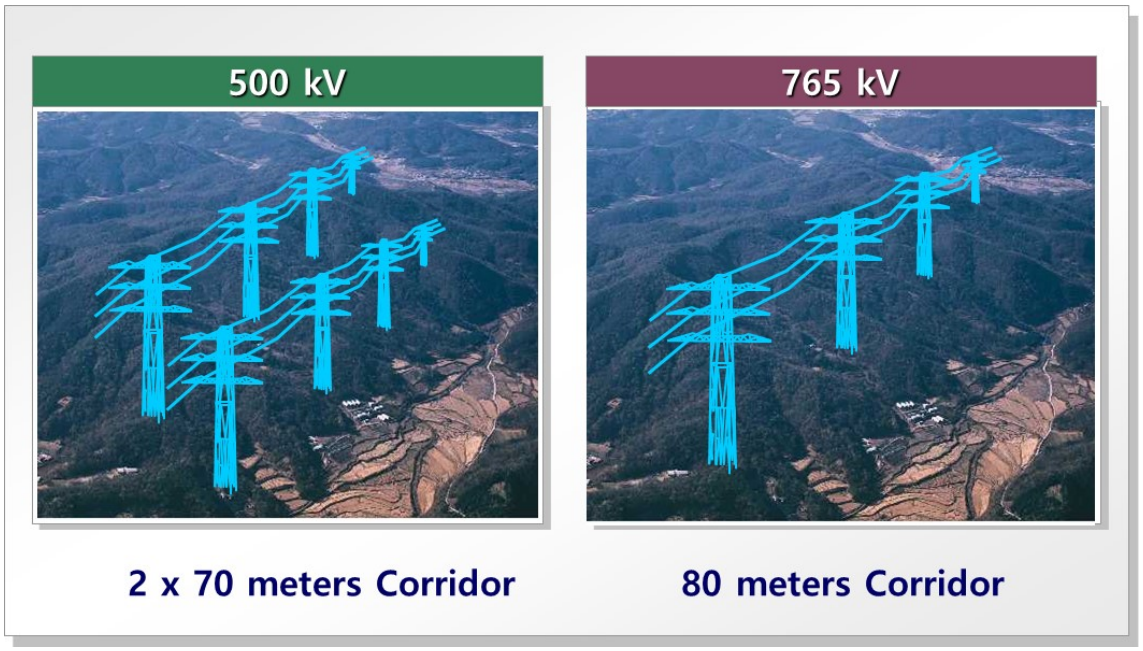

Figure 3-6: Comparison of 500 kV and 765 kV Right of Ways for Dasu TL

3.4 Alternatives for Mansehra GS

A number of alternatives were considered for the proposed Mansehra Grid Station. The analyses have been carried out critically so as to justify the need of the Project. Besides the economic viability, environmental sustenance and social soundness of the proposed project also considered while analyzing various alternatives. The alternatives considered during the study are as under:

- Site Alternatives
- Construction Methods Alternatives
- Technological Alternatives

3.4.1 Location Alternatives

The site selection criteria for the Mansehra GS were based on a number of parameters as indicated below:

- Suitable and relatively flat Land Availability
- Type of Terrain
- Easy Access to Site
- Environmental Issues
- Social Issues

A total of three sites as depicted in Figure 3.7 were assessed for the location of grid station as below:

- Sawan Maira site on Lassan Nawab Road - Option 1
- Upper site of the Sawan Maira – Option 2
- In Tehsil Oghi near Indus river – Option 3

Figure 3.7: Location alternatives of Mansehra GS

The evaluation of the location alternatives on the basis of the above-mentioned criteria is presented in Table 3-5

Table 3-5: Evaluation of location alternatives

Parameters for site Selection	Option 1: Sawan Maira Site	Option 2: Upper site of the Sawan Maira	Option 3: Tehsil Oghi
Suitable and relatively flat Land Availability	Relative flat and easily accessible site	Hilly area, access is comparatively difficult	Slightly hilly area with high density of population and difficult approach
Relief	Relatively flat terrain	Hilly Terrain, will require considerable works for site development	Hilly Terrain, will require considerable works for site development

Access to Site	Easy access near to main Lassan nawab road	Road access is slightly steep and hilly	Road access is slightly steep and hilly
Environmental Issues	Site subjected to afforestation by Eucalyptus trees under the Billion Tree Project of KP provincial government. Approx. 20,456 trees (2-3 yrs. old) are expected to be cut. Eucalyptus are invasive species have been promoted through BTP for their faster growth.	Site covered by natural forest (coniferous trees). Approx. 14,000 mature trees are expected to be cut. These are indigenous species and carry more environmental importance than the Eucalyptus.	Site covered by natural forest (coniferous trees). Approx. 10,700 trees are expected to be cut. These are indigenous species and carry more environmental importance than the Eucalyptus.
Social Issues	No settlement or individual structures within the site. Originally planned for airport	Scattered population in and around the site	High population density, located approx. 5 km southwest of Mansehra (130,000 population)

The site at Sawan Maira has the required space for the Grid Station and no resettlement or environmental restrictions. The area was earmarked for the development of an airport and when the plan was abandoned, the site has been planted with Eucalyptus trees (an invasive species) as part of the afforestation program of KP provincial government. The environmental value of the plantation is low and will be compensated by the project. Road access is also available. As a result, the site at Sawan Maira was selected as the preferred option.

3.4.2 Technological options

A number of technological options were examined by the engineering team of the Consultant with regard to substation configuration, and specifically Gas Insulated Switchgear (GIS), Air Insulated Switchgear (AIS) and hybrid solutions.

GIS substations offer a number of advantages, including well-established technology, proven high reliability and almost no need for maintenance. Due to the fact that gas insulation is much more effective, they require much less space than AIS substations. They operate on SF6, which when is changed, should be treated as hazardous waste. It is related to significantly higher cost of equipment than AIS.

Figure 3-8: AIS (left) vs GIS (right) substation

AIS substations require much more space for their installation due to the fact that air is less effective insulation medium. They are also well-proven technology but have more maintenance needs than GIS. They operate on mineral oil, which is periodically disposed of as special waste. They comprise the most cost-effective option. Hybrid switchgear combines elements of both substation types and is used for special needs.

The relevant options and the justification of the selection of the preferred option are summarized in the table below.

Table 3-6: Technological option for Mansehra Grid Station

Criteria	Option 1: AIS	Option 2: GIS	Option 3: Hybrid
Technical Robustness			
Spacing	Open air, needs a lot of space	Enclosed, requires much less space than the AIS	In between AIS and GIS in terms of space
Maintenance	Requires regular maintenance	Almost maintenance free	More complex system, needs maintenance
Flexibility	More space for expansion	Very compact design usually no so flexible	Depending on configuration, more flexible than GIS
Economic	Cost effective option	Expensive	Costs between GIS and AIS
Environmental			
Site development works	Depending on the relief but generally high	Very limited due to small size	Between AIS and GIS
Waste	Special waste (spent mineral oil)	Toxic waste (spent SF6)	Depending on configuration, may

Criteria	Option 1: AIS	Option 2: GIS	Option 3: Hybrid
			operate on both mineral oil and SF6
Social			
Use of land, expropriations	High need	Compact construction, limited requirements	Depending on configuration, usually between GIS and AIS

All substation configurations have pros and cons. Industrial practice suggests that when space is available, AIS is the usual choice, on the basis of lesser costs of equipment; while in urban settings where land is scarce and expensive, GIS is preferred. In the case of Mansehra, where the setting is rural and space is available, the AIS configuration has been chosen. AIS also allows for more flexibility in view of planned future expansion.

4 PROJECT DESCRIPTION

4.1 Project Overview

The proposed project consists of 765 kV transmission line, will comprise a double circuit transmission line from Dasu to Islamabad (Dasu Transmission Line) via Pattan, Thakot and Mansehra, and 765/500 kV Mansehra Grid Station, located about 26 km to the west of Mansehra city. The transmission line originates from Dasu switchyard located on the left bank of River Indus and terminates at Islamabad West Grid Station evacuating power from DHP. The Project location is shown in Figure 4.1.

The total length of the transmission line is about 250 km and will have the capacity to evacuate about 10,000 MW. As the transmission line is too long, Mansehra Grid station has been added to reduce transmission line. The location of Mansehra GS is about 26 km from Mansehra existing KKH. Islamabad West grid station is located about 30 km west of Islamabad. On the way to Islamabad, it crosses Indus River, existing KKH, 220 kV transmission line from Dubair Khwar to Islamabad and under construction 132 kV line to supply power for the under construction DHP.

4.2 Dasu Transmission Line

4.2.1 Overview

The proposed DTL will require 674 towers, including 217 angle towers and remaining will be suspension towers. The average size of each tower footprint will be 20m x 20m (400 square meters). The average height of each tower will be about 83m. The right of way (RoW) of the transmission line will be 80m wide. Please see Table 4.1 for salient information on DTL.

Table 4-1: Summary of Line Route and Towers

Items	Dasu to Besham	Besham to Haripur	Haripur to Islamabad
Terrain	Mountainous (Difficult Terrain)	Semi-Mountainous / Hilly	Relatively Flat
Route Length	61 km	100 km	89 km
Elevation (amsl)	Max.1,292 m Avg. 932 m	Max.1,831 m Avg. 1029 m	Max.1006 m Avg. 549 m
Number of Towers	178	258	238
Average Span	346 m	387 m	373 m

4.2.2 DTL Alignment

The DTL will pass through two provinces i.e. Khyber Pakhtunkhwa and Punjab. The section of DTL in KP runs through eight districts i.e. Upper Kohistan, Lower Kohistan, Shangla, Battagram, Mansehra, Abbottabad, Haripur, and Attock. Kohistan districts further has six union councils and 28 villages from which the line is passing; Shangla district has four union councils and 18 villages; Battagram district has nine union councils and 32 villages; Mansehra district has eight union councils and 22 villages; Abbottabad has three union councils and seven villages; Haripur district has seven union councils and 22

villages; and lastly the Attock district has four union councils and 13 villages through which the Transmission line is passing.

Figure 4-1: Project location map

4.2.3 Tower Foundations

Concrete foundations will be used for the tower erection. Typically, four foundations would be required for each tower, i.e., one foundation for each leg of the tower. Tower foundation depth will be in between 3-6 m. In certain cases, the foundations may also need piles to be constructed underneath them. Each concrete foundation will have a steel stub, which will be fixed to the tower leg during the tower erection. See Figure 4.2 for a typical design of tower foundation.

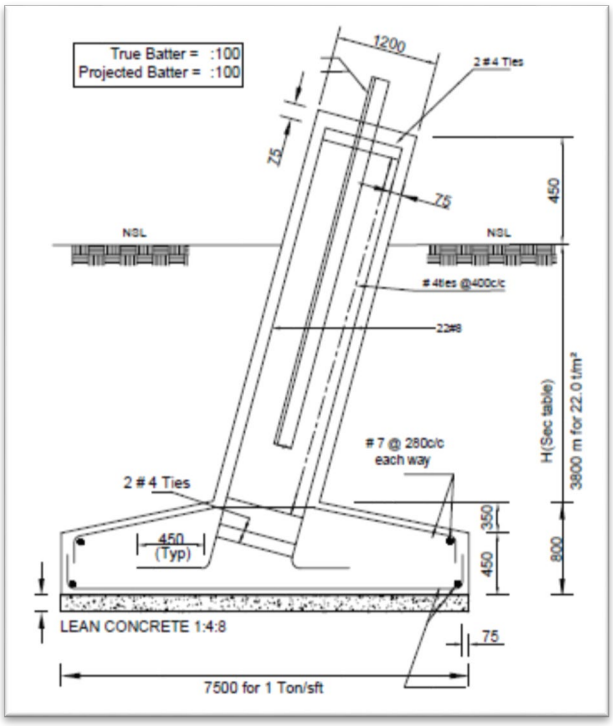

Figure 4-2: Typical Foundation for Tower

All foundations shall be designed to withstand the maximum load transmitted from the tower such as vertical load, uplift, settlement, overturning, sliding, horizontal load (wind load), and earthquake load. All these loads have effect on the foundation base. Critical load on the foundation shall be verified, especially for the following cases derived from the load using Load Factors based on normal conditions and abnormal conditions.

- Maximum uplift in the tower leg axis
- Maximum compression in the tower leg axis
- Maximum horizontal or scissoring stress at or below ground level

For stability of the tower foundation, some tower locations will require protection works. The retaining walls of bricks or stones will be made around the foundation for stability against water erosion etc. The retaining walls for protection of foundations will be designed by the contractor as per "Building Code of Pakistan with Seismic Provisions – 2007".

4.2.4 Design of Transmission Line Towers

The towers will be of lattice steel design, similar to the ones which are commonly used for high voltage transmission lines in Pakistan. The outline drawing of a typical suspension tower to be used for this project is shown in Figure 4.3. A total of six types of tower designs will be used for the project.

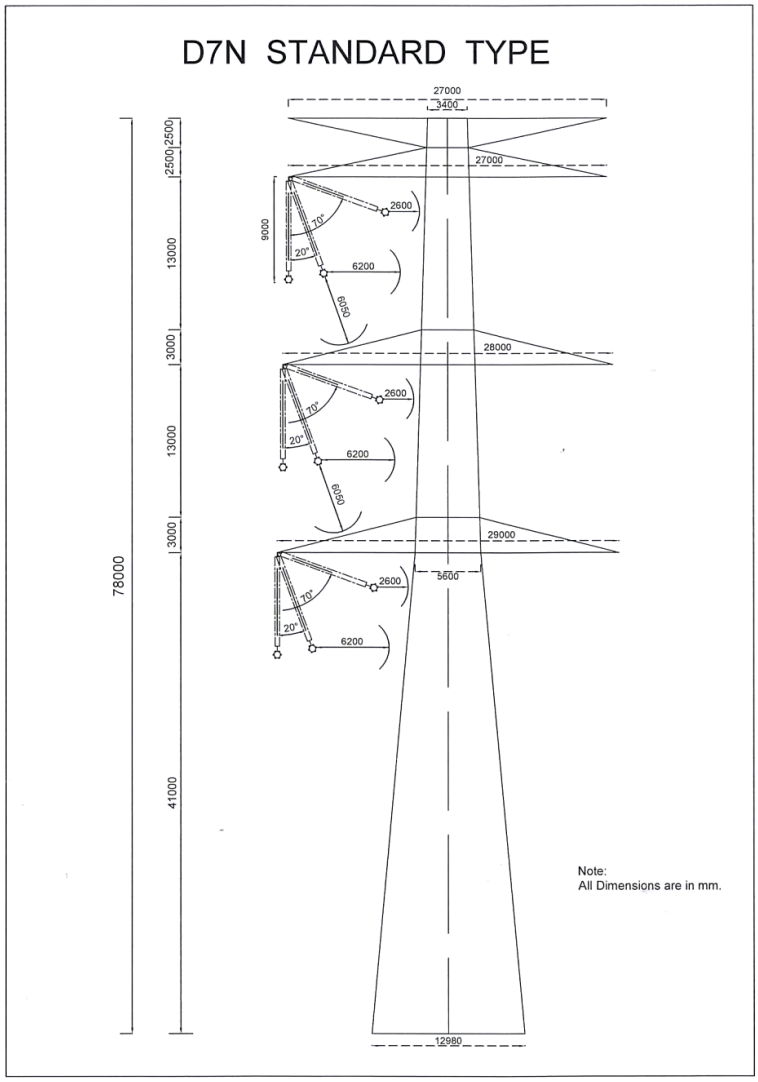

Figure 4-3: Typical Design of 765 kV DTL Tower

4.2.5 Conductor Design

For the DTL, aluminum conductor steel reinforced (ACSR) has been selected. About 9,500 km of this conductor would be required for the project. The size of the conductor chosen is 'Rail' that has a diameter of about 29.59 mm. A bundle of six Rail conductors (i.e., hexa-bundled conductor) will be used for each phase. Two shield wires will be installed above the phase conductors; one of them will be optical ground wire (OPGW), a tubular wire with optical fibers inside it for communication. [8]

Existing transmission lines in northern areas of Pakistan are generally built using Aluminum Conductor Steel Reinforced (ACSR) type of Conductors. However, lines falling in southern area beyond Guddu are using All Aluminum Alloy Conductor (AAAC). Since the 765 kV transmission line from Dasu to Islamabad will be north of Islamabad area, the existing philosophy of NTDC will be retained. Therefore, only ACSR conductor has been considered suitable for this transmission line in view of ease in operation and maintenance work.

[8] This optical fiber is meant for Supervisory Control and Data Acquisition (SCADA) system.

In order to determine the optimum conductor size and configuration, the following approach has been employed:

- Determine the minimum conductor size based on electrical performance and thermal capacity.
- Develop range of conductors by increasing size of conductor starting from the minimum size.
- Evaluate transmission line capital cost of each conductor considered.
- Evaluate cost of losses for each conductor at the design loading level.
- Combine the transmission line capital cost and the capital equivalent of the annual cost of losses to give total economic cost of the line for each conductor.
- Select the minimum cost alternative as the optimum conductor size.

During study of conductor optimization, various types and sizes of conductors have been examined and analyzed to ascertain and optimize technically adequate and most economical conductor option for 765 kV double circuit transmission line from Dasu to Islamabad via Mansehra. The study carried out was based on the conductor technical performance as well as its impact on the construction cost and the impact of losses over the life of project.

As 765 kV double circuit transmission line is being constructed for the first time in Pakistan's power system, all the parameters with respect to electrical performance and environmental effects for this transmission line have been examined and applied based on the international standards and experience of Utilities that have adopted 765 kV system in the world.

The climatic considerations for the designing of conductors are given in Table 4.2. These have been estimated based on the prevailing climatic conditions in the project area, climate change and guidelines provided by the Institute of Electrical and Electronics Engineers (IEEE) Standards Association.

Table 4-2: Climate Considerations for Conductor Design

Description	Unit measure	Value
Ice wall thickness	Mm	6
Maximum Wind Speed	m/s	45.5
Absolute maximum air temperature	ºC	40
Absolute minimum air temperature	ºC	minus 5
Maximum allowable temperature for Conductor	ºC	85
EDS Temperature	ºC	25

4.2.6 Insulators

Guaranteed protection of transmission lines against over-voltages is virtually impossible. However, line insulation must have enough strength to meet the stresses produced by over-voltages. In all cases (power frequency, switching and lighting), the insulation should be able to withstand failure or disruptive discharges.

Insulator units shall be made of high-quality alumina porcelain, and shall comply in all aspects with IEC publications 60120, 60305 and 60815 or equivalent standards. They shall be of the cap and pin type, and have ball and socket couplings. All insulators shall be equipped with a zinc anti-corrosion ring and a stainless-steel pin.

4.2.7 Minimum Clearances Required for the DTL

The minimum clearances given in Table 4.3 will have to be maintained at the specified maximum conductor temperature with the phase conductors and suspension insulators hanging vertically or deflected to any angle up to 70° from the vertical.

Table 4-3: Minimum Clearances Required for DTL

(Nominal system voltage 765 kV; maximum conductor temperature 85 °C)

Description of Clearance	Minimum Clearance (m)
Ground	15
Railway track	18
Road, street	16
Public and sub-urban area	18
Other lands cultivated etc.	15
Inaccessible area	14
Trees	11
Roof of buildings, structures, walls or other objects on which a person can stand or against which he can lean a ladder	13
Roof of Building not accessible to pedestrians	12
River crossing (no sail boating)	15
River crossing (sail boating suitable)	20
Communication line/telephone line	10
11 kV Distribution Line	10
132 kV Transmission Line	10
220 kV Transmission Line	10
500 kV Transmission Line	11

4.2.8 Construction Methodology

The construction approach and procurement strategy to be employed for the proposed DTL project will be driven by the short timeframe within which to develop and commission the works. The procurement strategy is yet to be finalized; however, it is likely that NTDC will adopt an Engineering Procurement and Construction (EPC) type of contract for these works where the EPC contractor will design the works, procure the equipment and undertake the construction works all in one package. The letting of this contract would follow standard World Bank procurement guidelines including pre-qualification and competitive bidding. Both skilled and semi-skilled construction workers will be required throughout the project.

The material specifications for tower, conductor, insulator types and fitting will be finalized in the bidding document. The detailed design, i.e., line route map, final tower location, detail tower drawing and construction methodology will be prepared by the construction contractor. NTDC and Consultant will review and approve the entire technical document prepared by the construction contractor.

4.2.9 Sequence of Construction Works

The proposed DTL project construction work will follow NTDC guidelines and specifications. The key stages in the construction process of overhead high voltage transmission line are summarized in Table 4.4**.**

Table 4-4: Typical Activities for Overhead Transmission Line Construction

Stage	Activity	Description
1	Site Preparation	This may include: • Vegetation clearance where the line passes over or close to trees which could infringe safe clearances • Verification of local utilities and underground services prior to works and establishing of safeguards and obtaining of necessary agreements • Geotechnical and geographical surveys in advance of works where necessary • Any intrusive works undertaken in accordance with archaeological chance find procedures.
2	Site Enabling Works	This may include: • Determining access requirements (routes and detailed arrangements agreed in advance with land owners) • For tower locations where no vehicle access is required, access will be via the RoW / surrounding land with no new access construction. Normal practice in Pakistan is to transport construction materials from the closest road access by personnel or donkeys/mules where possible. • For tower locations where it is determined vehicle access is required, access will be via: existing access roads • The RoW / surrounding land with no new access road construction • In certain circumstances where ground conditions prevent normal access, it may be necessary to construct a temporary access track. • In mountainous areas, cable trollies may also be used to access the site and to transport material to the tower location and other parts of the RoW.
3	Civil Works	Tower foundations are constructed first, four foundations per tower as per final tower design. The foundations are using both explosives and manual or mechanical means of excavation depending on site conditions and filled with concrete. Piled foundations may be required in some areas where ground conditions are unstable. The dimensions of the excavation will differ depending on the type of tower to be installed. Wherever possible, concrete would be delivered by ready mixed concrete truck from batching plants strategically located along the route. Foundation strengthening works typically require increasing the bulk of concrete in the foundation, depending on the additional tower loads that are expected. This normally involves excavation around the existing foundation and application of additional concrete.
4	Steel Erection	Steelwork sections for the towers will be delivered by access road, cable cars/trollies and helicopter (if possible). The assembly of each tower at ground level would proceed as far as possible until the utilization of a crane becomes necessary

Stage	Activity	Description
		to enable the higher sections of the tower to be completed. It is normal practice to use cranes to erect steelwork, subject to good access being available. In very rare cases where terrain is difficult and to minimize disturbance, steelwork may be delivered by helicopter.
5	Conductor Stringing	Stringing is undertaken using a winch to pull the conductor along the towers and a 'tensioner' at the other end to keep the conductor above the ground. Typically, the sections depend on the requirement of angle towers decided during the construction phase. These winch locations are not fixed and can be selected to minimize impact at sensitive locations.
6	Testing of Equipment	Overhead line components including conductors, insulators, towers, joints and fittings are designed and tested to prove compliance with structural, mechanical and electrical requirements.
7	Reinstatement of Tower Construction Area	At completion, the area would be cleared and tidied up. Fences and hedges would be repaired and access routes and disturbed land would be reinstated in agreement with the land users and title owners. Any site security fences would be retained throughout the dismantling and construction process.

4.2.10 Resource Requirements

The material required for transmission line towers and line, such as steel and aluminum will be mainly sourced from the international market. The cement will be sourced from cement factories located around Islamabad and quarry and borrow material will be sourced locally at existing quarries along the tributaries of the Indus river. The estimated quantities of the key materials are given in Table 4.5.

Table 4-5: Estimated Quantities for Materials

Description	Estimated Quantity [a]	Remarks
Tower Types D7N, D7L	457	Suspension Towers
Tower Type D7L, D7M, D7H, D7T	217	Angle Towers
Total towers	674	
Steel for tower components	75,000 t	
Conductor (ACSR)	9,500 km	
Shield wire	250 km	
Optical Ground Wire (OPGW)	250 km	
Insulator Assemblies	13,656 sets	

Description	Estimated Quantity [a]	Remarks
Copper rods for grounding	2,708 sets	
Copper wire for grounding	88,520 m	
Survey and sub-soil investigations	250 km	
Concrete for foundation construction	25,000 t	From which 7,800 t of cement, 17,400 t of sand and 31,200 of gravel

[a] These estimates are based on the current stage of engineering design. Actual quantities may vary depending on the finalization of the design and will be available at detailed design stage.

4.2.11 Manpower

The required manpower will be decided depending on the contractor's construction methodology and policy. Nevertheless, the estimated man power to be deployed is 1000 – 1100 workers (300 in civil works, 300 in tower erection, 250 in conductor stringing and 150 – 250 in other works). They will be distributed in 3-4 construction fronts, depending on the number of Lots/contractors will be selected after the design. Labor will be mobilized mostly from the local community and use of local subcontractors will be preferred.

Both skilled and unskilled labor will be recruited from the local communities in the proximity of the DTL RoW as far as possible, in-order to complete the proposed project within timeline and to the benefit of local economy.

4.2.12 Construction Equipment and Machinery

An indicative list of construction machinery required during the construction is presented in Table 4.6.

Table 4-6: Construction Machinery

Equipment Type and Characteristics	Specifications	Minimum Number required
Excavator	0.6㎥	15
Crane mounted trucks	5 t	2
Crane	5 t	10
Winch Machine	5 t	10
Derrick/Gin Pole		10
Tensioner		5
Engine puller	7 t	5
Engine puller	5 t	5
Pilot Line/Reel Winder	min.7,500 m	20
Hydro engine compressor	100 t	10
Hydro engine compressor	60 t	5
Dies set for Rail Conductor		10
Dies set for Cardinal Conductor		3
Dies set for ACS Shield Wire		5

Equipment Type and Characteristics	Specifications	Minimum Number required
Traveler for Conductor (Rail and Cardinal)		3000
Traveler for ACS Shield Wire		50
Traveler for OPGW		50
All necessary tool & plants required for foundation, excavation, erection and stringing etc.		Lot

4.2.13 Access Tracks

The DTL route passes through mountainous area in the section from Dasu to Haripur. While selecting the DTL route particularly through the mountainous terrain, consideration has been given to the ease of access and availability of existing roads/track. However, some of the proposed tower sites are located on steep slopes making it very difficult to access the RoW while also posing safety issues for construction crew. The construction of access tracks may solve the accessibility issue for some of the tower locations but a limited number of sites might still be inaccessible and unsafe to work on, using conventional construction methods.

Normal practice in Pakistan, for construction of tower's base or civil works, is to transport construction materials from the closest road access by personnel or commercially available donkeys / mules where possible. In more difficult ground conditions, cable cars/trolleys may also be used. The construction of new access roads is generally avoided. However, in certain circumstances where ground conditions prevent normal access, it may be necessary to construct a temporary access track. Such circumstances will be evaluated by the Contractor at detailed design stage.

At the current stage of design, route accessibility issues have been identified for the tower span AP-17 to AP-36. In specific, there is no existing road to access the location of AP-17. also, the topography of the area might make it difficult to transport the construction material by conventional methods. The tower locations A-18 to AP-36 can be accessed through KKH but due to the presence of steep mountains along the highway, access to exact tower locations is difficult.

4.2.14 Construction Camps

As per the current project planning, the Project will require three contractors (2 for TL and one for Mansehra GS). One construction camp will be required at every 50 km length of TL and one camp for Mansehra GS contract. Therefore, 6 construction camps will be required for the entire project (Figure 4-1). Prospective places of these construction camps include Dasu, Kayal/Pattan, Besham, Thakot, Battagram, Mansehra, Abbottabad, Haripur, Hasan Abdal, and Fateh Jhang area. While the exact location of these camps will be decided by the contractors as per their work plan, prospective locations of the construction camp is presented in the Table 4-7 and Figure 4.4

Table 4-7: Potential Construction Camp Coordinates

Sr. No.	Name of Camp	Distance between camps	UTM, East	UTM, North
1	Dasu	0 km	338137.83 m	3906270.80 m
2	Pattan	50 Km	318420.90 m	3887625.49 m
3	Thakot	70 Km	310522.32 m	3849747.93 m

Sr. No.	Name of Camp	Distance between camps	UTM, East	UTM, North
4	Chattar Plain	43 Km	327779.37 m	3832102.61 m
5	Mansehra GS	65 Km	317223.31 m	3794168.61 m
6	Mansehra	73 Km	337736.67 m	3790667.57 m
7	Haripur	60 Km	315612.63 m	3762417.48 m

The construction camps will include residential quarters, washing areas, kitchen, toilets, fuel storage, water storage, sewage disposal arrangements, firefighting arrangements, electric generators, and others. Preference will be given to establishing these camps within the existing camps of under construction 132 kV transmission line connecting DHP, WAPDA or NTDC owned premises. Otherwise the land for these camps will be obtained on a rental or lease basis.

A machinery yard will also be needed for each construction team; it can be combined with the construction camp or established separately. The machinery yard will be parking bays, maintenance and washing bays, fueling arrangements, oil and fuel storages, firefighting arrangements, and tools and parts storage.

4.2.15 Batching Plants

The contractors may need to establish concrete mixing and batch plants for tower foundation construction. These plants will be established at appropriate places based upon the distance from and accessibility to the tower locations. The batching plants will be equipped with pollution abatement / dust control systems and will be installed at least 300 m away from any settlement. The contractor will be required to obtain all clearances as per the national and provincial legislations.

4.2.16 Operational and Maintenance Requirements

The power evacuation facilities will be operated and maintained by NTDC in accordance with its general system maintenance procedures. This involves an inspection regime which requires access to the towers from time to time and visual inspection of the line corridor. Where defects or repairs are noted, maintenance crews will be mobilized to undertake the corrective works. Also, the ability to access the right of way is ensured. Should larger scale works be identified, then this will generally be undertaken by suitable call-off contractors under individual contracts.

4.2.17 Construction Timeline

The construction is expected to take 42 months to complete. The warranty period is 24 months from the commissioning of the transmission line. The construction schedule is presented in Figure 4.5.

Figure 4-4: Prospective Construction Camp Locations for DTL

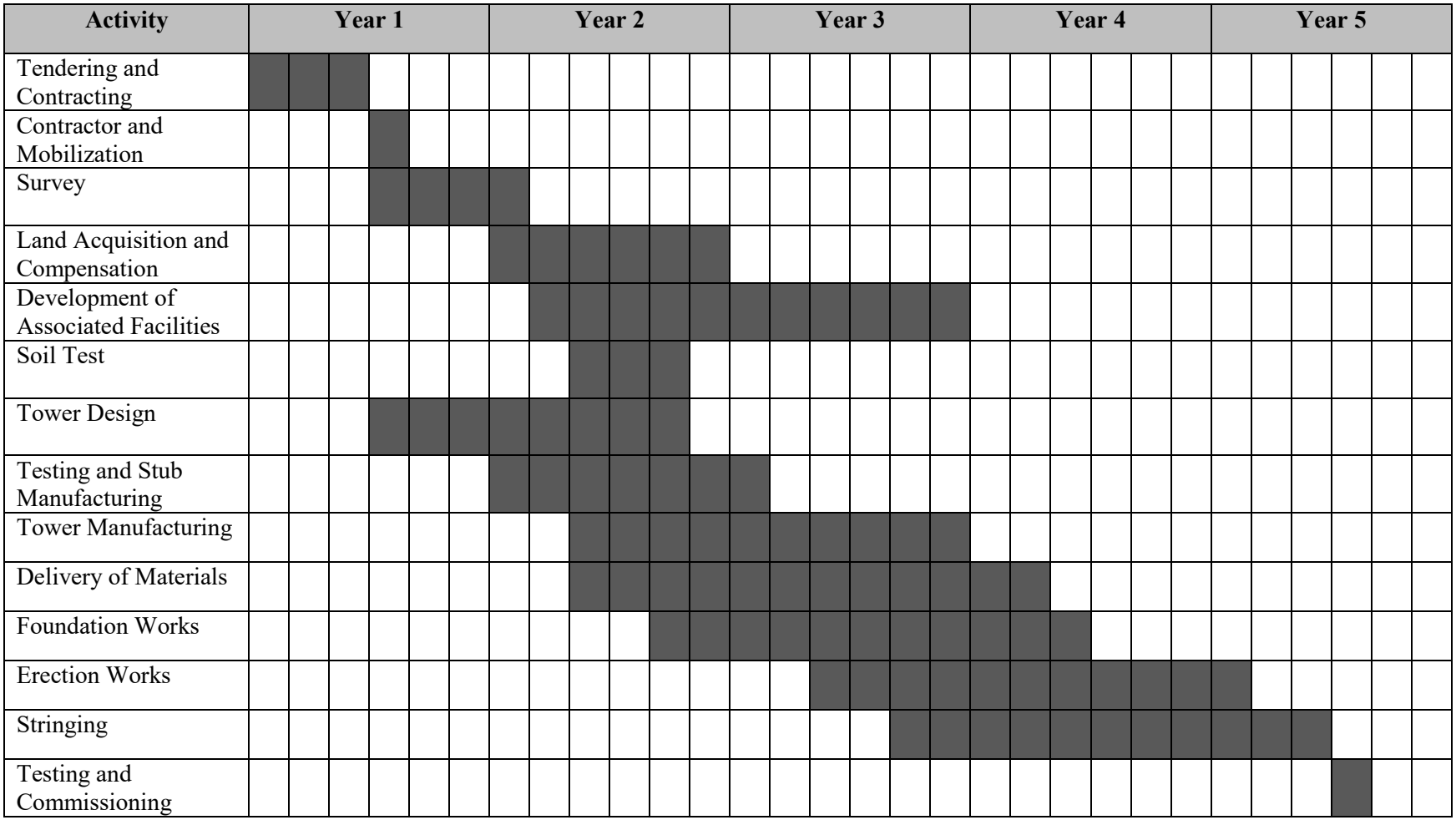

Figure 4-5: DTL Implementation Schedule

4.3 Mansehra Grid Station

4.3.1 Description

A 765/500 kV AIS grid station will be constructed in 158 acres of land at Mansehra to receive power from Dasu Hydropower Project (from 765 kV transmission line). The location of the grid station is shown in Figure 4.5.

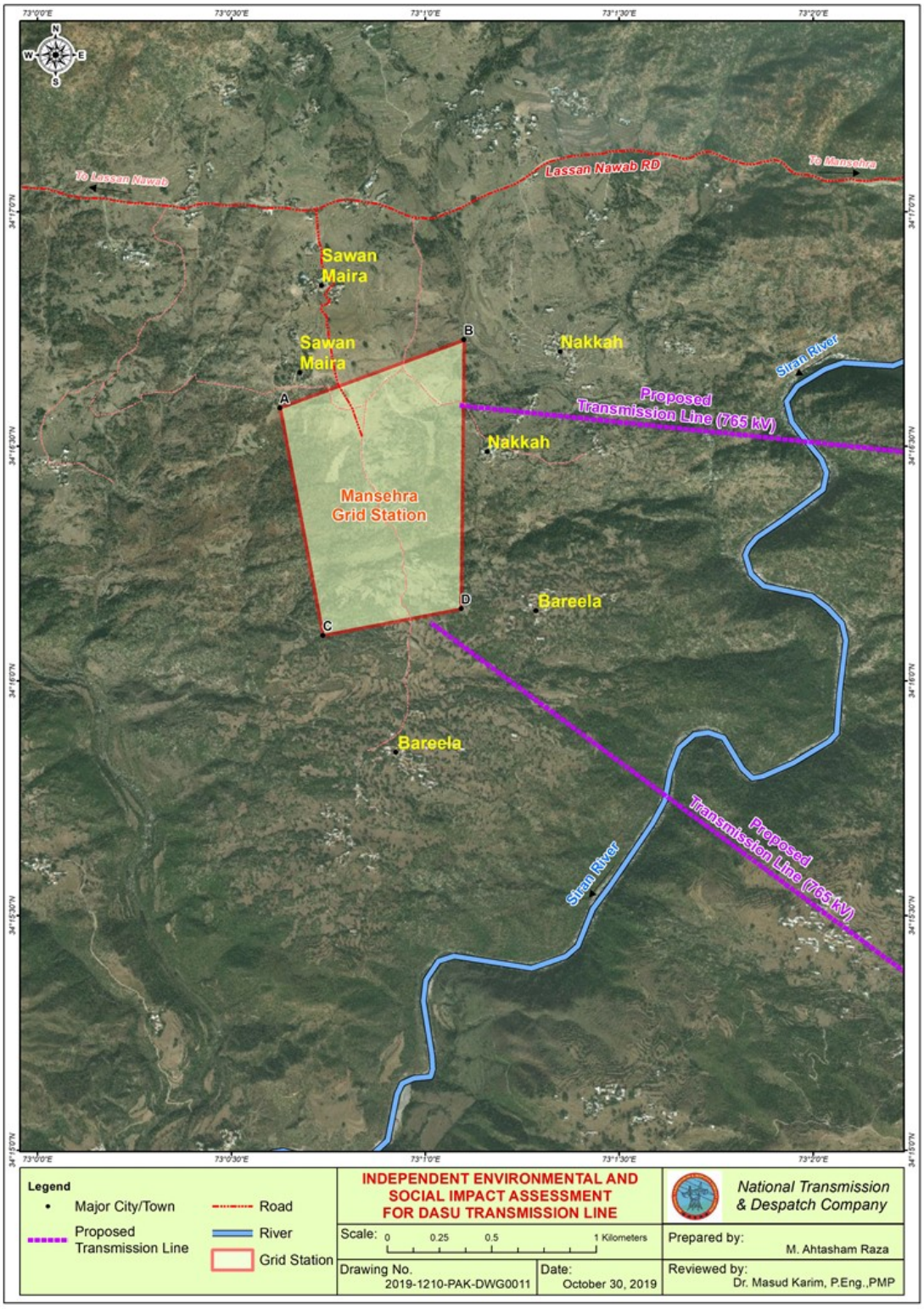

Figure 4-6: Mansehra Grid Station location

The grid station configuration will be as follows:

- **765 kV AIS switchgear** with eight (8) bays and space for future extension by four (4) bays, with:
  - 765 kV one and half breaker busbar system (six (6) diameters)
  - six (6) 765 kV transmission line bays
  - six (6) 765 kV reactor bays incorporated in transmission line bays
  - two (2) 765 kV transformer bays
- two (2) autotransformer banks of three single phase units 765/220/33 kV, 3 x 400 MVA.
  - one (1) spare single phase autotransformer unit 765/220/33 kV, 400 MVA
- two (2) reactor banks of three single phase 765 kV, 3 x 120 MVAr
  - one (1) spare single phase reactor unit 765 kV, 120 MVAr
- four (4) reactor banks of three single phase 765 kV, 3 x 80 MVAr
  - two (2) spare single phase reactor unit 765 kV, 80 MVAr
- **220 kV AIS switchgear** with six (6) bays and space for future extension by two (2) bays, with:
  - 220 kV one and half breaker busbar system (four (4) diameters)
  - two (2) 220 kV transmission line bays
  - four (4) 220 kV transformer bays
- two (2) three phase power transformer 220/11 kV, 20 MVA.
- **11 kV GIS switchgear** with five bays and space for future extension by two bays:
  - 11 kV single busbar system
  - two (w) 11 kV transformer bays
  - two (2) 11 kV auxiliary transformer bays
  - one (1) 11 kV bus section bays
- two (2) three phase, 11/0.4 kV, 1.000 kVA, auxiliary power transformers

The grid station will have future extension capabilities to all switchgear (765 kV, 500 kV, 220 kV, 11kV). The grid station will also include metering, for each transmission line and each transformer, associated substation control and monitoring system and relay protection, AC and DC auxiliary power supply, telecommunication, including Digital programmable logic controller (PLC) for each transmission line.

A typical layout of a grid station is shown in Figure 4.6. In terms of civil works, the key components of the proposed 765/500 kV grid station are; (i) bay, (ii) control building, (iii) residential colony with water supply and sanitation facilities, (iv) fencing and landscaping, and (v) Access road. These key components are further described in the following sections.

4.3.2 Bay and other Substation Equipment

A substation "bay" is the physical location within a substation fenced area where the high voltage circuit breakers and associated steel transmission line termination structures, high-voltage switches bus supports, controls, and other equipment are installed. Typical component of substation and their functions are given in Table 4.7.

Table 4-8: Typical Substation Components and their Functions

Equipment	Functions
Transformers	To step-down or step-up voltage and transfer power from one current to another. The windings of such large transformers are immersed in transformer oil, which is a highly refined mineral oil that is stable at high temperatures and has excellent electrical insulating properties. Its

Equipment	Functions
	functions are to insulate, suppress corona and arcing, and to serve as a coolant for transformers
Circuit Breakers	Automatic switching during normal or abnormal conditions
Feeder Bay	Steel work housing for circuits
Reactors	Equipment for the efficient operation of long transmission power lines as they compensate the voltage on power lines to avoid uncontrolled voltage rise, especially on lightly loaded lines
Isolators	Equipment for de-energizing a circuit for maintenance and repair
Bus bars	Incoming and outgoing circuits of the same voltage tie into a common node called a busbar, which consists of a number of tubular conductors made of aluminum
Wave trapper	Equipment for trapping communication signals sent via the transmission lines rather than the telephone network
Loop-in lines	Incoming power lines (connected to bus bars)
Loop- out lines	Outgoing power lines (connected to bus bars)
Telecommunication mast	Equipment used for remote communication with the sub-station

4.3.3 Control Building

One or more control buildings are required for the substation to house protective relays, control devices, battery banks for primary control power, and remote monitoring equipment. The size of the building depends on design of the grid station. Typically, the control building will be constructed of concrete block, pre-engineered metal sheathed, or composite surfaced materials. Special control buildings may be developed within the substation developments to house other control and protection equipment.

4.3.4 Residential Colony

An employee residential colony will be built on one side of the grid station to house about 100 families of operation staffs, who will be stationed at the operation stage. Common drinking water supply (through groundwater wells) and sewerage facilities (with septic tanks) will be established to provide water and sanitation facilities to the colony. Storm water drainage facilities will be established both in the grid station site and in residential colony. The storm water drainage facilities will be connected to the natural gulley/stream located on northwestern side of the grid station site. WHO endorsed standards on EMF (http://www.who.int/peh-emf/standards/en/ - developed by International Commission on Non-Ionizing Radiation Protection, ICNIRP) will be complied through design considerations by providing adequate distance from the grid station equipment and residential colony. Exposure to noise from the grid station equipment will also be evaluated, to comply with national standards, to provide adequate distance from the grid station and residential colony.

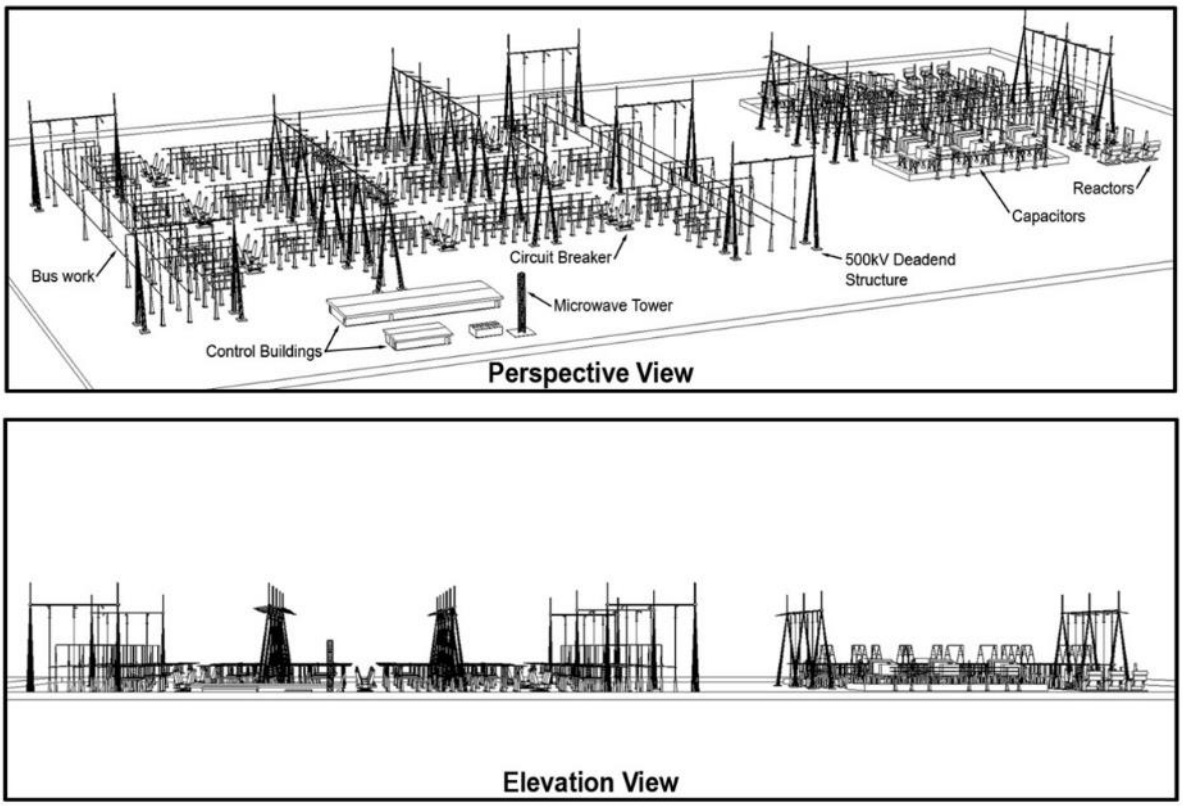

Figure 4-7: Typical HV Grid Station

4.3.5 Construction Camp

A construction camp to accommodate about 40 to 50 outstation workers will be built within proposed grid station area. The camp will include residential quarters, washing areas, kitchen, toilets, fuel storage, water storage, sewage disposal arrangements, firefighting arrangements, electric generators, and others.

4.3.6 Fencing and Landscaping

A security fencing (a fencing wall) will be constructed around the entire perimeter of the grid station to protect sensitive equipment and prevent accidental contact with energized conductors by third parties.

A 3 m buffer zone with plantation will be developed around the fence and landscaping will be carried out wherever allowed.

4.3.7 Access Road

The proposed project site is accessible from Mansehra Lari Adda road to Lassan Nawab road, at Telrari Chowk the road access to Bareel chowk road to proposed site, a distance of 26 km. The grid station site is currently connected to the Bareela Chowk to Swan Maira road about 1.5 km cemented road. This road will be upgraded to provide access for personnel, material deliveries, vehicles, trucks, heavy equipment, low-boy tractor trailer rigs (used for moving large transformers), and ongoing maintenance activities. Road upgrade will be carried out in the existing RoW of the road, i.e. no land will have to be acquired.

There are three other local access roads one is going to Nakka settlement, others are connecting to Bareela, Ziarat, and Kathgarran. However, it is anticipated that only Bareela road will be used for the project.

There are paved roads crossing the proposed site, the main road Bareela to Sawan Maira is about 1,143 m, with two branch roads, one with a length of 223 m and the second one with a length of 256 m. In addition, another paved road is also connecting Sawan Maira and Nakkah Chowk with a length of 313 m. These local roads (1.94 km) prove vital access to the communities and are currently crossing the site will be realigned during site construction.

4.3.8 Construction Activities

The process for constructing the new grid station will follow standard NTDC practice for grid station construction. The key activities in the construction process include the following.

- The major civil works in the grid station area will include construction of foundations and buildings. The raw material required for these constructions are aggregates, sand, cement and steel. The exact quantities of these materials required for construction will only be known at the time of design. However, all these materials will be procured from the market and no quarry site will be developed under this subproject.
- The steelwork will then be erected. The transformers, circuit breakers, reactors and other high voltage equipment will be delivered to site, erected and then commissioned. During construction when the civil works are being carried out (foundations, buildings, etc.), there would be approximately 100 to 150 people present on the site at any one time. Depending on the level and nature of construction activity taking place, there will be varying numbers of people housed on site within a construction camp. This will be constructed within the proposed grid station facility. Overall, it is estimated that 200 – 250 staff will be employed in various works (civil, installation, electrical, other) during project construction.
- Construction will commence with the clearing of vegetation and the levelling and terracing of the ground surface in those areas where heavy electrical transformers and other switchgear will stand. Once levelled and terraced, the concrete works and construction of foundations for the supporting steelwork, transformers and other switchgear will commence. This will also include the construction of storm water drainage pipes, slabs, bund walls, a control room, small buildings and storage areas that are needed.
- All open areas between the transformer plinths and other switchgear foundations will be covered with about a 100 mm layer of 25-38 mm crushed stone.
- Waste generation from the construction works is estimated to be about 140 kg/day (considering an average per capita waste generation in Pakistan, which ranges from 0.286 to 0.612 kg/capita/day). These wastes will be disposed at the local municipal waste disposal sites. Since the project site is located close to Mansehra city, the municipal waste disposal site is already available. No new waste disposal sites will be developed for the project.

4.3.9 Operation

Grid stations in grid system of NTDC are designed and constructed for operation, supervision and control by the staff around the clock, unlike the grid system of many developed countries where the grid stations are remote operated, supervised and controlled at central control centers.

The operation staff at control rooms of grid stations comprises shift engineers, operators, attendants, etc. and perform duty in three shifts i.e. morning shift, evening shift and night

shift. The operation staff supervises and controls the grid station in accordance with the provisions made in the design and construction of the equipment and transmission lines and in compliance of the instructions of the system operator.

The operation staff records hourly loading data (Amperes), voltage data (kV), temperature, and other parameters, etc. of the transformers and transmission line in the station log sheet and onward passes to system operators. They also maintain the record of all the normal and abnormal events of the local system and record of telephonic instruction of all the stakeholders of the system for reference. They coordinate with system operator and manage the scheduled and non-scheduled shut-downs on the grid station equipment and transmission lines, for maintenance and other purposes. They perform switching operations of the switchgear as desired under instructions of system operator Drinking water supply and sanitation facilities (septic tanks and storm water drains) will be maintained regularly.

Weed control from the grid station facilities will be carried out mechanically and no pesticides will be used for these purposes.

Waste material will be managed as per standard procedure of NTDC. All the material waste from the grid station areas of NTDC will be brought to a central location in Lahore and will be managed.

4.3.10 Decommissioning

NTDC do not envision decommissioning of its grid stations at any point. Should this be required in the future, removal and disposal of equipment will be done in accordance with the legislative requirements at that time.

4.3.11 Implementation Schedule

Development of Mansehra Grid Station is expected to take about 3 years. The construction is expected to start in early 2020 and would be ready for commissioning in early 2023 by the time DHP will be commissioned.

5 EVIRONMENTAL BASELINE CONDITIONS

5.1 Physical Environment

5.1.1 Topography and land form

(a) The topography and landform changes along the DTL and can be grouped into four predominant sections, three for DTL and one for Mansehra Grid Station. The proceeding sections describe each section separately. Dasu to Besham

Towers and line section between Dasu switchyard and Komila (AP1-AP11) is 6.62 km and average elevation is 909 m amsl. From Komila (AP-11) to Yanjo Gah Nullah (AP-17) section length is 3.58 km and average elevation is 900 m amsl. From Yanjo Gah Nullah (AP-17) to Chor Nullah (AP-43), the route travels on the most difficult terrain among the entire line route because of the steep mountainous area on both banks of Indus. The length of this section is 15.78 km and average elevation is 890 m amsl. From Chor Nullah (AP-43) to Palas (opposite of Pattan) (AP-53), in this section of line route the area between AP-46 to AP-50 is difficult as the bottom area will be covered by the reservoir of Pattan HPP while the upper areas are difficult with respect to the steep mountainous area. Best possible locations are selected for the tower sittings. The length of this section is 9.72 km and average elevation is 880 m amsl. From Palas (AP-53) to Kotal (AP-59), the line route moves on the left bank mountain ridges, mostly above the road leading to Kotal Town. The 220 kV line from Dubair Khwar to Islamabad also moves near the bottom ridges of left bank mountains. The length and average elevation of this section are 7.39 km and 950 m amsl, respectively. Kotal (AP-59) to Chakot (AP-65 close to Shamalgul Town also) section is 6.97 km and average elevation is 850 m amsl. From Mehr Bat (AP-65) to Besham (AP-72), the line route takes the right bank mountains and moves on the ridges of less steep mountains where the Karakoram Highway is also available. The length of this section is 9.07 km and average elevation is 960 m amsl. One of the challenging location in this section is shown in Figure 5.1 and the elevation profile between Dasu to Besham is presented in Figure 5.2.

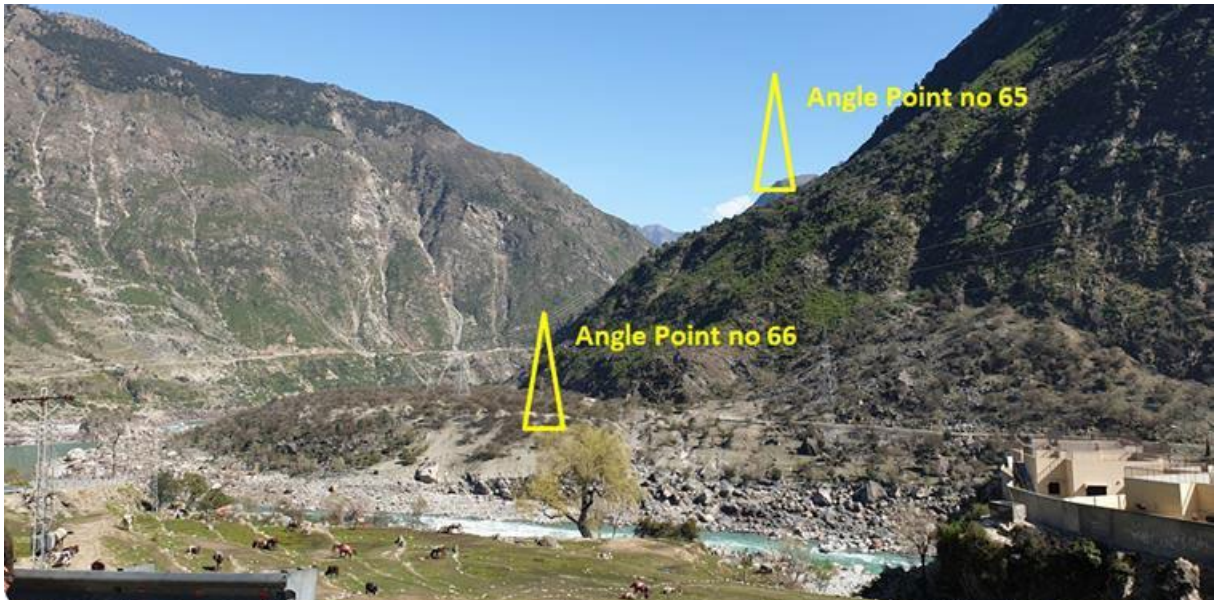

Figure 5-1: Challenging location

Figure 5-2: DTL Elevation Profile for Dasu to Besham Section

(b) Besham to Mansehra Grid Station

Besham (AP-72) to Maira (AP-98) is 21.46 km with an average elevation of 822 m amsl. Maira (AP-98) to Peshora (AP-119) section moves to the left bank of Indus River. It takes the high mountains after crossing Badkul Town in order to avoid the population center and steep slope along the Karakoram Highway near Thakot. Badkul to Peshora section is crosses the elevation of 1,426 amsl. The length of this section is 13.96 km and average elevation is 960 m amsl. From Peshora (AP-119) to Banrian (AP-134) section is 14.94 km long and located at an average elevation of 1,160 m amsl. The line moves on the hilly and semi hilly area. The line route moves along the Nandihar Khwar Stream and takes the path to avoid the dense and scattered population areas. It crosses the 220 kV existing line which needs special attention at the detail design or at the construction stage. In this section, the route is finalized keeping in view of greater space for any change required during the construction stage for achieving clearance from 220 kV Line and Settlement areas. From Banian (AP-134) to Chinarkot (AP-140), the line route moves to high elevation by taking the ridges of mountain. In this section, the forest area is widely spread. The line route is positioned in order to avoid the forest and settlements as well. The section length is 9.13 km with an average elevation of 1,449 m amsl. Chinarkot (AP-140) to Trangri (AP-153) the line route crosses the high mountains of 1,830 m amsl and the forest area comes in the line route. To minimize the cutting of trees in the mountain forest, maximum tower height is considered. The length of this forest area is 4.5 km along the line route. The section (AP140-AP153) length is 13.90 km and average elevation is 1,228 m amsl. One of the challenging location in this section is shown in Figure 5.3 and the elevation profile between Besham to Mansehra GS is presented in Figure 5.4.

Figure 5-3: Challenging location

Figure 5-4: DTL Elevation Profile for Besham to Mansehra Section

(c) Mansehra GS

The proposed Mansehra Grid Station (MGS) is located in Tehsil Sawan Maira east of the town Lassan Nawab Sahib and is situated on a plateau at an average altitude of 700 m amsl. The access to the site location is from Lassan Nawab road. Based on the site visit, the area planned for the new MGS is sufficient for sitting all the equipment. Grid station map is presented in Figure 5.5. The total area of MGS is about 158 acres.

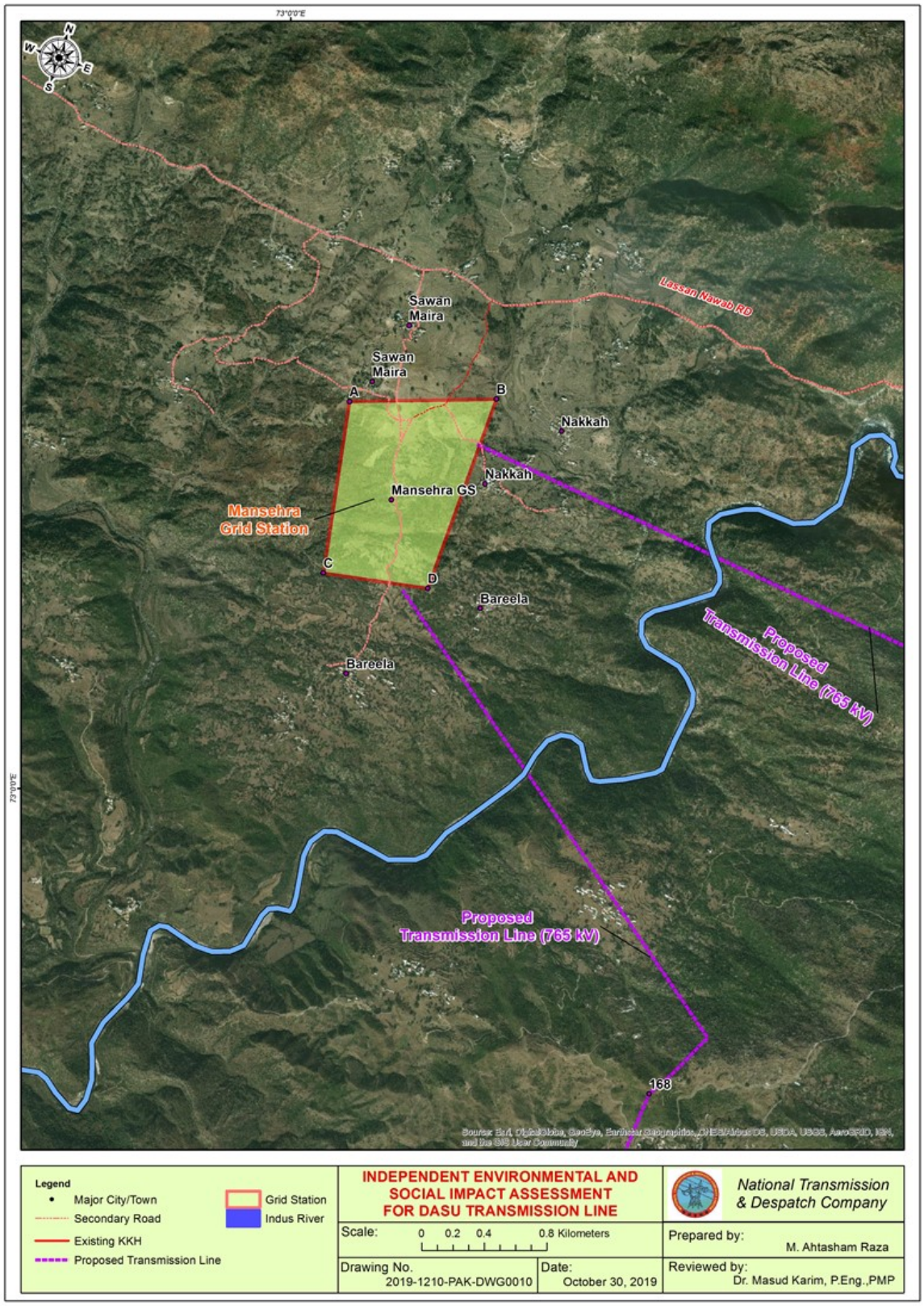

Figure 5-5: Mansehra GS location and access

From the 3 longitudinal and transverse sections (Figure 5.6 and Figure 5.7) of the land suggest a significant excavation work for grading the plot.

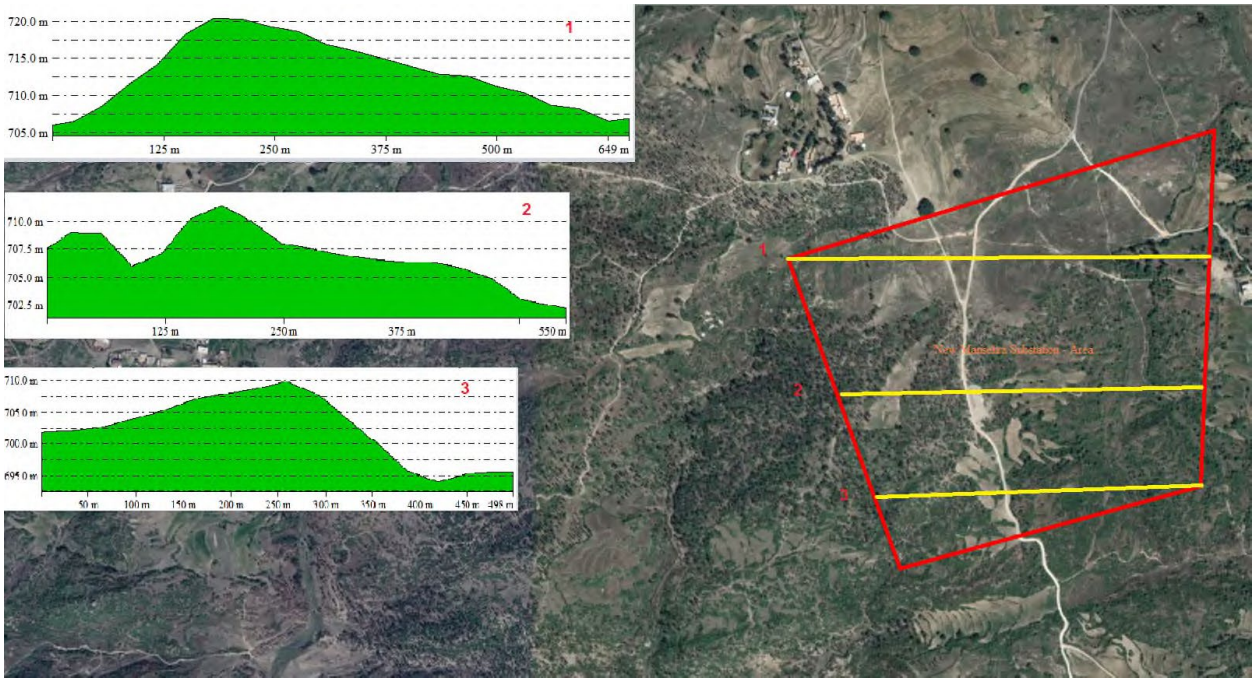

Figure 5-6: Mansehra GS topography – Longitudinal profile

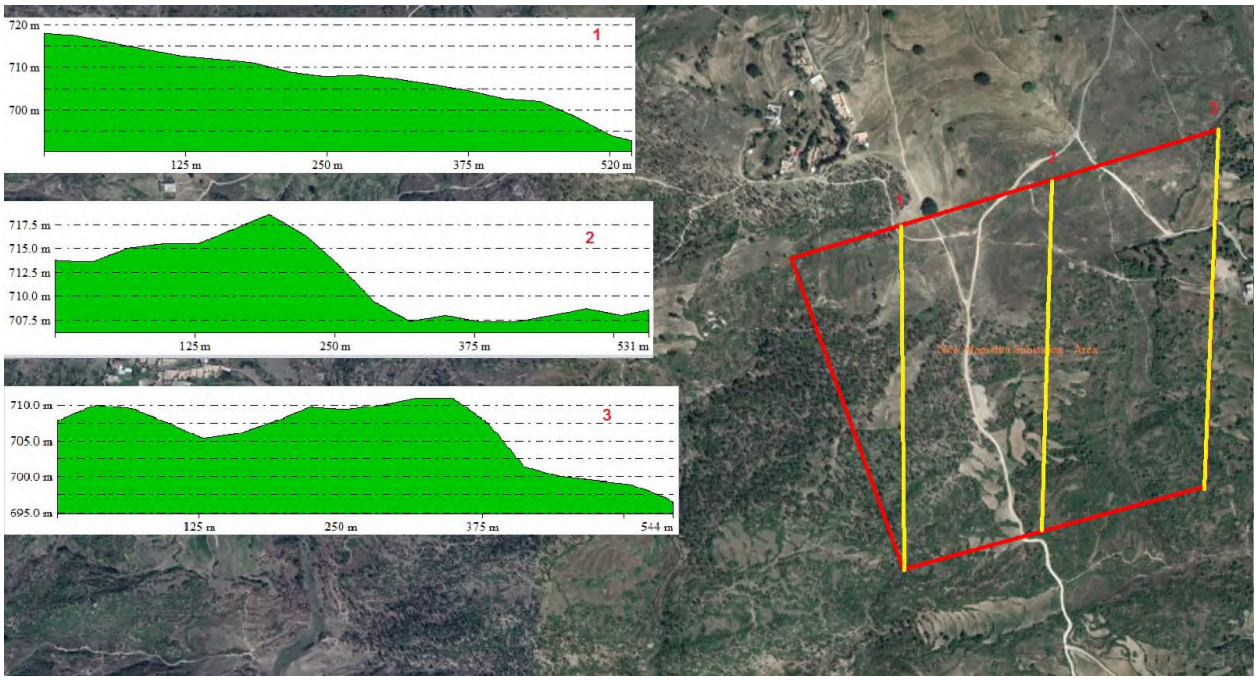

Figure 5-7: Mansehra GS topography – transverse profile

(d) Mansehra GS to Islamabad GS

Trangri (AP-153) to Lassan Thakral (AP-167) the line route moves along the Siran River in Plain areas upto Bher Kund (AP-157). After Bher Kund the line route bypasses the population of Mansehra City and moves towards the Lassan. New Mansehra Grid Station has been chosen between towns of Lassan Thakral and Lassan Nawab Sahib. The grid station area is on relatively flat terrain with no access roads. Road construction and bridges will be considered for the construction of the New Mansehra Substation and the 765 kV connecting line. This section length is 21.72 km and average elevation is 900 m amsl. The line connection between 765 kV DTL and New Mansehra Grid Station is 3.5 km.

Figure 5-8: Challenging location

From Lassan Thakral (AP-167) to Lakhala (AP-171), section length is 10.38 km and average elevation is 841 m amsl. Lakhala (AP-171) to Chatthi Gali (AP-175) a section of 9.52 km the line route crosses Mangal River near the Lakhala Town, average elevation is 670 m amsl. From Chatthi (AP-175) to Kag (AP-180), the line bypasses the population of Darwaza Town. Length of the section is 5.78 km with an average elevation of 612 m amsl. From Kag (AP-180) to Sarai Saleh Mohra (AP-185), the line route crosses the 220 kV existing line, with a length of 12.24 km and average elevation of 600 m amsl. AP-185 to Mirpur and Kahal (AP-190), the line route crosses two 132 kV existing line, Railway Track and Hazara Expressway (E-35) near the Mohra Town. This section length is 8.40 km and average elevation is 600 m amsl.

From Kahal (AP-190) to Mang (AP-191), the line route moves on the bottom of small elevation mountain and bypasses the scattered population areas as well as agricultural areas. It crosses the Kahal Stream. The 220 kV existing line crossing also comes in this section near the Khanpur Road. Also, near the AP-191 there is a quarry on the side of the road. The above section length (AP190-AP191) is 4.94 km and Average Elevation is 619 m amsl.

From Mang (AP-191) to Dingi (AP-198), the line route moves on the Plain areas bypassing the dense and scattered population areas. The line route also bypasses the Hattar Industrial State Area. It also crosses the 132 kV existing line, Railway Track and Dotal Khas Stream near the Kot Najibullah Town. The line route in this section mostly moves in parallel to the Hazara Expressway (E-35). This section length is 10.53 km and average elevation is 482 m amsl. From Dingi (AP-198) to IWGS (AP-217), the line traverses in the plain areas up to the Grid Station. The line crosses seven 132 kV lines, one 220 kV line, Karakoram Highway, Haro River, one 500 kV line, Grand Trunk (GT) Road, and Motorway (M-1). This section length is 33.89 km and the elevation ranges in between 406-451 m amsl. One of the challenging location in this section is shown in Figure 5.8 and the elevation profile between Mansehra GS to Islamabad West GS is presented in Figure 5.9.

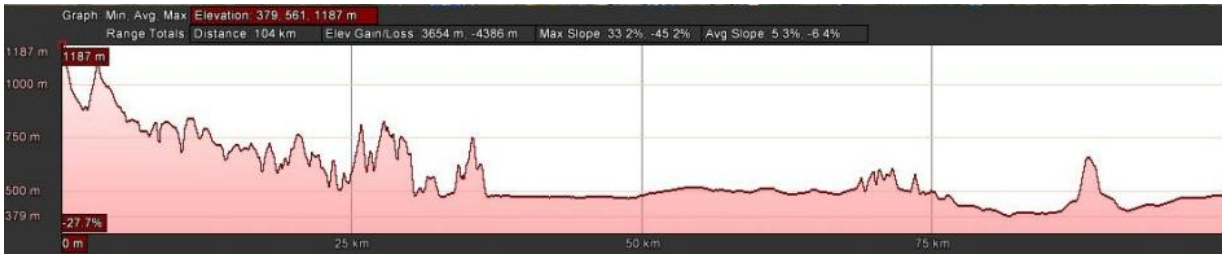

Figure 5-9: DTL Elevation Profile for Besham to Mansehra Section

5.1.2 Landuse

The Project influence area is mostly covered by agricultural land (about 42.5%), shrub and bushes (about 18.7%), moist temperate (about 13%), rangeland (8.25%), Oak forest (6.35%), dry temperate (about 4.9%), settlements (about 4.39%), and some other usage, e.g., sub-tropical broad-leaved, Alpine pasture, and water bodies. Most of the agricultural land starts from Mansehra onward to Islamabad direction. Landcover map is presented in Figure 5.10.

5.1.3 Climate

The climatic variations occur due to change in the latitude, altitude, position and changing terrain along the project area, therefore, the proposed project corridor from Dasu to Islamabad has been divided into two segments: i) from Dasu to Mansehra; and ii) from Mansehra to Islamabad. Climate of these segments is discussed below.

5.1.4 Climate of Dasu to Mansehra Section

Climatic data of Dasu to Mansehra pertaining to rainfall, relative humidity, wind and temperature has been obtained from Pattan (Kohistan), Shangla, and Abbottabad observatories of Pakistan Meteorological Department and is discussed below.

(a) Precipitation

Precipitation intensity and quantity greatly vary in the mountainous terrain as compared to the plain areas because of the orographic control system provides the uplifting mechanisms to hold wind currents with moisture, resulting in copious rainfall mainly on the sides of the winds.

Table 5.1 presents the mean monthly maximum precipitation of 181.7 mm, 261.48 mm, and 145 mm in Kohistan, Abbottabad and Shangla districts, respectively9. There are normally two spells of rains in these areas, one is associated with monsoon winds from mid-July to end September, when average monthly rainfall ranges between 26.53 to 261.48 mm, and the second spell with the western winds from December to April, when average monthly rainfall ranges between 67.8mm to 181.7mm. Higher elevations in these areas also receive precipitation in the form of snow. Regular snowfall starts at the end of December and may occur up to the end of February.

Table 5-1: Mean Monthly Precipitation10

District	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Kohistan	172.3	129	148.9	102.73	65.23	76.3	98.53	67.57	26.53	26.77	76.6	181.7
Shangla	120.9	112	123.9	145.33	12.9	53.03	134.7	121.9	60.33	25.55	39.28	67.8

9 Data Source: NTDC Environment Assessment Report, Group D, Volume 4.4/7

10 Government of Pakistan, **Pakistan Meteorological Department,** http://www.pmd.gov.pk/en

Abbottabad	100.5	82.9	85.65	113.65	51.73	132.7	261.48	177.8	76.38	24.23	53.9	81.83

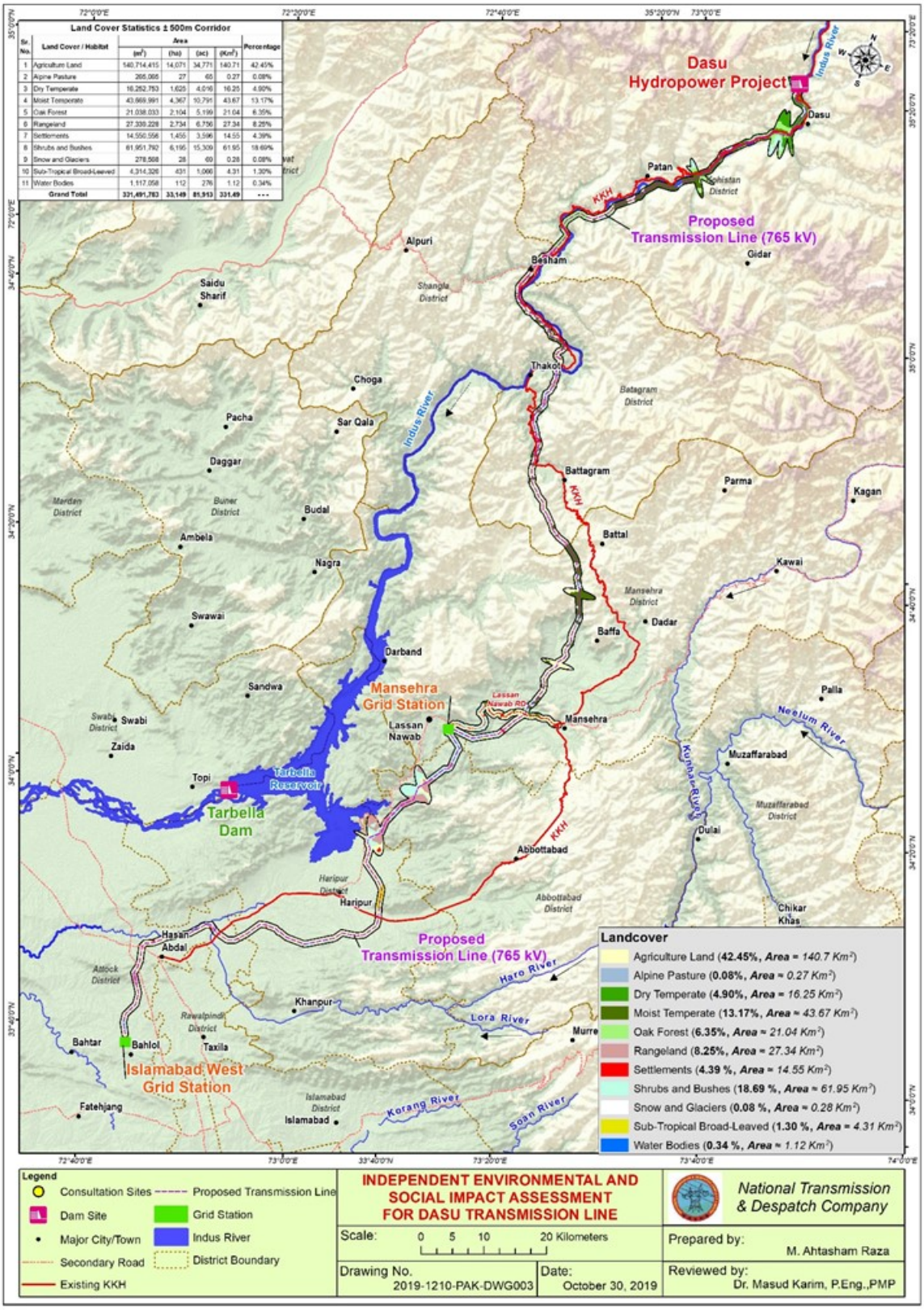

Figure 5-10: Landuse map of the influence area

(b) Temperature

Mean monthly temperatures for the three districts are presented in **Table 5.2**, which show the mean monthly maximum temperatures of 37.3˚C, 31.8˚C and 35.05˚C observed at Kohistan, Shangla, Mansehra and Abbottabad, while mean monthly minimum temperatures of 13.47˚C, 12.65˚C and 14.45˚C, respectively.

Table 5-2: Mean Monthly Temperature[10]

District	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Kohistan	13.47	17.7	22.23	29.7	35.93	37.3	37.1	36.1	34.37	30.77	24.27	16.47
Shangla	12.65	15.4	19.65	24.88	30.73	31.8	30.43	29.3	28.6	26.45	21.08	15.15
Abbottabad	14.45	17.9	22.18	27.85	34.3	34.78	35.05	33.88	32.55	30.28	23.23	16.85

(c) Relative Humidity

The relative humidity is fairly high in the area as shown in **Table 5.3**. It is highest in August and the lowest in May. With the advent of monsoon, the humidity increases during July and August and declines from September onwards. Maximum mean monthly relative humidity is recorded as 75%, 88% and 83% in Kohistan, Shangla and Abbottabad districts, respectively.

Table 5-3: Mean Monthly Relative Humidity

District	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Kohistan	56	59	60	55	51	54	69	73	74	75	61	52
Shangla	74	75	69	69	56	63	81	88	82	69	69	70
Abbottabad	82	81	76	71	20	25	79	83	81	80	80	81

(d) Wind Direction

The predominant directions of winds in the area are normally from northeast during winters at morning time (at 8:00 am) and from the southeast in the evening (at 5:00 pm). During summers the predominant wind direction in both morning and evening is from the southeast. The wind speed is not more than four knots at all the stations year around.

5.1.5 Climate of Mansehra-Islamabad Section

This section of the project area comprises of three districts namely Mansehra, Haripur and Attock. Mansehra district observes cold winters and pleasant summers. The meteorological data for Mansehra[11] to Islamabad section of the project area is discussed below.

(a) Precipitation

As shown in **Table 5.4**, maximum precipitation is recorded in the month of August, which is 102.66 mm, followed by February, April and July having rainfall of 92.52 mm, 80.72 mm and 78.04 mm, respectively. The minimum precipitation is recorded in the month of

11 In this Section, meteorological data of Abbottabad is presented which is representative of the Mansehra district as well.

December as 13.85 mm and then November as 16.4 5mm which is the mean monthly precipitation in these years. Mean monthly precipitation data[12] is presented in **Table 5.4**.

Table 5-4: Mean Monthly Precipitation (Abbottabad-Islamabad)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005	101.1	100.8	107.7	44.7	74.1	12.6	78.6	66.6	52.8	20.7	21.3	3.6
2006	64.8	63.3	83.1	35.1	26.1	36.3	133.8	129.3	44.4	39.0	58.2	108.0
2007	1.8	170.4	142.5	6.3	33.9	86.1	110.4	81.3	53.1	6.3	11.1	9.0
2008	81.0	13.5	0.6	161.4	36.0	78.3	84.0	192.3	50.7	16.5	12.6	48.3
2009	95.4	120.9	80.7	147.9	43.2	21.6	44.7	73.2	68.1	6.3	19.2	3.6
2010	8.4	140.1	17.7	33.3	33.0	81.3	306.0	187.2	45.9	8.7	2.4	1.2
2011	3.0	140.7	50.4	67.8	48.9	43.8	84.6	114.0	96.3	56.1	41.7	1.1
2012	43.8	63.6	45.6	121.8	45.6	7.5	53.4	121.2	118.5	23.1	13.2	61.8
2013	0.6	204.0	140.7	130.5	66.0	75.6	32.4	145.2	40.8	48.6	39.6	1.0
2014	0	128.1	201.0	63.3	69.0	31.5	75.0	75.0	81.0	98.7	12.6	0.9
2015	2.9	143.7	75.4	77.8	48.9	43.8	84.6	102.0	98.3	66.1	42.7	0.8
2016	3.1	139.4	49.5	67.8	47.2	42.8	83.6	112.0	94.3	56.8	41.6	1.1
2017	3.1	144.2	76.4	77.8	46.2	43.1	81.9	102.0	99.1	65.2	41.2	0.8

(b) Temperature

Temperature in different parts of the project area along the Dasu transmission line route from Mansehra to Islamabad varies according to the elevation **(Table 5.5)**. Temperature begins to rise rapidly from the end of March till June, which is the warmest month. The temperature remains high during July to September in the semi-arid zone of the project area at Haripur and Attock districts. With the onset of southwest monsoon by the end of June, the temperature begins to decrease gradually; however, the drop is rapid only after October. January is the coolest month. The data shows that the monthly temperature varies from 10.81ºC in January to 36.33ºC during June. The average monthly temperature ranges from 13.30ºC during the month of January to 33.81ºC during the month of June.

Table 5-5: Mean Monthly Temperature (Abbottabad-Islamabad)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005	12.45	13.75	19.11	22.11	25.58	32.41	29.30	28.61	26.97	23.43	17.66	15.00
2006	13.14	19.02	19.26	22.74	31.43	33.11	31.86	27.80	26.10	24.17	18.75	13.93
2007	12.79	15.25	18.14	25.74	29.76	33.97	33.44	29.80	27.54	23.00	20.78	14.42
2008	10.81	13.28	20.56	22.73	29.61	36.33	32.60	28.51	26.21	24.17	19.21	16.46
2009	14.43	15.61	19.90	23.10	28.33	30.94	32.14	30.17	27.50	23.56	17.80	15.48
2010	15.68	15.39	22.34	25.34	28.72	31.42	30.58	28.07	25.64	25.27	19.96	14.94
2011	13.56	15.27	19.70	22.65	31.14	35.29	33.45	29.23	27.07	23.86	20.82	14.64

12 Climate modeling was employed to generate the climatic data illustrated in this section sing the NCEP Reanalysis data sets (The NCEP/NCAR Reanalysis 1 project is using a state-of-the-art analysis/forecast system to perform data assimilation using past data from 1948 to the present. A large subset of this data is available from PSD in its original 4 times daily format and as daily averages. Simulation was run using these data sets and the coordinates of the project area which produced the results presented in the report).

2012	12.11	12.77	18.02	22.64	27.99	34.22	34.98	31.38	28.68	26.15	20.64	15.78
2013	13.75	16.38	20.96	24.49	30.98	35.06	34.14	30.11	29.35	25.41	19.66	15.11
2014	14.29	14.55	19.21	23.36	27.45	35.31	33.75	30.30	27.97	23.93	19.55	15.47
2015	13.86	16.72	21.72	23.06	31.14	35.29	33.45	29.23	27.07	23.86	20.82	14.64
2016	12.47	15.35	18.89	24.71	30.76	34.47	34.14	30.81	28.15	22.89	21.28	14.92
2017	14.17	16.15	19.79	25.72	32.01	34.02	35.34	31.18	29.35	24.19	22.81	15.09

(c) Relative Humidity

In the project area from Mansehra to Islamabad, Tarbela Dam reservoir is the nearest main source of evaporation and humidity. Apart from Tarbela reservoir, there are several other surface water bodies and vegetation cover which also contribute to higher relative humidity of the project area particularly near Haripur district. While in district Attock, Haro River and Indus River are the main sources for evaporation and humidity. Maximum humidity of 92.60% has been recorded during the month of August, while 29.22% during the month of June in the area. The mean monthly humidity for the last ten year of the proposed project area varies from 31.39 % in the month of June to 66.84 % in the month of August **(Table 5.6).**

Table 5-6: Mean Monthly Relative Humidity (Abbottabad-Islamabad)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005	77.74	78.54	77.65	66.64	60.84	43.02	75.32	83.04	80.76	64.94	63.78	65.22
2006	74.14	73.87	77.25	65.31	40.81	36.70	65.66	92.60	84.96	72.23	71.29	77.06
2007	76.49	80.60	76.54	61.95	47.70	45.45	54.68	78.73	72.94	61.04	60.18	71.94
2008	77.23	72.64	74.00	71.16	49.57	35.99	62.42	85.75	78.78	68.67	64.08	67.98
2009	76.89	74.38	71.21	67.18	47.06	41.25	61.55	74.57	74.94	66.28	71.29	68.55
2010	71.85	74.92	67.51	64.99	52.02	47.93	73.02	91.62	83.02	53.82	57.21	65.98
2011	68.19	72.29	65.92	62.38	38.77	29.34	51.44	80.10	79.22	67.89	60.62	66.80
2012	71.55	71.96	68.38	72.42	49.40	29.22	44.08	68.07	68.67	49.10	50.12	65.51
2013	69.10	72.05	67.33	61.03	37.58	36.59	53.07	73.80	66.87	65.95	60.35	64.48
2014	72.95	72.80	69.59	65.86	60.22	31.17	53.77	73.77	73.83	68.80	60.60	60.38
2015	70.81	73.09	66.87	67.31	40.79	32.39	54.21	81.12	80.20	69.14	61.86	67.81
2016	71.08	72.97	67.81	68.03	41.89	33.31	53.21	82.17	81.21	70.12	62.81	68.11
2017	72.92	72.28	69.29	65.36	61.21	32.14	53.27	75.71	72.83	69.81	61.62	60.13

5.1.6 Hydrology and flooding

Indus River is the main river in the project area and is basically snow-fed. The Indus and its tributaries receive all their water in the upper parts of their catchments. In Indus River, the water level is at its lowest from mid-December to mid-February. After that the river starts rising, slowly at first and then more rapidly at the end of March. The high-water level usually occurs between mid-July and mid-August. The river then falls rapidly until the beginning of October, when the water level subsides more gradually. Annually, the upper Indus River carries about 110 billion cubic meters (bcm). In total, 44 crossings of the transmission line alignment with Indus river, its tributaries and streams (nullahs) have been identified (see Table 5.7). With regard to flooding, the first zone of DTL route from Dasu to Besham is crossing the Indus River at several points but there is no flooding risk for the

transmission line and its towers since the river is flowing in a deep gorge and the DTL is aligned higher up along the mountains.

The Besham to Mansehra section crosses Siran River in addition to several small water streams (nullahs). The Siran River is gradually shifting its direction of flow through deltaic pattern developing flood plains. Haro River also develops a number of flood plains. The transmission line route is passing through these flood plains and precautions will have to be taken during the construction phase to avoid any flood damages to the transmission line. Other parts of the DTL section do not face any significant flood risks.

Table 5-7: Key River and Stream Crossings along DTL Route

Angle Tower		River/Stream	Latitude	Longitude
From	To			
1	2	Indus River	35°18'10.56"N	73°11'42.66"E
2	3	Seo Nullah	35°17'35.01"N	73°11'54.07"E
13	14	Musam Abad Nullah	35°15'10.98"N	73°12'28.34"E
15	16	Indus River	35°14'35.30"N	73°12'18.86"E
16	17	Yanjo Gah Nullah	35°14'27.57"N	73°11'47.84"E
17	18	Indus River	35°14'24.33"N	73°10'48.68"E
36	37	Kero Nullah	35°11'0.59"N	73° 6'30.32"E
42	43	Indus River	35° 8'40.18"N	73° 5'7.63"E
43	44	Chor Nullah	35° 8'29.09"N	73° 5'1.84"E
52	53	Sherakot Nullah	35° 5'49.48"N	73° 0'20.46"E
59	60	Kolai Nullah	35° 2'33.92"N	72°57'9.20"E
65	66	Indus River	35° 0'35.91"N	72°53'34.53"E
72	73	Alpure Khwar	34°56'5.75"N	72°52'8.94"E
77	78	Malango Nullah	34°53'34.36"N	72°51'41.89"E
80	81	Shang Khwar	34°52'36.78"N	72°52'59.94"E
85	86	Bandi Paiza Nullah	34°51'46.28"N	72°55'47.98"E
88	89	Wach Khwar	34°51'12.63"N	72°56'32.15"E
89	90	Qala Khwar	34°51'12.40"N	72°57'0.66"E
94	95	Manri Nullah	34°50'2.45"N	72°57'38.23"E
98	99	Indus River	34°49'1.08"N	72°58'11.38"E
101	102	Tarkho Nullah	34°48'2.74"N	72°58'23.94"E
110	111	Shamrat nullah	34°45'37.97"N	72°58'10.57"E
119	120	Jrando Khwar	34°42'17.40"N	72°59'3.85"E
120	121	Battagram Nullah	34°41'11.82"N	72°59'10.75"E
124	125	Landay khwar	34°39'36.91"N	72°59'30.06"E
131	132	Maira Dab Nullah	34°37'7.47"N	73° 1'55.43"E
137	138	Qaim Gal nullah	34°37'7.47"N	73° 06'33.10"E
140	141	Naari spring	34°33'5.44"N	73° 07'54.10"E

Angle Tower		River/Stream	Latitude	Longitude
From	To			
142	143	Saror Nullah	34°31’58.45”N	73° 8’6.44”E
153	154	Malakpur Nullah	34°25’37.29”N	73° 9’22.78”E
155	156	Siran River	34°42’31.76”N	73° 42’31.31”E
157	158	Siran River	34°23’36.52”N	73°08’13.24”E
159	160	Siran River	34°22’39.07”N	73°08’27.62”E
164	165	Madan Nullah	34°19’9.90”N	73° 6’54.00”E
171	172	Mangal Nullah	34°11’22.94”N	73° 0’26.64”E
174	175	Soha Nullah	34° 8’6.58”N	72°58’30.96”E
180	181	Kaag nullah	34°03’21.70”N	72°57’34.55”E
184	185	Dor River	34° 8’6.58”N	73° 0’35.56”E
186	187	Soka Nullah	33°57’23.30”N	73° 0’2.88”E
190	191	Kahil Nullah	33°56’5.04”N	72°57’7.23”E
194	195	Hattar Nullah	33°55’0.37”N	72°51’28.62”E
201	202	Haro River	33°53’8.20”N	72°45’21.66”E
204	205	Haro River	34°42’31.76”N	73° 42’31.31”E
209	210	Hasan Abdal Nullah	33°49'26.97"N	72°38'57.29"E

The River Siran is one of the main rivers in Mansehra district and is situated about 14.5 km from Mansehra Grid Station.

The proposed site of Mansehra Grid Station has no river or stream crossing its area. However, during the Monsoon times, when the quantities of water increase significantly, the site is in risk of flooding. According to the flood risk index of the region, the wider project area exhibits high risk.

5.1.7 Geology

Geologically, the northern Pakistan region is divided into three blocks, from north to south: Karakoram Block, Kohistan Island Arc and Indian plate. The project area is located in the southern part of the Kohistan Island Arc bounded by the Main Karakoram Thrust in the north and west (Northern Suture) and by the Main Mantle Thrust (MMT) to the south and east (see Figure 5-5).

Geology of the proposed DTL route can be better described by dividing the whole corridor into three distinct zones as discussed below.

(a) Geology of Dasu area

The Kohistan Arc Complex is an area of igneous and sedimentary rocks that was formed during the mid-Cretaceous period. The area lies near to the area where the Asian and Indian continental plates meet, resulting in considerable thrusting, uplifting, tilting and plutonic activity. In the project area mainly granulites and amphibolites can be found on both sides of the Indus. These rock formations belong to Cretaceous period. At places the geological conditions are quite complex, with major faults, volcanic intrusions, batholites and thrusts.

During the visit along the road sides coarsely crystalline dioritic granulite are found. These granulite rocks are generally massive to blocky, slightly foliated and strong to very strong.

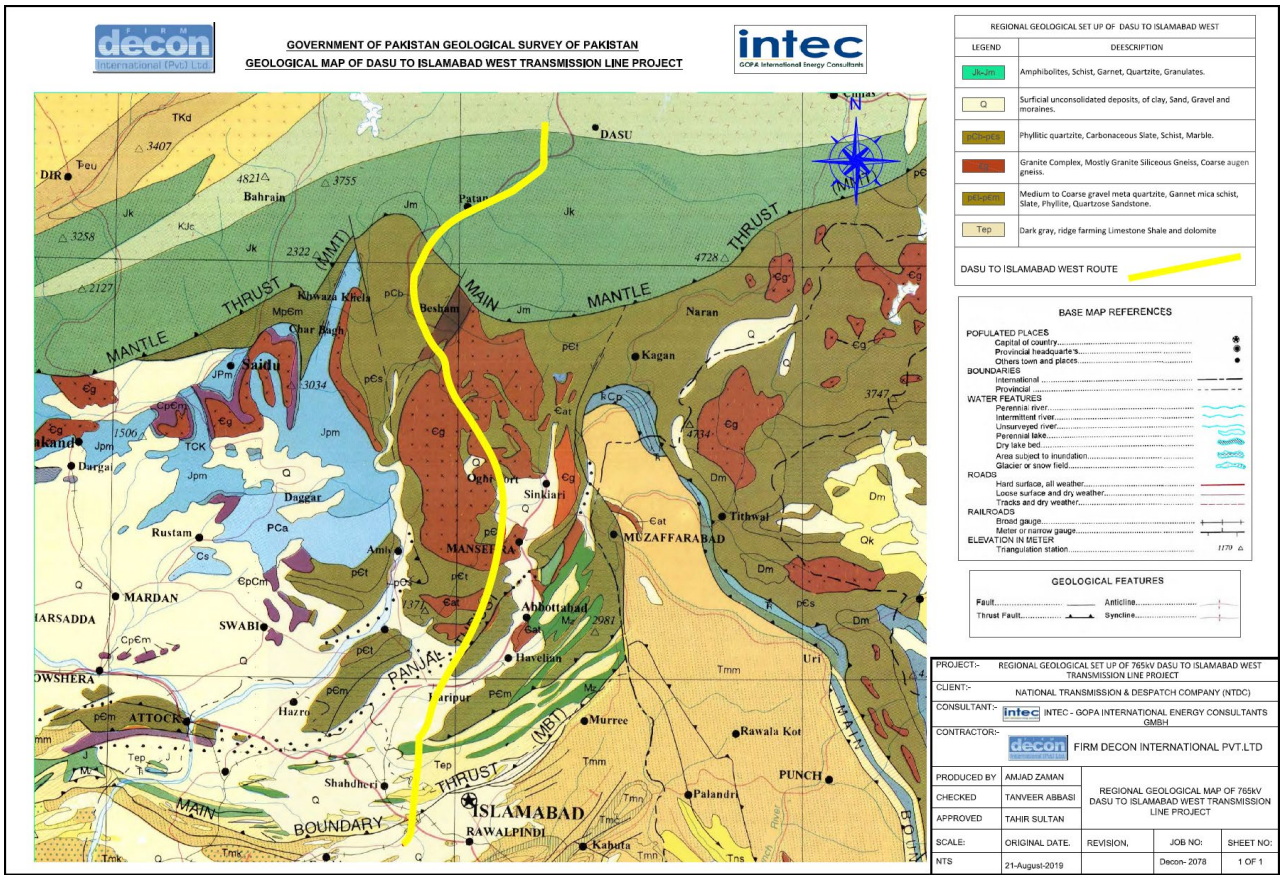

Figure 5-5: Geological Map of the Project Area

(b) Geology of Besham area

The Besham Group comprises a heterogeneous mixture of biotitic gneisses and schists (most of uncertain paragenesis), granitic gneisses, metapsammites, amphibolite, bluequartz pegmatites and other pegmatites, weakly deformed hornblende-granodiorite, mylonites, phyllonites and undeformed microgranites. The gneisses are medium to coarse grained. The gneissic textures and fabrics with a quartz, feldspar, muscovite, biotite, and garnet and hornblendic-amphibole mineralogy are the products of the pre-Himalayan high-grade deformation and metamorphism with its associated granite and pegmatite intrusion. Pegmatite and amphibolite sheet intrusion sub-parallel to the fabric and banding is very common throughout the Besham Group. Most have sheared contacts, but undeformed intrusive contacts are also seen. Most of the amphibolites are sills less than 1m thick. Some amphibolitcs are cut by pegmatites. Boudinage has commonly isolated pods of pegmatite and amphibolite within the gneisses.

(c) Geology of Mansehra Hazara area

The geologic formations of the Hazara district range in age from Precambrian to Quaternary and include sedimentary, igneous, and metamorphic rocks and unconsolidated material. The rock units of Precambrian and possibly early Paleozoic age and early and middle Paleozoic age are mainly clastic, although contains considerable non clastic carbonate material. The main episode of igneous activity took place in Late Cretaceous and early Tertiary time and resulted in the synorogenic intrusions of the Mansehra Granite. These granite rocks are thought to represent the southern fringes of the extensive granite

intrusions in the axial zone of the Himalaya. Post orogenic intrusive rocks include mafic dikes and quartz veins, the latter thought to be associated with a phase of weak hydrothermal activity, which produced veins of soapstone and barite.

5.1.8 Seismicity of the Project Area

The proposed DTL route crosses areas which have been declared 'Moderate to severe Damage Zone' having 'g' factor ranging between 0.1 and 0.3. The route crosses the major fault – the Main Mantle Thrust (MMT) - near Jijal and Dubair Khwar. As a result, the project area from Kohistan to Battagram is considered area of high seismicity risk, while Mansehra, Haripur and Attock districts are at medium risk of earthquake. These considerations will inform the technical design of the tower foundations and the civil structures of Mansehra Grid Station.

5.1.9 Soils of the Project Area

(a) DTL alignment

The proposed project area from Dasu to Besham has high relief mountains and the parental rocks due to weathering affects converted into unconsolidated heterogeneous material (Colluvial). They are generally deposited at the base of high mountain cliffs and high angle steep slopes, or at gentle part of slopes.

Soils of Besham-Mansehra area, including the soils of the Mansehra Grid Station, mainly comprise of reworked loess, colluvial and alluvial deposits. These deposits are mainly found in terraces in the flood plains of rivers in the area and valley reliefs. As mentioned earlier, the colluvium is originated from the fall material from the cliffs of the hills slopes. Alluvial deposits have also been observed along the rivers and streams or nullahs in Mansehra district. Reworked loess has been observed along the valleys of Battagram and Mansehra.

From Mansehra to Islamabad, the soils are comprised of colluvial deposits along the hills cliffs. Quaternary alluvial material has been found in the flood plains of Haripur-Islamabad along the rivers and streams plains. Alluvial deposits of this area are mainly composed of silt, sand, clay, gravels, cobbles and boulders. During field visits to the project sites, loess depositions have also been observed forming almost vertical gullies by water from streams.

(b) Mansehra Grid Station

Soil and subsoil investigations were carried out to support the design of the civil structures at Mansehra GS. Four boreholes were drilled to assess the geotechnical conditions of the subsurface. The boreholes were drilled up to 12 m. A thick soil cover was found, with weak to moderately strong, fine to coarse grained Granite Gneiss. Groundwater was not encountered up to 12 m depth. It is reported that the depth of the groundwater table is at 20-30 m. The exact locations of the boreholes as well as the main findings are presented in Table 5.8.

Table 5-8: Stratigraphy / lithology of the project site

Borehole	Easting	Northing	Layer depth (m)	Subsurface stratigraphy / lithology
BHMS-01	317155.00	3794467.00	0-12	Dense to very dense, whitish grey, highly weathered, medium to coarse grained SAND possibly of Granite Gneiss containing Quartz grains

Borehole	Easting	Northing	Layer depth (m)	Subsurface stratigraphy / lithology
BHMS-02	317170.00	3793841.00	0-9	Dense to very dense, brownish grey, medium to coarse grained, highly weathered SAND possibly of Granite Gneiss
			10-11	Medium dense, light brown, fine to medium grained sandy CLAY
			11-12	Dense, brownish grey, fine to medium grained SAND
BHMS-03	319514.00	3793239.00	0-3	Overburden: Very dense, whitish grey to grey locally off-white, medium to coarse grained SAND possibly of granite Gneiss
			4-12	Moderately strong, whitish grey, coarse to very coarse grained, strongly porphyrite with feldspar phenocryst Granite GNEISS, fracture close to medium spaced, horizontal to sub-horizontal
BHMS-04	317364.00	3794075.00	012	Very dense, brownish grey, medium to coarse grained Sand possibly of Granite Gneiss, rounded to sub-rounded

5.1.10 Geomorphology of the Project Area

The DTL alignment from Dasu to Besham is characterized by small scale landslides, rock fall and erosion processes from the slopes of the mountains. Onward from Dasu to Besham transmission line route is crossing hills slopes of ingenious and metamorphic rocks. These two major rocks formations are very stable for tower foundations and there are no chances for major landslides although alluvial materials have also been observed as the upper surface layer, but the thickness of alluvial material is not enough to cause significant impacts on the tower foundations as the underlying rocks seem to be hard and of good strength.

The area from Dasu to Keyal has no major faults; as a result, the risks of land sliding is less. However, the area between Pattan and Besham is comparatively more disturbed structurally, mainly due to the passage of the MMT and presence of Pattan Shear / Fault.

From Besham to Mansehra the chances for major land sliding and rock falling from the hills are limited, due to the relatively hard rock nature of this area.

Proposed project area from Mansehra to Islamabad has igneous, metamorphic and sedimentary geological origin; however, the area from Haripur to Attock has alluvial and colluvial deposits in the plains. From Mansehra to Haripur the proposed transmission line passes through hilly terrain of low relief. The area from Haripur to Islamabad is of plain terrain formed by alluvial materials mostly.

5.2 Environmental Quality

5.2.1 Groundwater

From Dasu to Besham, gravity springs are the main groundwater source for communities along the project corridor used for drinking as well as domestic purposes. The water level is high in these springs and water flow is enough to fulfill the community needs. Gravity springs are abundantly found in the project area, communities have sourced these springs with storage tanks at some sites and water pipes to individual houses.

Onward from Besham towards Battagram, the main groundwater sources are gravity springs and small numbers of dug wells and boreholes. These water sources fulfill the drinking water and other domestic needs of the communities. The average groundwater table is about 20-30 meters deep. From Battagram to Haripur the main groundwater sources are gravity springs, dug wells, borehole and tube wells.

In areas of mountainous terrain, gravity springs are the major groundwater source with a few dug wells and boreholes. While in the plain areas from Mansehra to Haripur, dug wells, bore holes and tube wells are the primary sources of groundwater.

In the plain areas (Haripur- Islamabad) dug wells, bore holes and tube wells are the main sources of groundwater. In Haripur groundwater is mainly used for drinking and domestic purposes with limited use for irrigation purposes. While in the plain areas of Attock district groundwater is used for irrigation purposes as well.

From Haripur to Islamabad (Attock) plenty of groundwater is available due to good recharge system present in this area. The average water table varies from place to place. The average water table depth is about 20 meters in the Hazro towards northeast and 120 meters in Jand and Pindi Gheb tehsils toward southeast along the proposed project area.

5.2.2 Water Quality

Measurements of surface water quality are carried out as part of the DHP monitoring program, at a number of locations along the Indus River and its tributaries down to Tarbela dam. The analysis focuses on the physicochemical parameters of surface waters. The results show compliance with the national standards.

In Mansehra GS, groundwater quality was analyzed in July 2019 by collecting samples from available wells in Sawan Maira village. The results revealed that water quality generally complies with National Standards (Table 5.9), with the exception of Coliform contamination.

Table 5.9: Water Quality in the Mansehra GS Site area

No.	Parameter	Unit	Sample # 1	Sample # 2	NEQS
1	Temperature	^{0}C	21.0	20.0	----
2	pH	--	7.48	7.24	6.5-8.5
3	Total Dissolved Solids (TDS)	mg/l	374	215	1000
4	Total Suspended Solids (TSS)	mg/l	04	02	---
5	Chloride	mg/l	75	56	250
6	Fluoride	mg/l	0.08	0.03	1.5
7	Taste	Object./unobj.	Unobject.	Unobject.	Unobject
8	Odor	Object./unobj.	Unobject.	Unobject.	Unobject.
9	Color	TCU	0	0	15
10	Iron	mg/l	0.15	0.14	0.3

No.	Parameter	Unit	Sample # 1	Sample # 2	NEQS
11	Sodium	mg/l	42	56	200
12	Nitrate (as NO_3^-)	mg/l	21	23	50
13	Nitrite (as NO_2^-)	mg/l	BDL13	00.2	3
14	Ammonia	mg/l	0	0	1.5
15	Hydrogen Sulfide (H_2S)	mg/l	BDL	BDL	0.05
16	Sulphate	mg/l	86	72	250
17	Lead	mg/l	BDL	BDL	0.10
18	Total Hardness as $CaCO_3$	mg/l	132	144	500
19	Turbidity	NTU	0	0	5
20	Zinc	mg/l	0	0.01	3
21	Manganese	mg/l	BDL	BDL	0.1
22	Benzene	mg/l	BDL	BDL	10-120
23	Aluminum	mg/l	BDL	BDL	0.2
24	Molybdenum	mg/l	BDL	BDL	0.070
25	Chromium	mg/l	0.02	0.01	0.050
26	Cadmium	mg/l	BDL	BDL	0.003
27	Boron	mg/l	BDL	BDL	0.300
28	Barium	mg/l	BDL	BDL	0.700
29	Antimony	mg/l	BDL	BDL	0.005
30	Arsenic	mg/l	BDL	BDL	0.010
31	Cyanide	mg/l	BDL	BDL	0.070
32	Mercury	mg/l	BDL	BDL	0.001
33	Nickel	mg/l	BDL	BDL	0.020
34	Total Coliform	Number/100ml	60	40	0/100 ml
35	E. Coli	Number/100ml	0	0	0/100 ml

5.2.3 Ambient Air Quality

The project area is a predominantly rural area, where ambient air pollution is attributed only to vehicular traffic.

Ambient air quality measurements for the DTL alignment are available since the environmental assessment studies of DTL (for summer and winter period), while measurements in Mansehra GS were carried out in July 2019. Although the measurements for DTL are dated a few years back, there hasn't been any development in the area that would justify a change in air pollution. The results of ambient air quality are shown in Table 5.10.

[13] BDL: Below Detection Limit

Table 5.10: Atmospheric quality along the DTL alignment

Description	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		SO_2 (µg/m³)		CO (mg/m³)		CO_2 (µg/m³)		NO_2 (µg/m³)	
	S	W	S	W	S	W	S	W	S	W	S	W
NEQS	35	35	250	250	120	120	5	5	-		80	80
Dasu Bridge	19.8	75.4	25.6	79.7	42.5	18	1.6	5.4	342	562	41.1	36.5
Komila Bazar	26.3	109.8	24.5	118.6	44.2	25.9	2.3	3	352	740	41.2	34.8
Old Seo	29.9	55.9	32.2	86.8	37.5	10.7	1.9	1.4	347	499	38.7	30.3
Seo Mosque	35.2	89.2	36.5	64.6	37.8	10.8	1.8	1.3	340	528	34.2	23.3
Pattan	33.3	26.3	73.2	45.2	38.9	10.1	2.5	10.1	376	366	45.6	21.3
Besham	78.6	50.2	39.8	61.8	45	10.9	2.8	10.9	365	385	47.8	36.7
Thakot	-	3	-	83.2	-	18.8	-	2.2	-	626	-	62.9
Battagram	-	83	-	76.8	-	17.2	-	1.8	-	702	-	54.1
Chattar Plain	-	79.7	-	58	-	17.2	-	1	-	570	-	40.7
Mansehra	-	72.1	-	78.2	-	19.8	-	1	-	437	-	124
Abbottabad	-	182.7	-	110.8	-	33	-	4.8	-	573	-	114.6
Havelian	-	72.1	-	58.5	-	12.5	-	2.3	-	346	-	56.2

Table 5.11: Ambient Air Quality in Mansehra GS

Parameter	Time Duration	Unit	Method	Day #1	Day #2	NEQS	IFC Guide-line
PM_{10}	24 Hours	µg/m³	Beta Gauge Measurement Method	142	142	250	50
CO	8 Hour	mg/m³	Non Dispersive Infrared Absorption (NDIR)	2.65	2.65	5	----
NO_X as NO_2	24 Hour	µg/m³	Reduced Pressure Chemiluminescence (CLD)	26.3	26.3	80	40
SO_X as SO_2	24 Hour	µg/m³	UV fluorescence (UVF)	32.4	32.4	120	50

Measurements have shown that air quality generally complies with standards, with the exception of particulate matter where exceedances WBG Guidelines are observed in many locations, however, complied with NEQS.

5.2.4 Noise

Noise measurements for the DTL alignment are for summer and winter period, measurements in Mansehra GS were carried out in July 2019. Although the measurements for DTL are dated a few years back, there hasn't been any development in the area that would justify a change in noise, which is mostly attributed to vehicle traffic.

Table 5.12: Noise levels along the DTL alignment

	Site	Summer			Winter			NEQS 2010
		*Day	**Night	24 h	*Day	**Night	24 h	Residential Area:
1	Seo Mosque	46.4	49	47.3	48	42.9	46.4	Daytime: 55
2	Old Seo	47.3	50.6	48.4	51.3	47.7	50.1	Nighttime: 45
3	Dasu	51.4	47.1	49.9	58	44.9	53.6	
4	Komila Bazar	49.1	48.9	49.1	56.1	52.8	55	
5	Pattan	55	53.8	54.6	53.8	48.8	52.2	
6	Besham	56.8	56.9	56.8	59.4	58.7	59.2	
7	Thakot	-	-	-	53.4	51.7	52.8	
8	Battagram	-	-	-	59.7	54.2	57.9	
9	Chattar Plane	-	-	-	43.6	31.1	39.3	
10	Mansehra	-	-	-	62.3	60.1	61.5	
11	Abbottabad	-	-	-	67.1	61.1	65.1	
12	Havelian	-	-	-	50.7	49.5	50.3	

Table 5.13: Noise levels in Mansehra GS

Hours	Humidity	Wind speed	Temp	Wind Direction	Day #1	Day #2
	%	m/sec	°C		dB(A)	dB(A)
6:00 am	17.4	87	12.6	N	59.2	50.55
7:00 am	18.5	75	12.4	NW	58.9	53.05
8:00 am	19.7	71	11.5	N	51.3	52.8
9:00 am	20.9	74	11.8	N	50.6	49.4
10:00 am	22.3	69	10.9	N	52.7	48.9
11:00 am	23.1	55	10.2	NW	48.5	50.6
11:59 am	95	10.5	23.2	E	45.05	45.5
1:00 pm	94	10.9	24	SE	46.25	46.3
2:00 pm	99	10.7	23.7	E	46.25	46.05
3:00 pm	89	11.3	23.1	NE	47.75	45.6
4:00 pm	22.4	87	10.9	E	48.35	45.2
5:00 pm	21.8	81	11.6	E	46.5	45.5

Hours	Humidity	Wind speed	Temp	Wind Direction	Day #1	Day #2
	%	m/sec	°C		dB(A)	dB(A)
6:00 pm	20.9	77	11.1	NE	47.15	45.35
7:00 pm	20.1	72	11.8	N	47.4	46.3
8:00 pm	19.5	76	12.4	NE	47.65	46.8
9:00 pm	18.2	96	10.6	NW	49.85	46.15
10:00 pm	17.4	72	12.7	W	48.2	47.05
Day Average					**49.5**	**47.7**
11:00 pm	16.2	78	10.3	NW	46.1	46.75
12:00 am	15	76	11.1	N	45.15	46.55
1:00 am	13.8	79	15.9	NW	48.7	47.1
2:00 am	12.5	82	15.1	NW	45.45	44.65
3:00 am	12.7	85	15.4	N	48.55	47
4:00 am	14.1	92	16.3	NW	49.7	50.25
5:00 am	15.3	90	14.8	W	54.5	47.55
5:59am	17.4	87	12.6	N	59.2	50.55
Night Average					**49.7**	**47.6**

The results have some general compliance with noise standards with the exception of noise level exceedances in Mansehra and Abbottabad, which is attributed to the fact that they are urban centers and thus levels of traffic and noise are increased.

5.3 Biological Environment

This section describes the biodiversity in the Project area, focusing on the flora, mammals, and reptiles, amphibians, and birds. Full list of the species observed during field surveys are presented in Annex 4.1. The diversity in these groups has been described along with the field observations and the conservation status of the species. The habitat of the study area has been characterized on the basis of biological and physical factors and its spatial delineation is provided.

5.3.1 Overview of General Ecosystem and Biodiversity in Project Area

Currently there are 61 protected areas established in the northern Pakistan, comprising nine wildlife sanctuaries, 15 national parks, and 37 game reserves. Figure 5.11 presents the location of protected areas and game reserves in the project area. These protected areas cover 19% of landmass in the northern Pakistan, as compared to about 11% for the entire country's protected area coverage. A higher coverage of protected areas in northern Pakistan reflects the greater importance of the biodiversity of the area. The northern Pakistan is a particularly important stronghold for the globally endangered snow leopard (*Panthera uncia*, EN on the IUCN Red List; Appendix I of CITES; Appendix II on CMS/Bonn Convention). Other important species within northern Pakistan include: markhor (*Capra falconeri*; Near Threatened); Marco Polo sheep (*Ovis ammon polii,* Near Threatened; Kashmir musk deer (Moschus cupreus; Endangered); Himalayan lynx (*Lynx lynx,* Least Concern); blue sheep (*Pseudois nayaur,* Least Concern); brown bear (*Ursus*

arctos); Indian wolf (*Canis lupus*); and Himalayan ibex (*Capra sibirica*). Ibex, markhor and wild sheep are all key prey species of snow leopard (Panthera uncial, Endangered) and are therefore important to the species' survival.

Apart from 4 community managed game reserves (Khawajgan, Sheikh Abad, Jalio, Bhali Ghatti, and Lassan Thurkal) and one government managed game reserve (Mang). there are no protected areas along the project corridor.

5.3.2 Flora and Vegetation

Field surveys along the DTL alignment have revealed the presence of a total of 269 plant species. None of these species was endangered, however a few were endemic or exhibited conservation interest.

- ***Rhamnella gilgitica*** is an endemic tree distributed in the project area. It was formerly known from type locality in Northern Areas, however during field expeditions in 1993, it was found in Palas and Jalkot valleys of Kohistan district. Plant is also culturally significant as is utilized as vegetable and fruit. This species has rare occurrence because of overexploitation and over grazing and browsing.
- ***Otostegia limbata*** is shrub endemic to Pakistan and Kashmir. This species is mostly confined to cliffs along river beds over the calcareous rocks.
- ***Pimpinella stewartii*** is a perennial herb endemic to Pakistan and Kashmir. This plant has traditional and economic value as is utilized as carminative.
- ***Quercus baloot*** is endemic to Pakistan, Kashmir and Afghanistan. Due to overexploitation as fuel wood, current populations are highly threatened. Within project area approximately all its population is confined to Kohistan district.
- ***Korthalsella opuntia*** is epiphytic plant mostly associated with Q. baloot. Keeping in view the biodiversity value of epiphytic plants alone, protection of Q. baloot forests is of utmost importance.
- ***Pinus gerardiana*** is a vulnerable species (Farjon, 2013). Although it is not found in DTL corridor, this may still be treated as threatened species and indirect losses through land erosion may be taken into account.

Mansehra GS, as discussed earlier, is covered with a plantation as a result of the afforestation efforts of the Government in the framework of the Billion Tree Project. As a result, about 90% of the land is covered with small Eucalyptus (Eucalyptus camaldulensis) plants, while the other 10% with Pistacia lentiscus and Shisham (Dalbergia sissoo). The plants are between 1-2 years old. There is no other natural vegetation on site.

5.4 Terrestrial Fauna

Baseline information on terrestrial fauna for the DTL alignment is based on the Baseline Information Reports prepared by WAPDA in December 2018 under Detailed Ecological and Biodiversity Management Plans (DEBMP) and covering the whole area of the Dasu transmission line. Information on Mansehra was based on field surveys carried out in July-August 2019. During these surveys data was collected through direct and indirect methods including line transect, night surveys, visual encounter, and footmarks observations and hair/skins. Secondary data was collected through consultation with concerned department while published literature (research papers, books, awareness material) was also reviewed.

Figure 5-11: Protected Areas in Project Area

5.4.1 Mammals

From Dasu to Besham, the area in close vicinity of the transmission line is highly disturbed due to the presence of settlements, livestock, KKH, and local roads. The majority of the large and medium sized animals avoid lower altitude areas close to the KKH and settlements, and prefer to live in the higher altitude areas which are less disturbed. The habitat quality appears to have inverse-linear relationship with distance from the KKH, and prime habitats which host large mammals are available deeper in side valleys. Consequently, signs of more adaptable species like jackal, fox, rhesus monkey, porcupine, or some nocturnal species like civet, marten, and mouse were detected in the 2-km corridor along the DTL route. The signs encountered included pugmarks, scats, scratch, kills, and quills. They were also some direct sightings of jackal, fox, and mongooses during the field surveys. A large group of rhesus monkeys was sighted during survey in Kiru.

The project area from Mansehra to Islamabad is also disturbed due to large number of settlements, livestock, and main as well as local roads. Low numbers of species of large, medium and small mammals were reported in this area as compared to the upper part of DTL. Most frequent signs encountered in this area were of jackal, fox, wild boar, porcupine, pangolin, civet, marten, mongoose, and rodents. Some direct sightings of mongoose were also made near Muhalla Ghulamabad and a group of wild boars close to the motorway near village Pathar Garh.

The area of Mansehra GS, hosts mammal species that are common for the area and present no conservation interest. A list of such mammals identified during the survey is presented in Table 5.2.[14]

Table 5.2: Mammal Species at Mansehra GS

Scientific Name	Common Name	Family	IUCN Status	Trend by IUCN
Vulpes vulpes	Fox	Canidae	LC	Stable
Canis aureus	Jackal	Canidae	LC	Increasing
Herpestes javanicus	Small Indian Mongoose	Herpestidae	LC	Unknown
***Apodemus* sp.**	Wood mouse	Muridae	DD	Unknown
Mus musculus	House mouse	Muridae	LC	Stable
Rattus rattus	House/black rat	Muridae	LC	Stable
Hystrix indica	Indian Porcupine	Hystricidae	LC	Stable

Palas valley of Kohistan District is an internationally recognized biodiversity hotspot, recognized for the presence of a good population of Western Tragopan pheasants and stands of pristine moist temperate forest. However, the valley lies away from the projects impact zone, and valleys opening at/closer to the KKH are disturbed.

Despite the fact that **the majority of the species for which presence was confirmed are common and adaptable**, there is a number of species who are likely to present and present

[14] Detailed Ecological and Biodiversity Management Plans (DEBMP) For Dasu Hydropower Project (DHP), Vol-II, Terrestrial Ecology, Prepared by MWH, Stantec, NESPAK, ACE.

conservation value, small and declining populations, and relatively greater role in the ecosystem:

- **Common leopard** (*Panthera pardus)*: Presence and conflict of leopard were reported from Alai valley, Hoogii and Chattar plan area. Killing of leopards were also reported from Kuzabandi area of the Battagram. Survey team did not find any sign of the common leopard in the survey area. It was indicated that common leopard is more common in upper parts of Dasu, Pattan and Palas valley and very rare or absent in areas between Besham and Dandai.
- **Snow leopard** (*Panthera uncia)*: The area between Pattan and Dasu falls in distribution range on the species, and since it roams over larger landscapes its occasional visits in the side valleys of KKH cannot be ruled out. However, neither public reports nor sign surveys suggest presence of the species in the DTL project area.
- **Black bear** (*Ursus americanus)*: Black bear is not common but only visits the area when crops are fully grown. It is more common in the Pattan area, rare in Palas valley and Dasu and absent or very rarely visits other areas of the route.
- **Brown bear** (*Ursus arctos)*: The DTL project area falls in general in the distribution range of the brown bear, and the species is known to inhabit higher altitudes of Pattan and Dasu. There are confirmed reports of its occurrence in the Palas valley. However, all known areas of its occurrence are well away from the project area, and no evidence of its presence was found within the 2-km corridor of the DTL route.
- **Grey wolf** (*Canis lupus)*: Wolf is common from Dasu to Pattan and in Palas valley. In other areas, it is very rare and almost absent from areas below Besham. It was only reported from upper area of Alai valley where incidences of livestock killing were also reported.
- **Leopard cat** (*Prionailurus bengalensis)*: Leopard cat was reported from Alai valley, Thakot, Battagram and Oghi (Mansehra). Leopard cat is more common in the areas from Dasu to Pattan and mostly absent from other areas.
- **Indian pangolin** (*Manis crassicaudata):* The presence of Indian pangolin was reported from the Mansehra area but the survey team did not find any sign. Pangolin is common in areas close to the Islamabad Grid Station also.
- **Musk deer** (*Moschus chrysogaster)*: Musk deer is rarely present from Dasu to Pattan (including Palas valley) whereas it is absent from other areas.
- **Grey goral** (*Naemorhedus goral):* Grey goral was reported from the Bheer area of District Haripur. Grey goral presence was reported from Phuner to Haripur. Grey goral's presence was also reported from Kiru to Pattan. It is mostly absent from rest of the project area.

5.4.2 Reptiles and amphibians

A total 25 species of reptiles and amphibians are found along the DTL alignment including five amphibians and 20 reptiles. Amphibians included two toad species and three frog species whereas reptiles included ten lizard species and ten snake species.

All species recorded are common, with mostly ‘Not Evaluated’ species according to IUCN RedList 2016 or having Least Concern status with stable population. Only one species,

Brown Cobra (*Naja oxiana*) was found as 'Data Deficient' with unknown population trend. None of the recorded species is protected under wildlife acts.

Seven of the recorded 25 herp species are CITES Species with two (*Varanus bengalensis* and *Python molurus*) enlisted in Appendix I, four species (*Hoplobatrachus tigerinus*, *Saara hardwickii*, *Ptyas mucosus*, *Naja oxiana*) are enlisted in Appendix II while one species (*Xenochrophis piscator*) is enlisted in Appendix III of the CITES Category 2015.

Location of Mansehra GS hosts only a few common species of herpetofauna. Survey results are presented in Table 5.8.

Table 5-9: Amphibians and reptiles at Mansehra GS

Scientific Name	Common Name	No. of during VES
Duttaphrynus melanostictus	Asian common toad	1
Fejervarya limnocharis	Asian Grass Frog	7
Uromastyx hardwickii	Spiny tailed lizard	3

5.4.3 Sensitive habitats and species hotspots

Though major part of the project area is degraded, some patches need attention. For example, at Kiru (between Dasu and Pattan), a population of grey goral is reported.

The area between Pattan and Besham, close to Jijal at the upper part of Shigal Banda village, where transmission line is passing at lesser disturbed area of higher elevation, is reported to be inhabited by common leopard, musk deer, goral and leopard cat.

In Mansehra district, from Maddan to Junna there are three protected areas falling close to the transmission line route (within 1-3 km). These are Mang Game Reserve (close to angle tower 191), Haripur (for birds), Rakh Sardaran Game Reserve (for birds), and grey goral conservation area in Bheer (close to angle tower 174), Haripur.

There is also a relatively good and less disturbed habitat near Lakhalla village (34.160499 N, 72.996902 E, close to angle tower 173) where local people reported a population of about 10-20 grey gorals. The area close to the Muhalla Ghullamabad (close to Haripur; 34.008998 N, 73.004402 E, between angle towers 183-184) is also protected and less disturbed and there are also chances of goral or some other wild species' presence. The area near the motorway (33.783798 N, 72.654701 E, close to angle tower 212) has also some dense forest and scrubs and was considered a good habitat.

5.5 Avifauna

5.5.1 Bird Surveys

An avian risk assessment was conducted under DEBMP along the DTL corridor. The avifauna study area included entire length of the DTL route (see Figure 5.12). The study divided the DTL route in three topographically different terrains (segments): i) Dasu to Thakot; ii) Thakot to Shinkiari (Mansehra district); and iii) Shinkiari to Islamabad West Grid Station site (Attock district). The long distance migratory bird survey was carried out in the first segment and the altitudinal migratory bird survey was carried out in all three sections of the study area.

The high mountains and also the bottom of Indus valley in the Dasu-Thakot segment were included in the investigations. The Tarbela dam reservoir was also considered for the study

since the DTL route passes close to it. Separate surveys of the urban avian biodiversity were also carried out in the vicinity of the DTL route over its entire length.

During the study, the migratory pattern of high-altitude birds was also considered. Higher altitude bird migration to low altitudes and back was also studied. The avian risk assessment was carried out in the light of the adaptability of various bird species and their visual capacity. The entire length of the DTL route is in the habitat of high altitude, two-way passage birds. Based on the field investigation and subsequent assessment, mitigation measures have been suggested to address the possible negative impacts on the birds susceptible for negative impacts caused by the DTL project including the risk of collision with the transmission lines and electrocution.

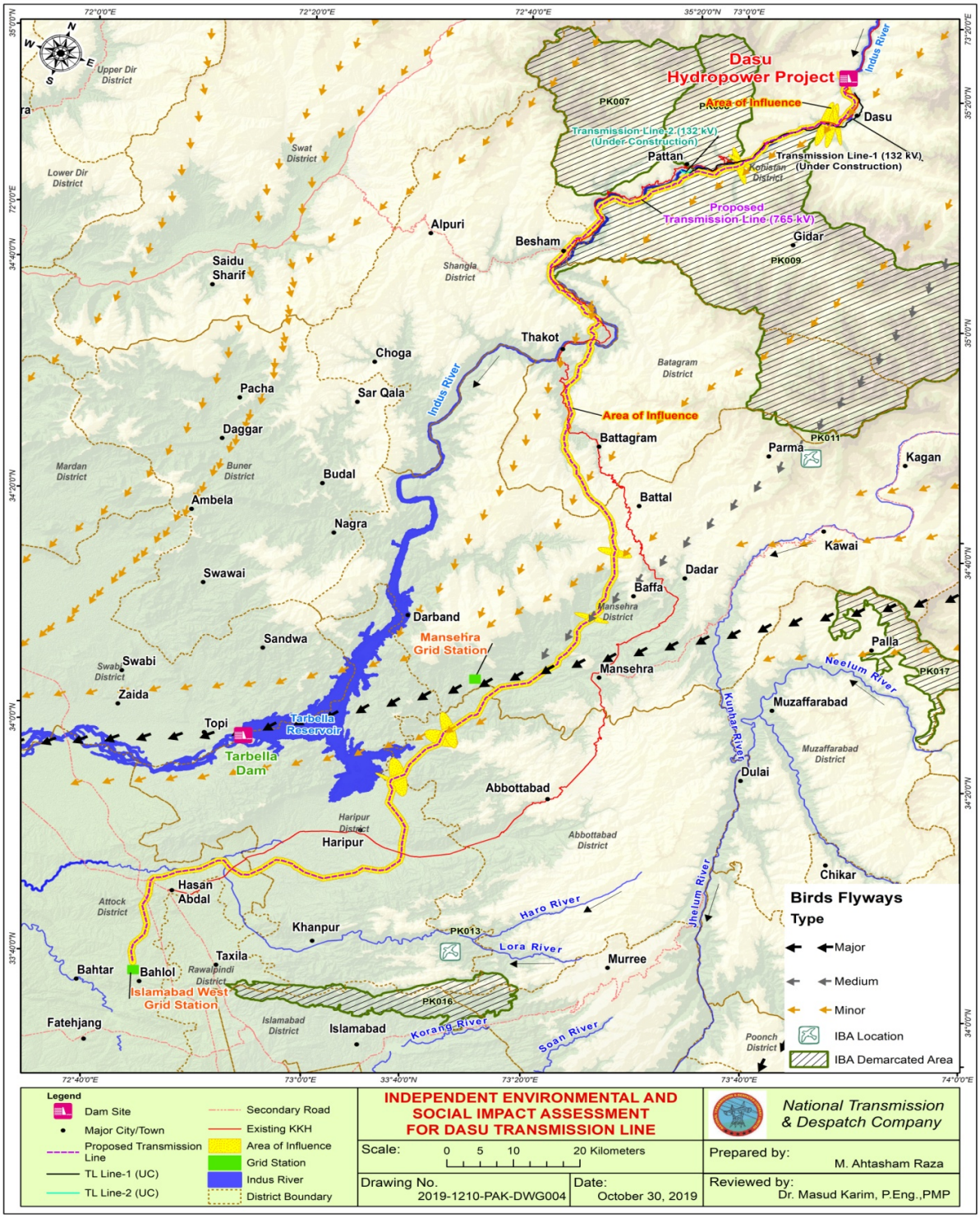

Figure 5-12: Map of the Bird Area of Concern

5.5.2 Bird Migration

(a) Long Distance or Latitudinal Migration Routes

The birds which breed in northern latitudes need to travel long distance to reach their wintering destinations in tropical areas of the southern latitudes. These birds fly in large flocks and follow landmarks. Each year they arrive and go back on the same routes or flyways. Based on the observations and other scientific evidences the ornithologists, have marked their routes on the maps (see Figure 5.13).

(b) Short Distance Migrants

At the end of summer season as cold spell starts prevailing the higher heights and descends further down to lower elevations insects hibernate and soft vegetation dries up, so there is shortage of food. The insectivorous birds and the seed-eaters start descending to lower height. During the winter they reach the plains. Some examples are: Kashmir Redstart; Grey-headed Flycatcher; Woodcock; Orange-flanked Bush Robin; Niltava; long-tailed Minivet; a variety of tits; Blue Whistling Thrush; Chiff Chaff; Ground Thrush, Tree-creeper; Wall-creeper; and a variety of tits, finches, and buntings. See Figure 5.14 for altitudinal migration routes.

(c) North-South Migration (Within Pakistan)

Some birds living throughout the year in warmer areas of Pakistan in the almost southern half of Pakistan, in spring they disperse to northern plains and foothills for breeding space and more food availability in summer. At the end of summer season as the cool starts prevailing, these migrate to southern Pakistan where weather is milder and more food is available. Some examples are: The Koel, Purple sunbird, Golden Oriole Paradise flycatcher, Baya, swallow. See Figure 5.14 for north-south migration routes.

(d) East-West Migration (Within Indo-Pak Sub Continent)

There are a few bird species which arrive from India just ahead of monsoon rains and go back after the end of summer rainy season. Examples are: Rain quail and pied Crested-cuckoo.

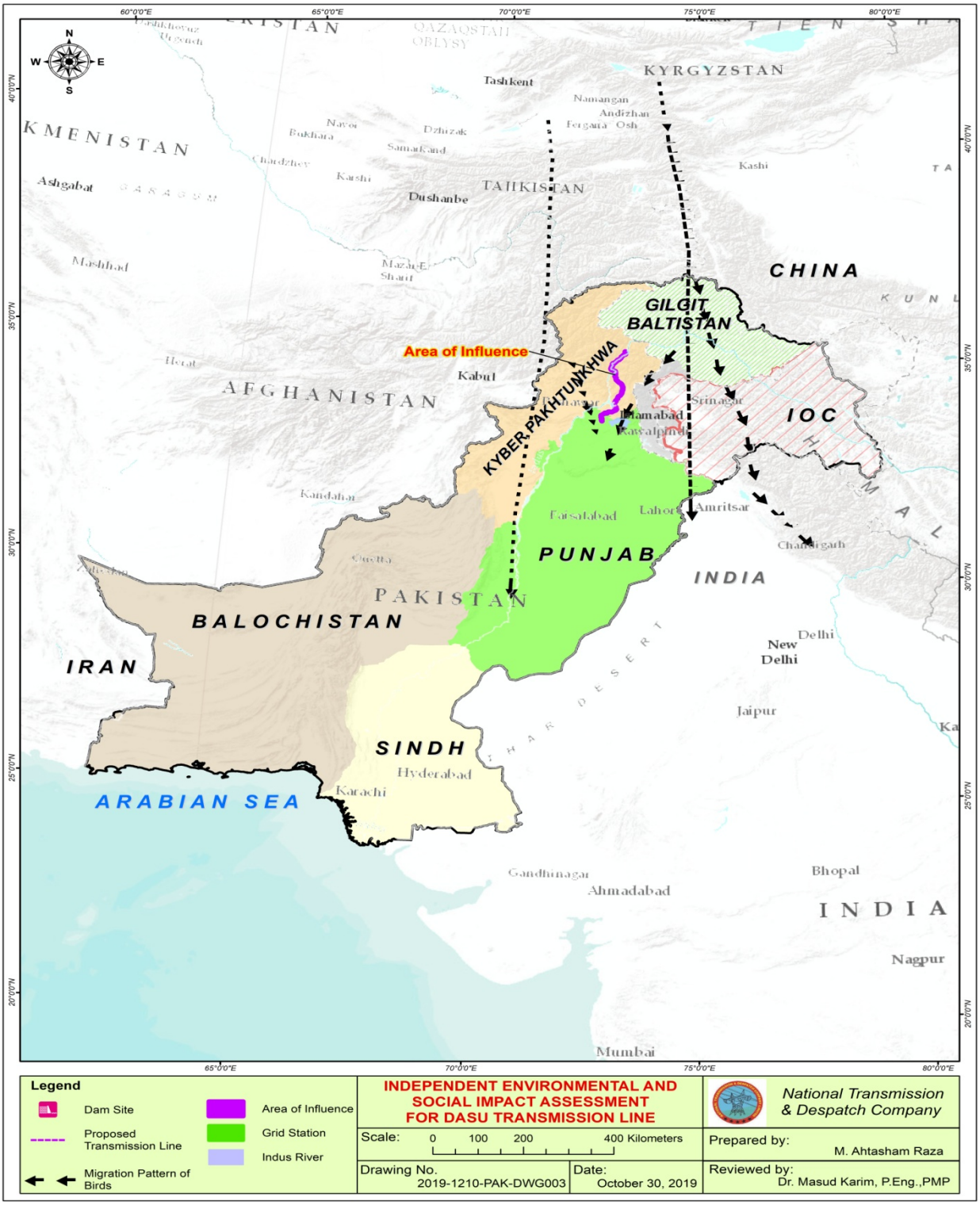

Figure 5-13: Latitudinal Migration Routes

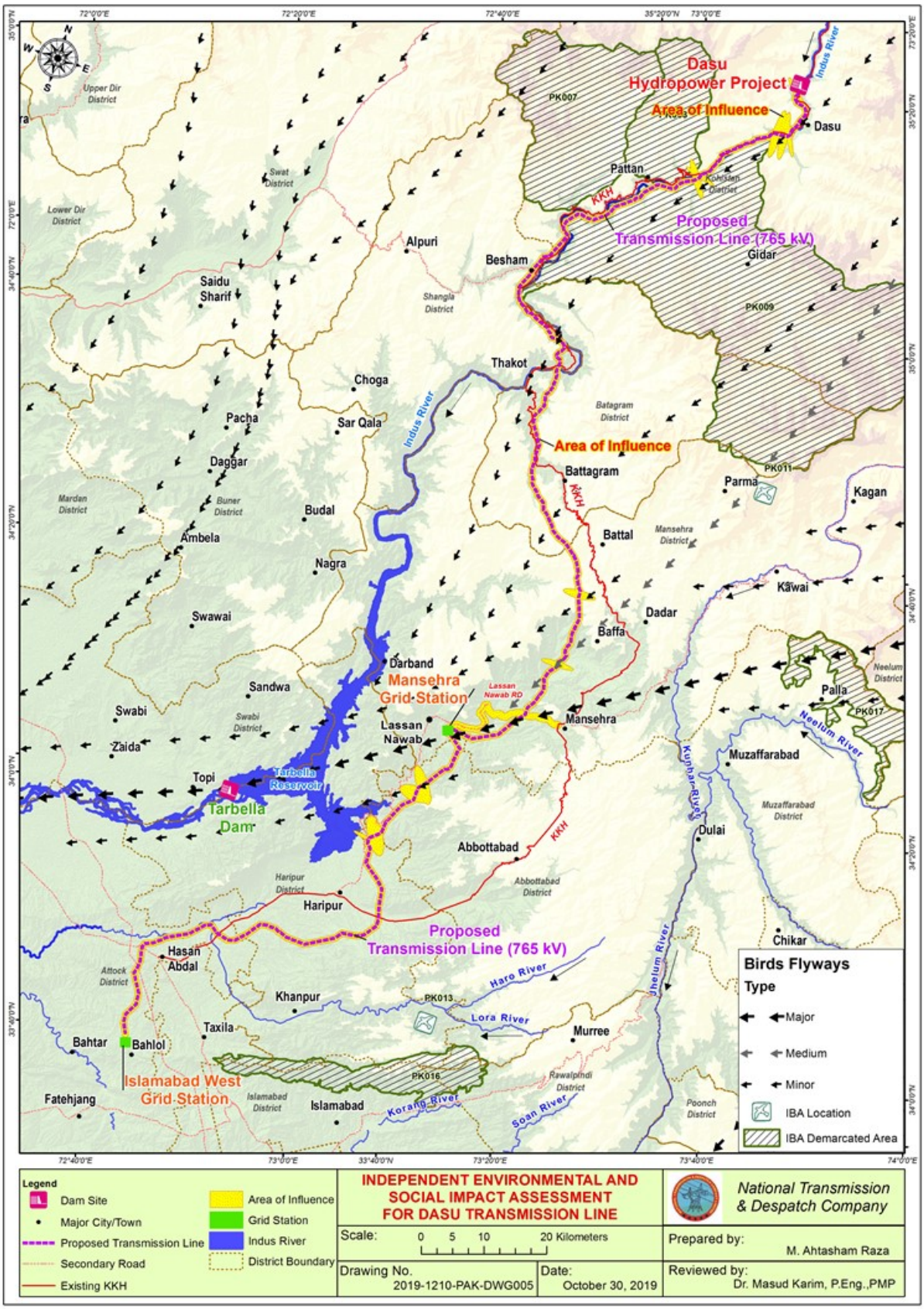

Figure 5-14: Altitudinal Migration of Birds in Autumn in Relation to DTL Route

5.5.3 Flight Behavior of Migratory Birds that Fly over the Indus River

Long-distance migratory birds follow land marks that exist in the path towards their destination. These landmarks for aquatic birds are big rivers. In case of birds passing over Tarbela, River Indus is the land mark for the migrants. During migration in mountainous areas, the birds fly high. The migrants follow the center of the valley thus avoiding mountains. The water birds after 6-8 hours of flight look for wide and slow-moving water to recoup their energy for further journey. However, if the water is almost stagnant and food is available in it or at its edges or in near vicinity and if the habitat provides shelter, the birds often tend to stop over for few days.

5.5.4 Birds that Often Perch on Towers or on High Tension Lines

Small birds such as ring-dove (*Streptopelia decaocto*) and also passerines such as European Starlings (*Sturnus vulgaris*) often use the transmission line poles and wires for perching during winter or for some resident species also in other seasons.

Species of the study area are sometimes seen perching on transmission line towers. These include:

- Black shouldered Kite (Elanus caeruleus)
- Pariah Kite (Milvus migrans)
- Long-legged Buzzard (Buteo rufinis)

It was observed that most bird species usually do not perch on high-voltage transmission line towers. However, there is no proper data collection for this in Pakistan. On the contrary the low-voltage transmission lines/distribution lines are often used by some bird species for perching.

5.5.5 Sensitive Bird habitats or Hot spots in the Project area

Figure 5.15 shows sites where concentrated breeding activity of raptors is anticipated, based on topography, nesting substrates, frequency of observation during the breeding season, and abundance of prey species. Details of sensitive bird habitats in the project area are given in **Table 5.9**.

Table 5-10: Sensitive bird habitats in the Project area

Sr. No.	Criteria of Importance of bird habitats	Observations	Remarks
1.	Natural habitat with rich diversity of birds	None, from Dasu to Islamabad closer (less than 5km) to DTL route on both sides.	Anthropogenic negatively impacted
2.	Habitat with some endemic birds	None, from Dasu to Islamabad closer (less than 5km) to DTL route on both sides.	None recorded in along the project area.
3.	Habitat with rare birds	None from Dasu to Islamabad closer (less than 5km) to DTL route on both sides.	Anthropogenic negatively impacted
4.	Habitats (Trees, gardens, agricultural fields and rural areas) for transit altitudinal migrants in spring and in autumn.	All along the path of DTL route.	Altitudinal migrants descend or ascend slowly and diurnally, with the slow decrease or increase in temperatures. Face no risk of collusion.
5.	Tarbela Lake is staging area for transit latitudinal migrants, mostly	Some portion of the DTL route passes close to the Tarbela lake/reservoir.	Birds face no risk of collision.

	waterfowl and some waders, in spring and again in autumn.		
6.	Habitats under degradation and disturbance	Several taluses or alluvial fans at the bottom of the Indus valley, up to Tarbela Lake.	These are with or without natural regrowth of grasses/bushes, but mostly modified to agricultural fields, under urban cover or both.
7.	Wintering area for some migrants.	Tarbela Lake is a wintering area for migratory waterfowl and some waders.	It is quite far from TLs. Face no risk of collusion.
8.	Two private Game Reserves	Close to Tarbela Lake	

Out of the 215 species found in the Study Area, most are considered in the IUCN "Least Concern" category. Four species are listed as Threatened: Sociable Lapwing (Chettusia gregaria, CR), Steppe Eagle (Aquila nipalensis, EN), the Common Pochard (Aythya ferina, VU), and the Western Tragopan (Tragopan melanocephalus, VU). Observed range-restricted species were Koklass Pheasant (Pucrasia macrolopha biddulphi), Himalayan Monal Pheasant (Lophophorus impejanus), White-cheeked Tit (Aegithalos leucogenys), White Throated Tit (Aegithalos niveogularis), Brooks's Leaf Warbler (Phylloscopus subviridis). Full details of these species are presented in Table 5.10. Observation locations for sensitive species are shown in Figure 5.16. The global population trend is stable or increasing for most species found in the Study Area (Bird Life International 2018). However, nearly a third of the species found in the Study Area are decreasing globally.

Table 5-11: Species observed with conservation significance

Sl.	Common Name	Scientific Name	Status	Population Trend
1	Steppe Eagle	*Aquila nipalensis*	EN	Decreasing
2	Common Pochard	*Aythya ferina*	VU	Decreasing
3	Sociable Lapwing	*Chettusia gregaria*	CR	Decreasing
4	Western Tragopan	*Tragopan melanocephalus*	VU	Decreasing
Range Restricted Species				
5	White-cheeked tit	*Aegithalos leucogenys*	LC (RR)	Decreasing
6	White Throated tit	*Aegithalos niveogularis*	LC (RR)	Decreasing
7	Koklass pheasant	*Pucrasia macrolopha biddulphi*	VU	Decreasing
8	Himalayan Monal Pheasant	*Lophophorus impejanus*	LC (RR)	Decreasing
9	Brooks's leaf warbler	*Phylloscopus subviridis*	LC (RR)	Decreasing

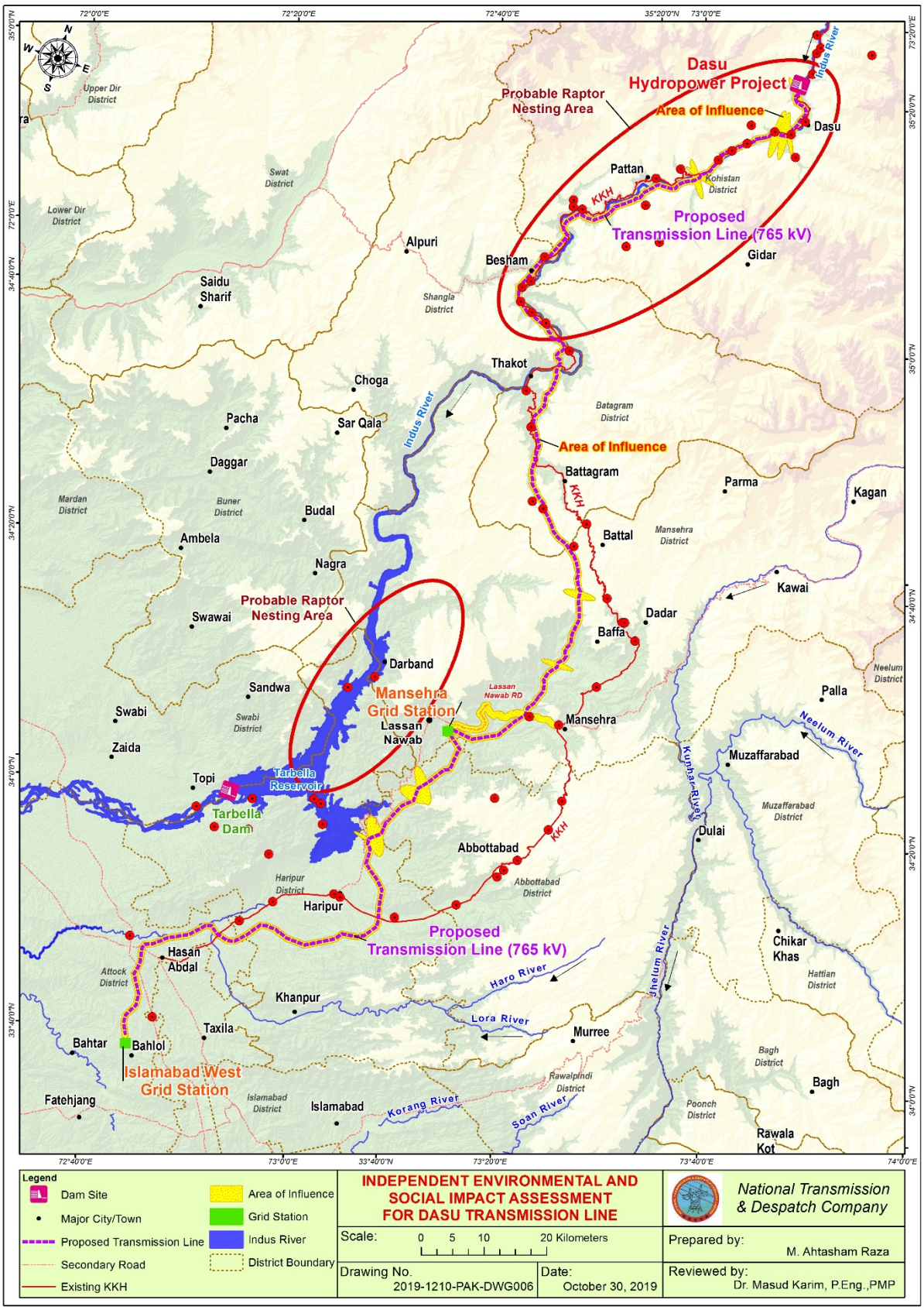

Figure 5-15: Likely Areas for Intensive Raptor Nesting

Scientific Name	IUCN Status	Geographic Coordinates			
		Degree Minute Second		Decimal Degree	
		Latitude	Longitude	Latitude	Longitude
Chettusia gregaria	Critically Endangered	34° 6' 37.440" N	72° 50' 57.480" E	34.1104	72.8493
Aquila nipalensis	Endangered	34° 53' 9.240" N	72° 52' 7.680" E	34.8859	72.8688
Calidris ferruginea	Near Threatened	35° 26' 48.480" N	73° 49' 40.440" E	35.4468	73.8279
Gyps himalayensis	Near Threatened	35° 24' 17.640" N	74° 22' 29.280" E	35.4049	74.3748
Numenius arquata	Near Threatened	34° 8' 30.840" N	73° 12' 49.320" E	34.1419	73.2137
Aythya nyroca	Near Threatened	34° 11' 33.360" N	72° 48' 15.480" E	34.1926	72.8043
Aegypius monachus	Near Threatened	34° 52' 37.560" N	72° 53' 36.600" E	34.8771	72.8935
Tragopan melanocephalus	Vulnerable	35° 7' 57.720" N	73° 6' 53.280" E	35.1327	73.1148
Aythya ferina	Vulnerable	33° 59' 20.760" N	72° 54' 48.240" E	33.9891	72.9134

Figure 5-16: Observation Locations for Sensitive Species

5.5.6 Avian Collision Risks along DTL

An avian risk assessment was conducted under DEBMP along the DTL corridor. Collision risks may be most pronounced in the vicinity of the Indus River and its tributaries, as many collision-prone species are closely associated with riverine, lacustrine, and wetland habitats. Study team of DEBMP identified a relative risk (1-12) category for each line span based on the numerical ranking or linear scoring system. Higher-priority spans are likely

to have the greatest effect and were prioritized for the proactive measures. There are 12 locations where the risk of collision is high as per risk ratings developed under DEBMP study. As per study these 12 locations have a risk rating of 9 through 12 and are perpendicular to migration corridors (n=9), and/or are near sensitive species (n=6). These lines also cross major drainages/waterbodies (n=7) and/or ridgelines (n=4). Figure 5.17 present these high risk spans in the DTL, the angle point numbers, the span length, and the total length of all 12 spans.

Figure 5-17: Migratory routes of birds crossing DTL

6 SOCIOECONOMIC ENVIRONMENT

This Chapter describes the socioeconomic baseline of the DTL and Mansehra GS. The description has been prepared on the basis of census and socioeconomic survey data collected through field investigations including interview and focus group discussions carried out in the project area as part of the present study. The data collected in 2016 was updated, thus this chapter represent the socio-economic baseline of the project area as of August 2019.

6.1 Data Collection Approaches

Multiple methods were used in the data collection. First, a full census of all affected households with the right-of-way of the TL. Second, a 10% sample was used to collect further detailed socioeconomic information at household-level. The key variables covered in the surveys and qualitative interviews included (i) identification of the affected population; (ii) demography, (iii) social organization (iv) literacy level, (iv) occupational structures, (v) income and expenses levels, (vi) access to public services, (vi) personal property, (vii) project's impacts on the poor, indigenous and/or ethnic minorities, and other vulnerable groups, (viii) identification of gender and resettlement impact and (ix) impacts, priorities and needs of the women. General consultation meetings were conducted with affected communities and villages. Third, community-level data were collected through FGDs, including separate FGDs for women. The FGDs provided avenues to air concerns by the project affected households and communities. In case of the Mansehra GS, which was identified selected only recently, the census included socio-economic data for all affected households. FGDs and community level meetings were held during the census for verification of households' level information. Local *patwaris* also assisted in the verification of titled owners to be affected by the Grid Station.

6.2 Overview of the Project Area

The DTL route traverses through eight districts of KP and Punjab provinces as described earlier. The route starts at Dasu in Upper Kohistan district with high and rocky mountains with steep slopes, crosses at Pattan in Lower Kohistan district, proceeds along Indus River in a more or less similar terrain up to Besham in Shangla district, passes through high mountains with less steep slopes and abundant vegetation cover of Battagram district, then moves on to hilly and mostly lush green areas of Mansehra and Abbottabad districts, and finally enters plain areas of Haripur and Attock districts. As the physical features of the proposed DTL route undergo these gradual but very noticeable changes, so do several of the social and socioeconomic aspects of these area. These aspects include the people and their culture and customs, housing patterns, population density, nature of agriculture, availability of social infrastructure and amenities, livelihood opportunities, and economic wellbeing.

The initial parts of the route in Kohistan and Shangla districts can be characterized by conservative people having very strong tribal bonding and affiliation, mostly pastoral lifestyle, cultivation limited to very small tracts of flat land that is hard to find in these areas, very small villages mostly in the form small clusters of a few houses and hence a very low population density, mostly *katcha*[15] houses, difficult road access, limited

[15] Katcha: a structure made of materials such as mud, stone, wood, and thatch.

availability of social infrastructure such as schools and hospitals, and limited livelihood opportunities.

The Battagram and Mansehra districts and to some extent Abbottabad district can be characterized, in varying degrees, by conservative people with not so strong tribal affiliation, more agriculture-based lifestyle, cultivation being practiced mostly on terraces that have been cut along mountain slopes in Battagram and in wider valleys and plain areas in Mansehra, comparatively larger villages primarily because of presence of wider valleys, mostly *pacca*[16] houses, easier access to roads, better availability and quality of social infrastructure, and finally more livelihood opportunities. In the same manner, the Haripur and Attock districts can be characterized by weak if at all tribal affiliations, vast cultivation fields because of the flat terrain, larger villages and towns, mostly *pacca* houses, extensive network of roads including highways and motorways, more urbanized lifestyle, greater and easier access to education and healthcare facilities, and much better livelihood opportunities compared with the initial parts of the DTL route.

Mostly rural population is located along the project alignment from Dasu to Islamabad. This is primarily because no major population centers exist in the initial parts of the route in Kohistan and Shangla districts, while for the remaining parts, the route has been selected in a manner so as to avoid large towns and population centers to minimize technical as well as social issues during transmission line construction and operation. The project footprint of the Mansehra GS has also been minimized through assessment of alternative options.

6.3 Administrative Set-up and Settlement Pattern in the Project Area

The DTL will pass through two provinces i.e., Khyber Pakhtunkhwa and Punjab. The section of DTL runs through eight districts i.e. Upper and Lower Kohistan, Shangla, Battagram, Mansehra, Abbottabad, and Haripur. Kohistan districts further has six union councils and 28 villages from which the line is passing; Shangla district has four union councils and 18 villages; Battagram district has nine union councils and 32 villages; Mansehra district has eight union councils and 22 villages; Abbottabad district has 3 union councils and 7 villages; Haripur district has seven union councils and 22 villages; and lastly the Attock district has four union councils and 13 villages through which the DTL route is passing. The DTL route passes through mostly rural areas. The field investigations have revealed that more than 91.9% of the population located within RoW is rural, while the remaining 8.1% is urban and semi-urban.

6.4 Comparative Descriptions of the DTL and Mansehra GS

Two separate RAPs have been prepared – one for the DTL and the other for Mansehra GS. The socioeconomic baseline data and analysis for the DTL and Mansehra are presented separately. In both cases, any household (and/or person), whose land, asset/infrastructure, source of income or access to resources/workplace is likely to be affected by the project's operations, is defined an affected person (AP). These include mainly the residents, owners and users of land or assets/structures within the RoW of the transmission line and Mansehra GS and the associated infrastructure.

The social impacts for the DTL largely include loss of agricultural crops and trees with associated loss of income and livelihoods while those impacted by Mansehra GS also lost lands – largely barren and with limited crop cultivation. Table 6.1 provides a brief comparative summary of impacts and profiles of the TL and Mansehra GS.

[16] *Pacca*: a structure made of brick and mortar

Table 6-1: Comparative Impacts and Profiles

Project Components	Impact Summary and Profiles				
	Land Area/ acres	Affected HHs	Affected Aps	Affected structure	Affected Trees
DTL	4,953	1,088	7,740	50	29,729
Mansehra GS	158	293	2,080	0	20,456

6.5 DTL Route: Socioeconomic Profiles of Affected Households in DTL Route

6.5.1 Profiles of the Respondents

In DTL route, the total number of affected households is 1,088 (7,740 affected persons). The profiles of the respondents are in Table 6.2. As evident, all respondents inhabit rural areas along the DTL. In many instances, they are very remote and often hard to access.

Table 6-2: Settlement types and Distribution of households

No.	Settlement Type	Surveyed Households (No.)	Surveyed Households (%)
1	Rural	1088	100
2	Semi Urban	0	0
3	Urban	0	0
Total		1,088	100

Source: Field Survey (2019)

Table 6.3 reveals that almost all of the respondents (with one exception) are resident-owners. None of the respondents was a resident tenant, resident owner cum tenant or resident absentee.

Table 6-3: Details of the respondents

No.	Respondent Type	Household (No)	Household (%)
1	Resident Owner	1,087	99.9
2	Resident Tenant	0	0
3	Resident Owner cum Tenant	0	0
4	Resident Absentee	0	0
5	Business owner	1	0.1
	Total Surveyed households	1,088	100

Source: Field Survey (2019)

6.5.2 Demographic Data

Household surveys were carried out to understand the demographic and socio-economic characteristics of the population in the project area. According to the survey, the male population is slightly higher compared to female population in the project area. On average the male population is 53.3% while the female population is 46.7% among the affected people. Average family size is 7.1 persons per family.

Age and sex are important demographic characteristics which have a bearing on employment and mobility. The data regarding the distribution of affected people by age is presented in 6.4.

Table 6-4: Age distribution of affected people

Sr. No.	Age range	Number	Percentage
1	18 - 30 Years	1383	17.9
2	31 - 40 Years	2444	31.6
3	41 and 50 Years	3046	39.4
4	51 Years and above	867	11.2
	Total	7740	100

Source: Field Survey (2019)

Sex distribution of affected people is presented in Table 6.5 below.

Table 6-5: Sex distribution of affected people

Age range	Male	%	Female	%
18 - 30 Years	695	16.8	688	19.1
31 - 40 Years	1259	30.5	1185	32.8
41 and 50 Years	1698	41.1	1348	37.3
51 Years and above	478	11.6	389	10.8
Total	4130	100	3610	100

Source: Field Survey (2019)

6.5.3 Education and Literacy

In term of education distribution, approx. 20% of the respondents (heads of households) were reported illiterate (respondents have had Deeni (religious) education). The rest 80% had some degree of education, with only 2% having a post-graduate degree. The results are shown in Table 6.6.

Table 6-6: Literacy of affected Households

Education	Respondents	
	No.	%
Illiterate (Deeni/religious education))	219	20
Primary	185	17
Middle	234	22
Matriculation	210	19
Intermediate	150	14
Graduate	65	6
Master and other professional degrees	25	2
Total	1088	100

Source: Field survey (2019)

The availability of schools along the DTL route is an important factor in the direction of increasing literacy levels. The relevant figures for the surveyed villages are given in Table 6.7.

Table 6-7: Availability of schools along the DTL route

Province	% of Surveyed Villages					
	Primary schools for boys	Primary schools for girls	Middle schools for boys	Middle schools for girls	High schools for boys	High schools for girls
KP	87	85	47	39	31	29
Punjab	77	68	27	29	16	15

Source: Field survey (2019)

6.5.4 Ethnicity, Tribes, Language and Religion

Population settled along the proposed DTL route belongs to several caste groups, tribes and ethnic minorities. Most of the ethnic groups are Maiya, Pashto, Hindko, Kohistani, Gujri, Bahasa Melayu, Punjabi, Kashmiri. The detailed census has shown that there are more than 50 major caste groups and tribes settled along the DTL route. The major castes, caste groups and tribes include: Manzar, Dubair, Kandia, Ranolia, Pattan, and Kayal, Koka Manke Khel, Darram Khel, Afghan, Gujar/ Ajar, Syed, Mian, Quershi, Swati, Akhun Khel, Mada Khel, Tanaoli, Dhunds, Gukhars, Mughals, Rajputs, Turks, Utmanzai, Hassanzai, Nusrat Khel, Jadoon, Karlal, Sarrara, Tareen, Dilazak, Tarkheli, Mishwani, and Pathan. Urdu is widely spoken.

No indigenous peoples are affected by the project alignment. In case of Pakistan, from operational point of view, the Bank considers only the Kalash people as indigenous.

6.5.5 Livelihood Sources

The main income generating activities are farming, employment in government and private sector, wage labor, operating own business such as running a grocery, livestock rearing and working abroad. The details are presented in Table 6.8. Farming is most dominant occupation in the area with approx. 24% and 27% of households depending on farming as the primary source of income, in KP and Punjab respectively. Employment to government or the private sector and wage labor are also important.

Table 6-8: Distribution of respondents by occupation

No.	Occupation	Respondents in KP (%)	Respondents in Punjab (%)
1	Farming	24	27
2	Government service	14	16
3	Private service	21	23
4	Business	8	4
5	Livestock	6	5
6	Employed abroad	3	2
7	Wage labor	23	21
8	Others	1	2

Source: Field Survey (2019)

6.5.6 Household Income

Table 6.9 shows that approximately 9% of the surveyed households fall in the income category of less than Rs. 15,000 which is below the official poverty line (OPL) which is

Rs. 20,30117. A further 35% reported income in the range of Rs. 15,000 to 25,000, which is around the poverty line. Only 7% of the households' report income above Rs. 100,000.

Table 6-9: Monthly Income of the Households

Sr. No.	Income Level (Rs./Month)	Number of Households	Percentage (%) of households
1	Less than 15000	98	9
2	15100 – 25000	381	35
3	25100 – 40000	326	30
4	41000 – 60000	152	14
5	61000 – 100000	54	5
6	110000 – 150000	44	4
7	Above 150000	33	3
	Total	**1088**	**100**

Source: Field Survey (2019)

The census results have shown that approx. 50% of households have more than a single source of income, with 22% of them having three or more sources.

6.5.7 Household Expenditure

Household expenditure, including food and non-food items such as fuel, education, health, clothing, utility charges and other miscellaneous expenditure was also surveyed. The results are largely compliant with the income data.

Table 6.10 shows that approx. 13% of the households spend less that Rs. 15,000. Notably, almost all (96%) households spend less than Rs. 60,000.

Table 6-10: Distribution of Household Monthly Expenditure

Sr. No.	Household Expenditure (Rs./month)	No. of Households	%
1	Less than 15000	142	13
2	15100 – 25000	283	26
3	25100 – 40000	337	31
4	41000 – 60000	282	26
5	61000 - 100000	44	4
	Total:	**1,088**	**100**

Source: Field Survey (2019)

6.5.8 Housing Conditions

The survey results show that 90% of the sampled households in KP and 96% in Punjab are living in Pacca houses. About 9% and 3% (respectively) live in Semi pacca (made of brick and mortar) and 1% in both provinces lives in katcha houses (made of mud, stones, wood, and or thatch).

17 According to the Economic Survey of Pakistan 2015-16, a new poverty line is estimated using patterns of consumption of reference group (using CBN) and it comes to Rs. 3030 per adult equivalent per month using the latest available HIES 2013-14 data. Taking the average household size of 6.7, the poverty line of a household is calculated as 3030 x 6.7 = Rs 20,301/- per household.

6.5.9 Household Possessions

The possession and use of household durable goods have multiple effects and implications. For instance, access to satellite dish or television helps household members to remain updated about daily events, information, and educational materials. Similarly, a refrigerator prolongs food storage and keeps food fresh and healthy. Ownership of transportation allows greater access to services away from the local area and enhances social and economic activities.

Table 6.11 presents the percentage of households that possess various durable commodities and means of transportation. Field survey shows that electric iron and fans emerged as the main needs of the households as all the respondents have these items at their houses. Televisions and mobile telephones are common devices possessed by most households for information and communication. Refrigerators are also largely available. With regard to transportation, motorcycles are the most widespread (approx. 69% of the households).

Table 6-11: Possession of Household Goods

Item	Households (%)
Television	98
Fan	100
Sewing Machine	55
Computer/ laptop	32
Tractor	12
Mobile Phone	98
Refrigerator	95
Washing Machine	70
Bicycle	4
Car	15
Motorcycle	69%
Air conditioner	7%
Pick up / Van	6%
Electric Iron	100%
Satellite dish	32%
Oven	17%
Raksha	2%

Source: Field Survey (2019)

The findings demonstrate a rather good quality of life that contradicts with the fact that approx. 44% of the households reported to have incomes below or around the OPL. This will be further reviewed and verified during the implementation phase.

6.5.10 Land Use

As mentioned earlier, the RoW of the DTL is 80m wide. Hence the total area of the RoW of the 254.6 km long DTL is approx. 20 million square meters or 4,953 acres. Of this total area, cultivated land covers 2,313 acres (47%), barren land covers 2,190 acres (44%) and forests cover 377 acres (7.6%). The rest are riverbeds, streams, roads, etc. Details are shown in Table 6.12.

Table 6-12: Land Use within the RoW of DTL

Land Use Category	RoW Length (km)	Area within RoW (Acres)
Cultivated land	117.1	2,313
Barren/ hilly (non-cultivated land)	110.9	2,190
Commercial/ residential land	0.2	3.5
Forest land (private)	12.6	248
Forest land (state)	6.6	129.5
River, stream/ nullah bed, etc.	3.1	61.1
Roads and motorways	0.4	8
Total		4953

Source: Field Survey (2019)

6.5.11 Land Holding

Land is the major determinant of farm income and big holding size is the symbol of dignity and honor in the rural set up. All 1,088 surveyed households are land owners. Generally, the affected people have small land holdings, as approx. 60% in KP and 72% in Punjab have less than 5 acres of land. Only approx. 13% in KP and 16% in Punjab have more than 12.5 acres. In addition, most of these lands are not cultivated particularly in the mountainous areas of the DTL route.

Table 6-13: Land Holding Size

Land Holding Size (Acre)	% of affected Households	
	KP	Punjab
Less than 1	25	32
1 – 5	35	39
5 – 12.5	27	13
12.5 – 25	8	9
25 and above	5	7

Source: Field Survey (2019)

6.5.12 Crops, Fruits and Vegetables

As per Table 6.14, the main crops of the area include wheat and maize, while other crops such as rice, pulses, tobacco, and millets are also grown. The table depicts the percentage of the area cultivated under the specific crops.

Table 6-14: Cropping pattern

Crops	Kharif Crops (%)		Rabi Crops (%)	
	KP	Punjab	KP	Punjab
Wheat		85		80
Maize	80		85	
Barley				3
Basmati Rice	6			
Vegetables		6		4
Pulses	3			
Chilies	1		1	

Crops	Kharif Crops (%)		Rabi Crops (%)	
	KP	Punjab	KP	Punjab
Tomato		2		
Potatoes		1		2
Tobacco		2		
Millets (Bajra / Jowar)			2	
Peanut				11
Other	10	4	12	

Source: Field Survey (2019)

6.5.13 Access to Infrastructure

Access to safe drinking water and sanitation is essential for health, security, livelihood, and quality of life, and is especially critical for women and children. Improved water supply and sanitation interventions could thus provide a wide range of benefits like longer lifespan, reduced morbidity and mortality from various diseases, and low health costs. Table 6.15 lists the available social amenities in the project area.

Table 6-15: Access to social amenities in the Project Area

Social Amenities	Availability (%)	
	KP	Punjab
Electricity	91	92
Sui-Gas	11	34
Fuel	17	51
Water Supply	34	31
Hospital	40	59
Road	90	92

Source: Field Survey (2019)

Table 6.15 indicates that almost all houses in the project area are electrified. However, the survey revealed that people are not satisfied with the power supply. They complained about the frequent power failures and low voltage. Potable drinking water supply is available to only approx. 30% of the households. The field survey revealed that people often have a small well in their houses and extract water via electric pumps or manually in case of power failure. Health facilities in the project area are not adequate; on the other hand, most of the surveyed households have reported to have access to road network.

6.6 Mansehra GS – Socioeconomic Profiles of APs

6.6.1 Profile of the Respondents

The total number of such affected households is 293 (2,080 affected persons). Table 6.16 shows that all the respondents belong to rural villages in Sawan Maira.

Table 6-16: Settlement Types by location

Sr. No.	Settlement Type	Surveyed Households (No)	Surveyed Households (%)
1	Rural	293	100
2	Semi Urban	0	0

Sr. No.	Settlement Type	Surveyed Households (No)	Surveyed Households (%)
3	Urban	0	0
Total		**293**	**100**

Source: Field Survey (2019)

Table 6.17 reveals that almost all of the respondents (with one exception) are resident-owners. None of the respondents was a resident tenant, resident owner cum tenant or resident absentee.

Table 6-17: Details of the Respondents

Sr. No.	Respondent Type	Household (No)	Household (%)
1	Resident Owner	292	99.9
2	Resident Tenant	0	0
3	Resident Owner cum Tenant	0	0
4	Resident Absentee	0	0
5	Business owner	1	1
	Total households	**293**	**100**

Source: Field Survey (2019)

6.6.2 Demographic Data

Household surveys were carried to understand the demographic and socio-economic characteristics of the population in the project area. According to the households' census data (total households 293), the male population is higher (52%) compared to female population (48%) in the project area. The data regarding the distribution of affected people by age is presented in Table 6.18

Table 6-18: Age Distribution of Affected Persons

Age range	No	%
18 - 30 Years	354	17
31 - 40 Years	666	32
41 and 50 Years	582	28
51 Years and above	478	23
Total	**2080**	**100**

Source: Field Survey (2019)

Sex distribution of affected people is presented in Table 6.19 below.

Table 6-19: Sex Distribution of Affected Persons

Age range	Male	%	Female	%
18 - 30 Years	195	18	168	17
31 - 40 Years	335	31	330	33
41 and 50 Years	325	30	270	27
51 Years and above	227	21	230	23
Total	**1082**	**100**	**998**	**100**

Source: Field Survey (2019)

6.6.3 Education and Literacy

In term of education distribution, 11% of the respondents were reported illiterate (respondents have had Deeni (religious) education). The rest 89% had some degree of education, with a notable 10% having a post-graduate degree. The results are shown in Table 6.20.

Table 6-20: Literacy of Affected Households

Education	Respondents	
	No.	%
Illiterate (respondents have had Deeni (religious) education)	32	11
Primary	38	13
Middle	56	19
Matriculation	47	16
Intermediate	53	18
Graduate	38	13
Master and other professional degrees	29	10
Total	**293**	**100**

Source: Field survey (2019)

6.6.4 Livelihood Sources

Income generating activities are farming, employment in government and private sector, wage labor. The details are presented in Table 6.21. Farming is most dominant occupation in the area with approx. 23% of households depending on farming as the primary source of income. (However, the most respondents described their farming/cultivation on residual land outside the project footprint). Employment to government or the private sector is also important.

Table 6-21: Distribution of Respondents Regarding Occupation

Sr. No.	Occupation	No. of Respondents	Percentage (%)
1	Employee in Government	35	12
2	Employee in private sector	50	17
3	Laborers	29	10
4	Job less	29	10
5	Retired Person	18	6
6	Farming (single occupation)	68	23
7	Others/Non-farming	38	13
8	Housewife	26	9
	Total	**293**	**100**

Source: Field Survey (2019)

6.6.5 Household Income

Table 6.22 shows that 67% of the surveyed households fall in the income category of less than Rs. 15,000 which is below the OPL which is Rs. 20,301[18]. A further 18% reported income in the range of Rs. 15,000 to 25,000, which is around the poverty line. None of the surveyed households' reported income above Rs. 100,000.

Table 6-22: Monthly Income of Surveyed Households

Sr. No.	Income Level (Rs./Month)	Number of Households	Percentage (%) of households
1	Less than 15000	196	67
2	15100 - 25000	53	18
3	25100 - 40000	26	9
4	41000 - 60000	9	3
5	61000 - 100000	9	3
6	110000 - 150000	0	0
7	Above 150000	0	0
Total		**293**	**100**

Source: Field Survey (2019)

The survey has shown (see Table 6.23) that 53% of households have more than a single source of income, with 29% of them having three or more sources. This clearly indicates occupational diversity and non-land source of incomes for people in the project area.

Table 6-23: Sources of income

Sources of Income for Households	No.	%
Single source of Income	138	47
Two sources of Income	70	24
Three sources of Income	56	19
More than 3 sources of income	29	10
Total	**293**	**100**

Source: Field Survey (2019)

6.6.6 Household Expenditure

Household expenditure, including food and non-food items such as fuel, education, health, clothing, utility charges and other miscellaneous expenditure was also surveyed. The results are largely compliant with the income data. Table 6.24 shows that 15% of the households spend less that Rs. 15,000. Notably, almost all (92%) households spend less than Rs. 60,000.

Table 6-24: Distribution of Household Monthly Expenditure

Sr. No.	Household Expenditure (Rs./month)	No. of Households	%
1	Less than 15000	44	15
2	15100 - 25000	76	26

[18] According to the Economic Survey of Pakistan 2015-16, a new poverty line is estimated using patterns of consumption of reference group (using CBN) and it comes to Rs. 3030 per adult equivalent per month using the latest available HIES 2013-14 data. Taking the average household size of 6.7, the poverty line of a household is calculated as 3030 x 6.7 = Rs 20,301.

Sr. No.	Household Expenditure (Rs./month)	No. of Households	%
3	25100 – 40000	79	27
4	41000 – 60000	70	24
5	61000 – 100000	24	8
Total:		**293**	**100**

Source: Field Survey (2019)

6.6.7 Household Possessions

The possession and use of household durable goods have multiple effects and implications. For instance, access to satellite dish or television helps household members to remain updated about daily events, information, and educational materials. Similarly, a refrigerator prolongs food storage and keeps food fresh and healthy. Ownership of transportation allows greater access to services away from the local area and enhances social and economic activities.

Table 6.25 presents the percentage of households that possess various durable commodities and means of transportation. Field survey shows that electric iron and fans emerged as the main needs of the households as all the respondents have these items at their houses. Televisions and mobile telephones are common devices possessed by most households for information and communication. Refrigerators are also largely available. With regard to transportation, motorcycles are more popular than cars but still not widely used (30% of the households).

Table 6-25: Possession of Household Goods

Item	Households
Television	70%
Fan	100%
Sewing Machine	32%
Computer/ laptop	25%
Tractor	5%
Mobile Phone	98%
Refrigerator	85%
Washing Machine	70%
Cooking rang	5%
Geyser	15%
Car	10%
Motorcycle	30%
Air conditioner	5%
Pick up / Van	9%
Electric Iron	100%
Satellite dish	15%
Oven	23%
Datsun/ Transport Vehicle	5%

Source: Field Survey (2019)

6.6.8 Land Holding

Land is the major determinant of farm income and big holding size is the symbol of dignity and honor in the rural set up. All 293 surveyed households are land owners. Generally, the affected people have small land holdings, as approx. 98.6% have less than 5 acres. Only 4 have more than 5 acres. In addition, the land holding size is decreasing with time due to inheritance fragmentation in the rural area.

Table 6-26: Land Holding Size

Land Holding Size (Acre)	No. of Households	%
0.1 – 5	289	98.6
6 – 10	4	1.4
	293	**100**

Source: Field Survey (2019)

Almost all affected land is planted in the framework of the billion trees project (BTP) with the exception of a small part of the area (5.4 acres) where some sessional Kharif and Rabi crops (mostly wheat and maize) are cultivated. No fruits or vegetables are cultivated in the project area.

6.6.9 Livestock

According to the field survey, buffalos, cows, goats, sheep and donkeys are the common livestock in the area. Table 6.27 shows the number of animals and their market value.

Table 6-27: Livestock in the project area

Livestock	Number	Average market Value per animal (Rs)
Buffalos	29	120,000 - 220,000
Cows	559	100,000 - 175,000
Sheep	159	40,000 - 75,000
Goats	370	40,000 - 75,000
Donkeys	149	20,000 - 60,000

Source: Field Survey (2019)

6.6.10 Access to Infrastructure

Access to safe drinking water and sanitation is essential for health, security, livelihood, and quality of life, and is especially critical for women and children. Improved water supply and sanitation interventions could thus provide a wide range of benefits like longer lifespan, reduced morbidity and mortality from various diseases, and low health costs. Table 6.28 lists the available social amenities in the project area. It can be seen that access to water supply and sanitation is very low while access to health services is also low.

Table 6-28: Access to Social Amenities in the Project Area

Social Amenities	Availability
Electricity	100%
Sui-Gas	0%
Water Supply	0%
Sewerage/Drainage	5%

Social Amenities	Availability
Hospital	25%
School	100%
Road	95%

Source: Field Survey (2019)

Recently government has initiated a Sui gas project in the area but still the project is not operational. Piped Gas is passing need of the entire community in the project area. Drinking water and gas are ranked as the top priority demand of women in the project area.

6.6.11 Housing

Among the 293 surveyed households, 290 (99%) are living in pucca houses and 3 (1%) are living in semi pucca houses, as shown in Table 6.29**.** Pucca houses are constructed with bricks, cement and concrete, with wooden and steel doors and windows. Semi pucca houses are made of bricks (joint with mud) and their roofs are mostly of wood, and partially bricks. It is noted that none of these structures are in the proposed Mansehra Grid Station site.

Table 6-29: Type of Houses

Sl.	House Type	Numbers	%
1	Pucca	290	99
2	Semi Pucca	3	1
Total		**293**	**100**

Source: Field Survey (2019)

6.7 Gender Analysis

Both along the DTL and Mansehra, women in the project area have no recognized role in the authority structure of the villages. Most of the women stay at home and only travel outside the village in case of visiting relatives, and weddings and to hospitals in nearby towns. However, the traditional attitude of not sending girls to school is changing now, because parents realized and understand that basic education is necessary for each individual without the discrimination of sex.

6.7.1 Women's Participation Level

The women participation in different activities was assessed as part of the socioeconomic survey of affected households. As shown in Table 6.30 women are mostly active in housekeeping and child caring while they participate in the social obligations of the household. Their involvement in other economic activities is very limited.

Table 6-30: Women participation in various activities

Activities	Participation (%)
Housekeeping	91
Child caring	82
Farming	7
Livestock	9
Business Activities, embroidery, Tailoring etc.	15
Employment government and private	13
Sale & Purchase	2

Activities	Participation (%)
Social obligations (marriage, birthday & other functions)	98
Elected Representation (councilor /political gathering)	5

Source: Field Survey (2019)

6.7.2 Gender Status and Decision-making

As reported, the daily work of a female is housekeeping, child rearing, and fetching water, laundry, cooking and taking care of animals and other social obligations like marriage, birthday & other functions. Most of females are expected to meticulously follow the cultural tradition of modesty, which is the main factor constraining participation of women in the social activities. During consultation it was found that the majority of decisions are taken jointly by men and women at household level. Obviously, this is more apparent in educated families and younger generations. However, the fact that women are not seen outside the house makes it difficult to approach them for information dissemination or stakeholder engagement activities. The problem is exacerbated for such activities taking place outside the village. The project will design effective dissemination strategies to address these restrictions.

6.7.3 Concerns of Women related to the Project

During the census/surveys and FGDs, women of the project area pointed out the following major issues relating to project activities: (i) Jobs should be provided to educated male and female along the TL area; (ii) Women demanded the compensation as per replacement value of the affected land and their assets; (iii) Working women, school teachers/ students of the area will need secured travel/mobility during the construction activities; (iv) Local women mobility will be restricted because of construction activities; (v) Timing of construction activities should be adjusted in such a way that it should not disturb the mobility of local population especially women and children during their routine (schools timing and working/jobs timing), with particular attention to women's health needs; (vi) Alternate route should be provided during construction in case of blocked access; and (viii) Women who are doing the embroidery work for domestic and commercial use; their skill should be enhanced by providing training and setting up of the embroidery centers in the project area.

7 POTENTIAL SIGNIFICANT IMPACTS AND HAZARD RISKS AND MITIGATION AND PREVENTIVE MEASURES

This Chapter assesses the project for key environmental and social aspects, identifies significant potential impacts and hazard risks that may be caused by the project activities and proposes appropriate mitigation and preventive measures to address these impacts and hazards.

7.1 Impact Assessment Methodology

The significance of potential impacts was assessed using the risk assessment methodology that considers impact magnitude and sensitivity of receptors, described below.

7.1.1 Impact Magnitude

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

The magnitude of each potential impact of the Project has 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 potential impact	Long term (beyond the project life)	Medium Term Lifespan of the project (within the project life span)	Limited to construction period	Temporary with no detectable potential impact
Spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond next project components, site boundaries or local area	Within project boundary	Specific location within project component or site boundaries with no detectable potential impact
Reversibility of potential impacts	Potential impact is effectively permanent, requiring considerable intervention to return to baseline	Environmental or social parameter needs a year or so with some responses to come back to baseline	Baseline returns naturally or with limited response within a few months	Baseline remains constant
Legal standards and established professional criteria	Breaches national standards and or international guidelines/obligations	Complies with limits given in national standards but violates international lender guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable

Parameter	Major	Moderate	Minor	Minimal
Likelihood of potential impacts occurring	Occurs under typical operating or construction conditions (Certain)	Happens under worst case (negative consequences) or best case (positive impact) working conditions (Likely)	Occurs under abnormal, exceptional or emergency conditions (occasional)	Unlikely to happen

7.1.2 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. For each potential impact of the project, sensitivity of the related receptor was determined using the criteria outlined in **Table 7.2**.

Table 7-2: Criteria for Determining Sensitivity

Sensitivity Determination	Definition
Very Severe	Vulnerable receptor with little or no ability to absorb proposed changes or minimal opportunities for mitigation.
Severe	Vulnerable receptor with little or no ability to absorb proposed changes or limited opportunities for mitigation.
Mild	Vulnerable receptor with some ability to absorb proposed changes or moderate opportunities for mitigation
Low	Vulnerable receptor with good ability to absorb proposed changes or/and excellent opportunities for mitigation

7.1.3 Assigning Significance

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

Table 7-3: Criteria for Determining Impact Significance

Magnitude of Impact	Sensitivity of Receptors			
	Very Severe	Severe	Mild	Low
Major	Critical	High	Medium	Negligible
Moderate	High	High	Medium	Negligible
Minor	Medium	Medium	Minor	Negligible
Minimal	Negligible	Negligible	Negligible	Negligible

7.2 Hazard Risks Assessment

A hazard risk assessment is a critical examination of health and safety hazards at a construction site and operation and maintenance (O/M) work. Performing regular hazard risks assessments can help construction and O/M stakeholders comply with occupational health and safety (OHS) regulations. Hazard risks assessments can help OHS teams

implement corrective measures to protect workers from health and safety threats during construction and operation stages.

7.2.1 Hazard Risks Assessment Codes

The principle behind the Hazard Risks Assessment System and the assignment of Hazard Risks Assessment Codes (HRACs) to identify and mitigate workplace hazards. HRACs are based on the hazard severity, probability of occurrence, and number of people exposed or potentially adversely affected in the event of an accident. While all hazards should be resolved as soon as possible, the Hazard Risks Assessment System is a safety risk ranking method to assist in making informed decisions concerning hazard control while providing decision makers with a consistent and defensible approach for prioritizing safety hazard abatement efforts based on available resources and with consideration towards competing demands and priorities.

7.2.2 Likelihood and Consequence of Hazards

HRACs require assigning a value for both the likelihood and probability of an outcome occurring, and the consequence or severity of a potential outcome. Based on these assigned values, a matrix format is used to place the specific hazard within a specific location of the matrix. This location can then be used to determine an HRAC number for that hazard activity.

The Likelihood or probability Code is considered numerical (1 through 4). These are presented below:

Sr. No.	Likelihood	Definition
1	Frequent	Immediate danger to the health and safety of the public, staff, resources, or property; occurs frequently or continuously.
2	Likely	Probably will occur in time if not corrected, or probably will occur one or more times during the life of the system.
3	Occasional	Possible to occur in time if not corrected.
4	Rarely	Unlikely to occur, may assume exposure will not occur.

Next is the Consequence or severity Code (A to D) is presented below:

Sr. No.	Consequence	Definition
A	Catastrophic/Fatal	Imminent and immediate danger of death.
B	Critical/Major	Significant injury or illness diagnosed by a physician or other license professional, which involves days away from work.
C	Minor	Medical treatment beyond first aid
D	First aid	Minimal threat to human safety and health, property, or resources, but is still in violation of a standard.

7.2.3 Hazard Risks Assessment Matrix

The hazard risks assessment matrix is presented in Table 7.4. This matrix helps OHS team to prioritize workplace hazards by identifying them as high, serious, medium, and low. Those hazards identified as high will require the most stringent controls available as well as immediate attention. They may even demand that such activities be cancelled from the Project. Specific workplace controls can be applied so that the associated hazards are more effectively controlled and therefore, result in a revised the assessment category to a more

acceptable level. Note that the box at the bottom indicates that if we can remove the hazard (such as incorporating an engineering design into a process), the hazard no longer exists and therefore can be removed from a project's control process – this is the ultimate hazard control.

Table 7-4: Worksite hazards

Severity / Probability	Catastrophic (A)	Critical/Major (B)	Marginal/Minor (C)	Negligible (D)
Frequent (1)	High	High	Serious	Medium
Probable/Likely (2)	High	Serious	Medium	Low
Occasional (3)	Serious	Medium	Medium	Low
Remote/Rare (4)	Medium	Medium	Low	Low
Eliminated (5)	Eliminated			

7.3 Summary of Assessed Impacts

The project's potential impacts and their significance have been assessed using the methodology described in Section 7.1. A summary of these impacts and their significance along with the mitigation measures are presented in **Table 7.5**, these impacts are discussed in the subsequent sections.

Table 7-5: Summary of Potential Impacts, their Significance and Mitigation Measures

Impact of various activities	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
Impacts from Siting – Environmental Aspects					
Supply of additional 22,000 GWh of electric power to the national grid (additional supply of 110 kWh per capita)	Very severe	Major	Critical (positive)	Adequate maintenance of the facilities in accordance with the standard operating practices of NTDC.	-
Risk of landslides and rock falls due to unstable geological conditions	Severe	Major	High	Construction of retaining walls for slope protection	Negligible
Greenhouse gas emissions from site clearing, materials life cycle and power leakages	Mild	Major	Medium	Net greenhouse gases emissions are negligible when compared to other feasible options for power transmission	Medium
Impacts from Siting – Social					
▪ Land acquisition of 158 acres for Mansehra GS with only 2.63 acres of cultivable land. ▪ Impacts on about 2,313 acres of cultivated land for DTL (for two cropping seasons only), relocation of 50 structures with 3.5 acres land. ▪ Reduced access to land for tower sitting	Severe	Major	High	▪ Compensation at negotiated price for land acquisition, cash compensation at market price for crops damage of 2 seasons, relocation and replacement cost for structures and roads, and trees as per RAPs. ▪ For DTL, compensation in the form of allowances for land under the towers due to reduced access; the owners will retain ownership and no acquisition would be undertaken.	Low

Impact of various activities	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
Impact on 1,381 households (consisting of 9,820 affected persons) including 318 vulnerable households	Severe	Major	High	Cash compensation of livelihood assistance ($0.0124 M) and vulnerability assistance ($0.121 M) as per RAPs	Low
Impact on 1.94 km local road to access Sawan Maira, Nakkah, and Bareela villages	Mild	Moderate	Medium	Realignment and reconstruction of these access roads around the property line in better quality for the affected communities with a cost of $0.606 M.	Low
Felling of 50,185 trees due to the clearance of land for Mansehra GS, installation of towers and clearing along the TL RoW	Severe	Major	High	Cash compensation for trees ($2.03 M) and afforestation through planting of 250,925 saplings (five times the number of trees cut) are considered in the ESMP. Slope stability measures will be considered in the engineering design to protect the slope, which will become unstable due to the trees cut.	Negligible
Impacts from Construction – Environmental					
Impact on wildlife habitats due to RoW clearance	Mild	Moderate	Medium	The project will affect 532.87 acres of forest land, which are the habitats of wildlife. Contractor will follow the recommendations developed under wild life conservation programs through Dasu Hydropower Project's Wildlife Conservation Management. Also Contractor will follow ESCPs 12 and 13.	Negligible

Impact of various activities	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
In average, tower foundation will be 3-6 m depth. Spoil will be generated due to the excavation work. Management of spoils at tower locations, especially at high altitude and steep slopes	Severe	Moderate	High	Contractor will be responsible to develop a blasting and spoil management plan. Emphasis will be given on control blasting and use of blasting mat to avoid impacts on the communities close proximity of the towers. Generated spoils will be utilized for back filling and excess materials will be disposed to designated locations approved by the CSC.	Negligible
Collision of birds during stringing operation	Severe	Moderate	High	Contractor will be responsible to prepare a schedule for stringing operation avoiding migration period February-March and September-November.	Negligible
Risk of soil pollution and soil erosion	Mild	Moderate	Medium	Contractor will take extra measures to prevent fuel and other hazardous material spillage. Fill materials should be covered and slope stabilization should be ensured to prevent erosion as per the ESCP 5.	Negligible
Risk of water pollution	Mild	Moderate	Medium	Contractor will ensure zero disposal of spoils in the water bodies and take measures to prevent water pollution from his activities as per the ESCP 3.	Negligible

Impact of various activities	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
Dust and air pollution from construction activities	Mild	Moderate	Medium	Maintenance of construction equipment and vehicles; usage of blasting mats, dust control measures as specified in ESCP 10.	Negligible
Noise and vibration from construction activities	Mild	Moderate	Medium	Control blasting and maintenance of construction equipment and vehicles; noise control measures as specified in ESCP 11.	Negligible
Generation of solid waste and hazardous waste	Mild	Moderate	Medium	Minimize generation of waste. Proper collection and disposal of wastes in approved sites by CSC or to vendors as per ESCP 1.	Negligible
Impact on quarry areas	Mild	Moderate	Medium	Use of existing quarry sties, and follow the mitigation measures presented in the ESCP 9.	Negligible
Traffic management at the crossing of major roads during stringing of conductors	Severe	Moderate	Medium	Contractor will be responsible to prepare a standard operating procedure (SOP) for traffic management for the 5 major highway crossings as per the Traffic Management ESCP 14.	Negligible
Impacts from Construction – Social Aspects					
Potential of 900 employment opportunities for local communities in un-skilled and semi-skilled category	Severe	Moderate	High (positive)	Preference to the local communities in the construction works is given. A skill development program for 900 local workers is developed under the ESMP with a budget of $0.115 M to assist	Low

Impact of various activities	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
				local communities in improving their skills, so that Contractor can engage them in semi-skilled work.	
Impacts on access roads and damages to local infrastructure	Severe	Major	High	Improvement of Lassan Nawab Road (Mansehra to Lassan Nawab to MGS) 26 km and tracks to access the RoW will be required to carry construction materials and heavy mechanical equipment. The cost will be included in the Civil Works Contract.	Low
Blocked access due to construction activities	Mild	Moderate	Medium	Traffic management plan to be implemented; Alternate routes to be identified in consultation with communities; GRM is prepared, GRC will be established, and cost for GRM is included in ESMP.	Negligible
1,450 workers will be stationed in 6 construction camps (5 for TL and one for Mansehra GS). These workers will be spread out through the 250 km length of DTL spanning geographically over eight (8) districts and at different phases of the project. Labor Influx in the project area will have risk of social tension, illicit behavior and privacy of women,	Severe	Moderate	High	• Engagement of local population in construction work will be encouraged through skill development by the Contractor. • Camps to be established at least 500 m away from communities; contractor to enforce code of conduct to respect local norms and culture; liaison with local	Low

Impact of various activities	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
crime, burden on and competition for public service provision, increased risk of communicable diseases and burden on local health services, water resources, inadequate waste disposal and illegal waste disposal, camp related land use, access roads, noise and lights				communities to be maintained; GRM to be established. • Contractor to obtain water in a manner not to affect the local communities; liaison with local communities to be maintained; GRM to be established. A provision of $54,210 is included in ESMP budget for GRM. Project Induced Labor Influx management plan is proposed in the ESMP and a community support program is recommended with a budget of $6 million. • The Contractor will prepare the construction camp management plan as per the ESCP 15, including the labor influx management. This will be reviewed and approved by NTDC and World Bank.	
Migrant labor may create social and gender issues due to the unawareness of local customs and norms and can hinder the mobility of local women for working in the field, herding livestock, picking fuel wood, etc.	Severe	Moderate	High	The contractor will provide qualified personnel to address the specific risks identified in the project including Sexual Exploitation and Abuse (SEA) risks and implement the recommendation and mitigations included in this ESIA. The contractor will be required to provide mandatory	Low

Impact of various activities	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
				and repeated training to workers on sexual exploitation and abuse and HIV/AIDS prevention and on the content and obligations derived from the code of conduct.	
Damage to sites/places of religious/cultural significance, such as graves	Major	Minor	Medium	Such sites to be demarcated and avoided during construction activities; liaison with local communities to be maintained; GRM to be established.	Low
Impacts from O&M – Environmental					
12 high risk spans are identified with a length of 14,533 m for bird collision and electrocution	Severe	Moderate	High	Placing of bird markers on the transmission line cables is included in Civil Works at a cost of $0.193 M.	Low
Pollution outages by repeatedly perching above an insulator	Mild	Moderate	Medium	First three spans close to Dasu reservoir are proposed to be fitted with appropriate anti-perching measures during initial line construction, the cost will be included in the Civil Works contract.	Negligible
Impacts from tree cutting during maintenance activities	Mild	Moderate	Medium	Bird nests will be preserved by minimizing trimming of trees during the bird breeding season. Trim the hollow bearing trees in a manner which reduces the potential for fauna mortality. Follow the ESCP 13.	Negligible

Impact of various activities	Sensitivity	Magnitude	Significance before Mitigation	Mitigation and Enhancement Measure	Significance of Residual Impact
Audible noise and radio interference from the transmission lines	Severe	Moderate	High	Design considerations to comply with the standards. In addition, NTDC will conduct noise monitoring at the operation stage to ensure the compliance with NEQS 2010.	Negligible
Impacts from O&M – Social					
Diminution of land value at the tower location	Severe	Major	High	Landowners will be compensated a reduced access allowance at the tower locations in the amount of $4.72 M. More details in RAPs.	Low

7.4 Significant Environmental Impacts from Project Siting

7.4.1 Improved Power Supply in the National Grid

The Dasu TL would evacuate about 22,000 GWh of electric power annually to the national grid through Mansehra and Islamabad West Grid Stations. According to World Bank statistics, the per capita electric power consumption in Pakistan is 448 kWh in 2014.[19] Dasu TL would supply additional 110 kWh of electric power per capita (considering the country population as 200 million). 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 in the region.

7.4.2 Risk of Land Slides and Rock Falls due to Unstable Geological Conditions

The geological and geomorphological conditions at some sections along the transmission line are unstable due to presence of several shear zones, and construction of huge 765 kV DTL towers may destabilize these geological conditions and cause landslides and rock falls during and after construction.

7.4.2.1 Mitigation

The final alignment of transmission line was selected to avoid the active land slide sites. Retaining walls will be built near the tower locations for protection of slopes and these would include shotcrete, rock bolts, anchors and dowels.

During construction, the slopes near the transmission line towers will be monitored for deformation, stress and strain, ground movement, and blasting vibrations; and adequate additional slope protection measures will be taken up if required. Blasting will be avoided at these locations where feasible, or controlled blasting will be used.

The transmission line towers have been designed considering the seismicity of the project area and in compliance with the "Building Code of Pakistan (Seismic Provisions-2007)".

7.4.2.2 Residual Impact

After construction of the retaining walls and implementation of the above mitigation measures, the risk of landslides and rock falls from construction of project activities would be adequately controlled. Hence, the significance of the residual impact will be negligible, as shown in **Table 7.5**.

7.4.3 Impacts on Trees

A total of about 50,185 trees will need to be felled for both Mansehra GS and transmission line construction. This includes 1,126 privately owned wood/ timber trees and 19,330 government owned trees (including 8 district government and 19,322 provincial departments) for Mansehra Grid Station. For DTL, 27,321 privately owned wood/ timber trees, 880 privately owned fruit trees and 1,528 government owned trees will be felled.

7.4.3.1 Mitigation Measures

Cash compensation for the affected trees will be paid to the owners in the amount of $2.03M. To compensate 50,185 trees, planting of 250,925 saplings (five times the number of trees cut) is proposed in the ESMP with a cost of $0.307 M. A tree plantation program

[19] https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?locations=PK

is developed and included in the ESMP. Selection of indigenous species are considered in the plantation program

7.4.3.2 Residual Impacts

After the compensation of trees summarized in Table 7.8 under Section 7.5.1.1, the impacts of the project will be mostly mitigated, in addition, planting 250,925 saplings will compensate the impact. Hence the significance of residual impacts will be Low, as shown in Table 7.5.

7.4.4 Net Greenhouse Gases Emission from DTL

Net greenhouse gas (GHG) emissions from implementation of DTL are estimated using the World Bank " Guidance Manual: Greenhouse Gas Accounting for Energy Investment Operations, Version 2.0 January 2013 (hereinafter "Guidance Note") and IPCC 2006 guidelines. The emissions from the Project and baseline emission of the nearest least-cost alternative (Combine Cycle Gas Turbine) estimated over 30 years.

Three sources of emissions are considered for accounting GHG from the Project. Emission sources and the estimates are presented in **Table 7.6**. The following sources are considered in the estimates:

- Direct generation emissions associated with losses
- Emissions generated due to Land Clearing for Civil Works
- Sulfur hexafluoride leakage as fugitive emissions generated from oil base transformers and circuit breakers

7.4.4.1 Total Emissions from DTL

Embodied emissions and construction emissions have not been calculated since the detailed information related to construction equipment is unknown at this stage. The total Project emissions from the three sources listed above are estimated 7.82 million tCO2e.

7.4.4.2 Baseline Emissions

The baseline—or least cost 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 project, the other feasible alternatives could be a line through another alignment. So, the emissions of other potential alternative would likely be very similar to the proposed alignment considered in the project.

7.4.4.3 Net Emissions

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

Table 7-6: Net GHG Emissions (tCO2) from DTL and Grid Station

Emission Type	DTL	Baseline	Net
1. Generation Emissions Associated with Losses	6,045,600	6,045,600	0
2. Emissions from Land Clearing	362,437	362,437	0
3. SF6 Emissions	1,407,830	1,407,830	0
4. Baseline Construction Emission (Optional)	0	0	0

Emission Type	DTL	Baseline	Net
5. Energy Emissions in Construction (Optional)	0	0	0
Total	**7,815,866**	**7,815,866**	**0**

7.5 Significant Social Impacts from Project Siting

7.5.1 Impacts on Land, Crops, Trees, and Structures

Total land acquisition will be 158 acres for Mansehra GS. The total affected land due to DTL's RoW is about 4,953.1 acres. Of this, about 2,315.6 acres is cultivated land, about 3.5 acres is commercial/residential land, 377.5 acres is forest land, and the remaining is barren land; see **Table 7.7** below.

Table 7-7: Impacts on land, Trees, Structures, and Others

Sr. No.	Resettlement Impacts	Unit	Quantity		Nature of Impact
			Mansehra GS	DTL	
A.	**Land to be Acquired**				
i)	Cultivated land	acre	2.63		Loss of land
ii)	Forest land	acre	155.37		Loss of land
	Total		***158***		
B.	**Land Affected**				
i)	Cultivated Land				
	Under Tower	acre	-	30.7	Decreased value and utility of affected land.
	Under line	acre	-	2,282.3	
ii)	Barren Land				
	Under Towers	acre		29.8	
	Under line	acre		2,160.1	
iii)	Commercial/ Residential land	acre	-	3.5	Decreased value and utility of affected land. Built-up structures falling under the transmission line will need to be removed.
iv)	Forest land	acre	-	377.5	Nominal impact.
v)	Others	acre		69.2	
	Total		***-***	***4953.1***	
C.	**Affected crops**				

Sr. No.	Resettlement Impacts	Unit	Quantity		Nature of Impact
			Mansehra GS	DTL	
i)	Total area of agriculture land to be impacted by tower installation and conductor stringing.	acre	2.63	2,313	Crop damage
ii)	Area under access tracks	acre	-	230	Crop damage
	Total		***2.63***	***2,543***	
D.	**Affected structures**				
1	Total Number of Residential Structures	No	-	49	Loss of structure
2	Total Number of businesses (poultry, etc.)	No	-	1	Loss of structure
	Total affected structures		**-**	***50***	
E.	**Affected trees**				
1	Privately owned Wood/ Timber Trees	No	1,126	27,321	Loss of trees
2	Privately owned Fruit Trees	No	-	880	Loss of trees
3	Government owned trees	No	19,330	1,528	Loss of trees
	Total affected trees		**20,456**	***29,729***	
F	**Project Affected Households**	**No**	**293**	**1,088**	
1	Households losing structures	No	0	29	
2	Households losing crops	No	6	684	
3	Households losing trees	No	147	510	
4	Vulnerable households	No	220	98	
G.	**Total number of affected Persons**	**No**	**2,080**	**7,740**	

7.5.1.1 Mitigation

The land acquisition and other project related impacts described above will be mitigated in accordance with the national regulations and WB safeguard policies. Two Resettlement Action Plans were prepared under the project, one for Mansehra Grid Station and the second one to cover the impacts of tower and transmission line. RAPs include compensation, relocation assistance, livelihood restoration, vulnerability allowance for poor and women-headed households, benefit sharing and community support programs. A summary of the compensation estimates given in the RAP is presented in Table 7.8.

Table 7-8: Resettlement Compensation Estimates

Sr. No.	Resettlement Activity	Amount (M PKR)		Total (M PKR) /Remarks
		MGS	TL	
A	Land Acquisition	1,617.9		

Sr. No.	Resettlement Activity	Amount (M PKR)		Total (M PKR) /Remarks
		MGS	TL	
	Sub-Total (A)	**1,617.9**		**1,617.9**
B	**Crops Compensations**			
i)	Crop damage within RoW	0.2	83.6	- **Compensation estimated for two seasons.**
ii)	Crop damage on access tracks	0	8.3	- **Compensation estimated for two seasons**
	Sub-Total (B)	**0.2**	**91.9**	**92.1**
C	**Compensation for Trees**			
i)	Private timber/ fuel trees	8.445	155.7	
ii)	Private fruit trees	0	6.2	
iii)	Government owned timber trees	144.975	8.7	
	Sub-Total (C)	**153.42**	**170.6**	**324.02**
D	**Commercial/ Residential Structures**			
i)	*Pacca* structures (17 structures)	0	14.6	
ii)	Semi-*Pacca* (24 structures)	0	16.2	
iii)	*Katcha* (3 structures)	0	0.9	
iv)	Boundary walls (4 structures)	0	0.36	
v)	Gate (1 structure)	0	0.03	
vi)	Poultry Farm (1 structure)	0	1.4	
D	**Sub-Total D**	**0**	**33.49**	**33.49**
E	**Allowances/ Livelihood Restoration (Estimated)**			
i)	Business interruption allowance.	0	0.06	- for 3 months at PKR 20,301 per month
ii)	Relocation assistance (transport)	0	0.15	- 5,000 for transport expenses
iii)	Livelihood assistance for relocation.	0.4	1.8	- for 3 months at PKR 20,301 per month.
iv)	Reduced access allowance	0	754.9	
v)	Vulnerability allowance for poor and women-headed households	13.4	6	- Cash allowance for 3 months at PKR 20,301 per month
vi)	Community Support programs	320	640	
	Sub-Total (E)	**333.8**	**1,402.91**	**1,736.71**

Sr. No.	Resettlement Activity	Amount (M PKR)		Total (M PKR) /Remarks
		MGS	TL	
F	**RAP Implementation**			
i)	RAP Implementation Consultant		85	
ii)	Training Cost	10	10	
iii)	Independent M&E	90	15	
	Sub-Total (F)	**100**	**110.00**	**210**

7.5.1.2 Residual Impacts

Even after payment of the compensation summarized in **Table 7.8**, the significance of residual impacts will be low, as shown in **Table 7.5**.

7.5.2 Impacts on Household Income and Livelihood Sources

The DTL project is likely to damage crops over an area of about 2,546 acres, as listed in **Table 7.7**. The damages to crops and felling of trees are going to affect the livelihood of about 1,373 households with 9,820 people. These households also include 318 vulnerable families.[20]

7.5.2.1 Mitigation

The impact on livelihood for DTL will be temporary and will only be for two seasons required for stringing. For the crop damages, the affected households will be paid cash compensation equivalent to value of crops for two seasons in the amount of $0.59 M. Similarly, the owners of timbre trees will be paid cash compensation equivalent to the value of wood; and owner of fruit tree will be paid cash compensation based on lost production for the entire period needed to re-establish a fruit tree of equal productivity. The vulnerable households will be paid vulnerability allowance $0.125 M in addition to the compensation for damaged crops and or felled trees. Details are provided in the RAP and summarized in **Table 7.8**.

7.5.2.2 Residual Impacts

After payment of the compensation summarized in **Table 7.8**, the impacts of the project on livelihood of the affected households particularly the vulnerable families will be mostly mitigated. Hence the significance of residual impacts will be Low, as shown in **Table 7.5**.

7.6 Significant Environmental Impacts during Construction

7.6.1 Generation of Spoils

Spoils will be generated due to the blasting and excavations for the tower foundation at a depth of 3-6 m. In the mountains with steep slope, management of these spoils will be extremely difficult, due to the absence of spaces that can be used as a potential disposal site for these materials. Improper disposal of spoils along the valley slopes may eventually deposited in to the cultivated lands or in to the rivers thus causing rockfall, landslides, soil

[20] Vulnerable households: having monthly income less than the official poverty line of PKR 20,301; or women-headed households.

and water pollution. The spoils will also act source of dust. The significance of the impact has been assessed as High.

7.6.1.1 Mitigation

The first step towards addressing the impacts of spoil is to use control blasting and proper design of blast to minimize the generation of spoils. Contractor will be responsible to construct retaining structures to prevent rockfall and landslide down to the rivers or establishments in the downhill side, use the excavated rock to the maximum extent possible as aggregate material in the concrete works for the foundation and retaining walls. The excess spoils should be stored behind the retaining walls or placed in the lands provided by local communities for developing terraces or in the areas approved by CSC.

7.6.1.2 Residual impacts

With implementing above mitigation measures, the potential impacts associated with spoil generation are likely to be adequately addressed and hence the residual impact is likely to be Negligible in significance.

7.6.2 Collision of Birds during Stringing Operation

The proposed TL alignment obstructs the fly-way of migratory and local birds. Large flocks of migrating birds follow the Indus valley fly-way with south ward migration starting from September to November and northward migration starting from February to March. During stringing of conductors, potential collisions might occur mostly with cables hanging perpendicular to the flight direction particularly with the top earth-wire because of its small diameter and poor visibility.

7.6.2.1 Mitigation Measures

The Avian Risk Assessment of DEBMP identified 12 highest-risk spans with a total length of 14,533 m of transmission alignment that are perpendicular to migration corridors of sensitive species. Contractor will avoid stringing of conductors in these spans during September to November and February to March period. A construction window will be developed specifically for this purpose.

7.6.2.2 Residual Impacts

With the help of the above mitigation measures, the potential impacts on migratory birds are likely to be adequately addressed and hence the residual impact is likely to be Negligible in significance.

7.7 Significant Social Impacts during Construction

7.7.1 Employment Opportunities for Local Communities

As described in Sections 4.2.11 and 4.3.7, the construction contractor(s) will have a work force of about 1,450 personnel. A large proportion of this workforce will be skilled and semi-skilled laborers including drivers, watchmen, camp staff, warehouse staff, and manual laborers. Based on the experience of under construction DHP, landowners prefer to have their family members employed by the Contractors. In extreme cases, refusal of employment by the Contractors lead to coercion. The local communities during the stakeholder consultations have shown great desire to be included in the project's workforce. In line with the aspirations of local communities, the contractors will be contractually bound to maximize employing the locals as appropriate. In addition, to maintaining good relations with the local communities, maximizing local employment may

also be cost effective since engaging workforce from other parts of the Country could be costlier. However, due to the lack of experience of the local communities, Contractor always prefer to have experienced person in their workforce to save time and improve the quality of workmanship.

7.7.1.1 Mitigation

A skill development program is considered in the ESMP to provide hands-on-training to the local communities prior to their employment. As part of the employment package, Contractor will first train them for 1 week with pay, then engage in semi-skilled work. This will encourage the Contractors to employ trained individual from the local community. This will be a win-win strategy for the Contractor and as well as for the communities to work on conflict resolution aims to accommodate both parties. The Project will bear the expenses of the initial training and will be included as a separate line item in Contractors' bills-of-quantities. The skill-development program will assist GoP's initiative in improving labor market situation with the supply of more skilled person in the job-market, including the market in the middle-east. The contractors will be required to formulate an employment policy keeping in mind the skill development program to ensure equitable availability of employment opportunities to all communities within the project area particularly the APs.

7.7.2 Impacts from Access Roads and Damages to Local Infrastructure

The construction activities will require using/establishing tracks to access the TL RoW from the existing road network. It has been estimated that on average about 200 m long access track will be used for each tower location though it may not be possible to do so for some tower locations in the mountainous terrain. Though exact locations and hence ownership of the land under these access tracks is not known at this stage, it can however be estimated that crops will be damaged over about 230 acers of cultivated land (200m long x 15 m wide x 310 towers located in cultivated areas). In addition, Lassan Nawab Road a length of 26 km will be used for transporting heavy equipment for the Mansehra GS. This road will require improvement to ease the radius of curvatures for heavy and long load.

In addition to the crop damage, the construction activities including establishing and using access tracks may also damage the local infrastructure such as existing roads/tracks, tube-wells, water courses, and drainage channels.

7.7.2.1 Mitigation

The crop damages caused by the establishing and or using access tracks will be compensated by paying cash compensation equivalent to value of crops for two seasons. The amount of $0.052 M is included in the resettlement cost estimates summarized in Table 7.6; further details are presented in the RAP. The improvement in Lassan Nawab Road will be included in the Civil Works Contract and all improvements will be done within the existing RoW without any land acquisition requirement.

For any inadvertent damage to the existing infrastructure, the contractor will be contractually liable to repair and or replace the damaged infrastructure to original or better condition. The GRM established at the site will also address any community grievances related to the damaged infrastructure. A provision of $54,210 is included in ESMP budget for GRM.

7.7.2.2 Residual Impacts

After payment of the compensation summarized in **Table 7.6**, the impacts of the project on livelihood of the affected households particularly the vulnerable families will be mostly mitigated. In addition, improvement of local access road by the Project will mitigate the impacts as well. Hence the significance of residual impacts will be Low, as shown in **Table 7.5**. The impacts associated with the damaged infrastructure will be completely mitigated and hence the significance of residual impacts will be quite negligible.

7.7.3 Project Induced Labor Influx

Social impacts are critical to address, as a modest 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 list below indicates expected categories of risks associated with project induced labor influx:

Risk of social tension: Conflicts may arise between the local community and the construction workers, which may be related to differences due to competition for local resources. Tensions may also arise between different groups within the labor force, and pre-existing conflicts in the local community may be exacerbated.

Increased risk of illicit behavior and crime: The influx of workers and service providers into communities may increase the rate of crimes and/or a perception of insecurity by the local community. Such illicit behavior or crimes can include theft, physical assaults, and substance abuse. Local law enforcement may not be sufficiently equipped to deal with the temporary increase in local population.

Increased burden on and competition for public service provision: Presence of construction workers and service providers (and in some cases family members of either or both) can generate additional demand for the provision of public services, such as water, electricity, medical services, transport, education and social services. This is particularly the case when the influx of workers is not accommodated by additional or separate supply systems.

Increased risk of communicable diseases and burden on local health services: The 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. This can result in an additional burden on local health resources. Workers with health concerns relating to substance abuse, mental issues or STDs may not wish to visit the project's medical facility and instead go anonymously to local medical providers, thereby placing further stress on local resources. Local health and rescue facilities may also be overwhelmed and/or ill- equipped to address the industrial accidents that can occur in a large construction site.

Inadequate waste disposal and illegal waste disposal sites: Large populations of workers generate increased amounts of waste, for which no sufficient local waste management capacities may exist, which would likely lead to improper disposal practices.

Camp related land use, access roads, noise and lights: The camp use can result in increase in noise and light pollution especially at night. The construction of new access roads can also lead vegetation removal and landscape transformation.

7.7.3.1 Mitigation Measures

The following mitigation measures have been proposed:

- Local population will be given preference in construction related jobs. Skill development through the project is planned to train local population prior to engage in construction work by the Contractor at a cost of $0.115 M.
- The Contractor will prepare the construction camp management plan which, in addition to other components, will include the labor influx management plan. This will also be based on the management plan for construction related impacts prepared for original project[21]. This will be reviewed and approved by CSC, NTDC and World Bank.
- The Contractor will select the specific work shift for the construction activities particularly near the settlements, to cause least disturbance to the local population, particularly women.
- Contractor will take due care of the local community and observe sanctity of local customs and traditions by his staff. Contractor will warn the staff strictly not to involve in any unethical activities and to obey the local norms and cultural restrictions.
- The Contractor will carry out the construction activities in such a way that the open defecation timings by the local community should not be compromised. The normal defecation timings are early in the morning and at late in the evening. So, the Contractor will have to schedule their work keeping in mind these times.
- During construction activities, if privacy of the nearby households is affected, the Contractor will inform the house owner to make particular arrangements. Similarly, Contractor will take care as much as possible that the construction activities should not affect the privacy.
- The contractor will also ensure that solid waste and wastewater is disposed of in an environmentally friendly manner in designated areas and by approved methods only. Contractor will ensure that soil and water is not contaminated by improper disposal of solid waste and waste water.
- The contractor will explore alternative water sources and ensure that water usage by the project does not affect or compete with water requirements of the local community.
- The Contractor will also ensure that noise and light pollution from the labor camp is kept at minimal levels especially at night.

7.7.3.2 Residual Impacts

After all mitigation measures listed above are implemented, the labor induced impacts on the local community will be mostly mitigated. Hence the significance of residual impacts will be Medium, as shown in **Table 7.5**.

7.7.4 Social and Gender Issues

Findings of the socio-economic survey reveal that the privacy of women is a major cause of concern for the communities of the project area. Due to the project activities local women may face difficulty to perform their daily outdoor chores. Women in the project area participate in other outdoor activities such as livestock rearing, bringing of potable water, collection of fire wood etc. that may also be affected by the project activities.

[21] Volume-8 of SRMP of original Dasu Hydropower Project: Management Plan of Construction Related Impacts

The induction of outside labor may create social and gender issues due to the labor force being unaware of local customs and norms. It may also cause hindrance to the mobility of local women for working in the field, herding livestock, picking fuel wood, etc.

Gender-based violence: 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 social control. This can lead to inappropriate and criminal behavior, such as sexual harassment of women and girls, exploitative sexual relations, and illicit sexual relations with minors from the local community.

Child labor and school dropout: Increased opportunities for the host community to sell goods and services to the incoming workers can lead to child labor to produce and deliver these goods and services, which in turn can lead to enhanced school dropout.

7.7.4.1 Mitigation Measures

- The contractor will be required to provide qualified key personnel to address the specific risks identified in the project including Sexual Exploitation and Abuse risks. Contractors will specify key staff with the technical skill and experience to implement the recommendations and mitigations included in this ESIA.
- The bidding documents will include specific requirements that minimize the use of expatriate workers and encourage hiring of local workers through skill development program, thereby minimizing labor influx.
- The bidders will be required to submit Codes of Conduct (CoCs) with their bids. The CoCs will set clear boundaries for acceptable and unacceptable behaviors of all individuals and companies and will be signed by companies, managers and individuals.
- All project consulting firms will also be required to prepare Codes of Conduct.
- The contractor will be required to establish anti-sexual harassment policies that governs conduct in the workplace.
- The contractor will be required to provide mandatory and repeated training to workers on sexual exploitation and abuse and HIV/AIDS prevention and on the content and obligations derived from the code of conduct
- Provisions will be set in contracts for dedicated payments to contractors for SEA prevention activities (e.g., training) against evidence of completion.
- The Contractor will ensure the implementation of the recommendations and mitigations related to SEA risks included in this ESIA. The implementation will be regularly reported by the Contractors and internally monitored by CSC and NTDC. Implementation of these recommendations and mitigations will also be monitored by the third-party M&E Consultant and presented in its monitoring reports.

7.7.4.2 Residual Impacts

After all mitigation measures listed above are implemented, the labor induced impacts on the local community will be mitigated, however, due to the severity of the issue, the significance of residual impacts will be Low, as shown in **Table 7.5**.

7.8 Significant Environmental Impacts during Operation and Maintenance

7.8.1 Audible Noise and Radio Interference from Transmission Lines

Audible Noise from Transmission Line occurs primarily in foul weather. In Dry Weather conditions, the conductor usually operates below corona inception level and generates few corona sources for audible noise. However, in wet conditions, water drops impinging or collecting on conductor produce a large number of corona discharges and thereby creating bursts of noise. Therefore, the audible noise increases to such an extent that sometimes it represents one of the limitations for the design of transmission line conductor. The audible noise for the proposed TL (Hexa-bundled Rail Conductors) has been estimated and presented in Table 7.9. The noise levels during fair weather are generally within the national standards. However, during rainy periods, the noise levels will exceed the night time standards up to 100m from the center of TL alignment.

Radio interference also called radio influence is a noise type that occurs in the Amplitude Modulation Radio reception including the standard broadcast band from 0.5 to 1.6 MHz. It does not take place in Frequency Modulation bands. Power line interference tends to be roughly in inverse proportion to the frequency. Radio interference can be predicted by applying Empirical or Comparative formula as a result of regression analysis performed on experimental data of Radio Interference of various variables such as conductor diameter, surface gradient, lateral distance from the line etc.

Instead of using absolute noise level, as a criterion for rating interference level, it is more logical to use a relative measure as signal to noise ratio. This parameter is generally employed to affect the effect of transmission noise on AM Radio broadcast. The radio interference is calculated and presented in **Table 7.13**.

No standard limit exists for Radio Interference but Canadian Standard Association has developed the recommended limits for Electromagnetic Noise based on the line voltage. For high voltage level of 765 kV, the acceptable limit is 60dBA in fair weather measured at the distance 40 meter from center of tower. The estimated radio interference levels from Dasu TL will be within these standards.

Table 7-9: Audible Noise and Radio Interference from Dasu TL

Distance from Centre of TL Alignment (m)	Audible Noise (dBA)		Radio Interference (dBuV/m)	
	Rain Weather	Fair Weather	Rain Weather	Fair Weather
40 (edge of ROW)	51.5	26.5	59.6	42.6
50	50.8	25.8	57.4	40.4
60	50.1	25.3	55.2	38.2
70	49.4	24.4	53.5	36.5
80	48.9	23.9	52.1	35.1
90	48.4	23.4	50.9	33.9
100	47.9	22.9	49.7	32.7

Distance from Centre of TL Alignment (m)	Audible Noise (dBA)		Radio Interference (dBuV/m)	
	Rain Weather	Fair Weather	Rain Weather	Fair Weather
National or international Standards	Residential Area: Day time: 55; Night time: 45		Canadian Standard Association: 60	

7.8.1.1 Mitigation

Exposure to noise and radio interference from transmission lines has already been considered during the design of the transmission line conductors and right of way to ensure compliance with the national and international standards. In addition, NTDC will conduct noise monitoring at the operation stage to ensure the compliance with NEQS. Hence, no additional mitigation measures are proposed.

7.8.2 Avian Risk Assessment

(a) Collisions

The Indus valley is a major fly-way for bird migration. Huge flocks of migrating birds follow the Indus valley fly-way with south ward migration starting from November and northward migration starting from March. Fatal collisions occur mostly with cables hanging perpendicular to the flight direction particularly with the top earthwire because of its small diameter and poor visibility.

Avian Risk Management Plan (ARMP) under Detailed Ecological and Biodiversity Management Plans (DEBMP) of Dasu Hydropower Project conducted during 2018-2019[22] identified six species designated by the International Union for Conservation of Nature (IUCN) as Threatened (Vulnerable, Endangered, or Critically Endangered) and Range-restricted potentially present in the Project area. The species list and their IUCN designations are presented below.

Sl.	Name	Scientific Name	IUCN Category
1	Sociable Lapwing	Chettusia gregaria	Critically endangered (CR)
2	Steppe Eagle	Aquila nipalensis	Endangered (EN)
3	Common Pochard	Aythya ferina	Vulnerable (VU)
4	Western Tragopan	Tragopan melanocephalus	Vulnerable (VU)
5	Himalayan Monal	Lophophorus impejanus	Range-restricted (RR)
6	Koklass Pheasant	Pucrasia macrolopha biddulphi	Range-restricted (RR)
7	White-cheeked tit	Aegithalos leucogenys	LC (RR)
8	White Throated tit	Aegithalos niveogularis	LC (RR)
9	Brooks'sleaf warbler	Phylloscopus subviridis	LC (RR)

The Avifauna Team of DEBMP collected a year of preconstruction data for the project. These data were used to develop a collision Avian Risk Assessment. A relative risk category was identified for each line-span based on the numerical ranking or linear scoring system. The 12 highest-risk spans with a total length of 14,533 m (i.e., relative risk 9 through 12) are sections of line that are perpendicular to migration corridors and/or are near sensitive species. The list of the spans is presented below:

[22] Draft Avian Risk Management Plan, Detailed Ecological and Biodiversity Management Plans (DEBMP), Dasu Hydropower Project, May 2019.

From	To	Span Length (m)
AP1	AP2	800
AP15	AP16	691
AP16	AP17	1,250
AP17	AP18	1,300
AP42	AP43	1,200
AP43	AP44	990
AP144	AP145	1,020
AP155	AP156	712
AP171	AP172	1,680
AP72	AP173	2,250
AP176	AP177	2,180
AP177	AP178	460
Total Length		14,533

(b) Electrocution

Due to modern engineering development, avian electrocution risk is becoming minimal for transmission structures due to the requirements of larger clearances (APLIC 2006).[23] The DTL project involves 765 kV transmission line and design considered larger horizontal and vertical clearance between energized and grounded components, so the line does not pose a significant avian electrocution risk.

(c) Nesting

Stick nests can pose an operational and safety risk to electrical systems (Figure 7.1). Nesting tends to be a localized problem occurring in favorable breeding habitat. Nest prevention is difficult on lattice towers. Instead, nests on structures should be managed so they are in positions where they do not create operational issues. The Dasu TL could be vulnerable to nesting issues within many environments and the ARMP includes recommendations that can be implemented reactively where such impacts are observed.

(d) Streamers

Streamer is a jet of liquid bird excrement that can exceed 152 cm. An outage can occur when a streamer simultaneously contacts differently energized phase components, or if the streamer fills the air gap and initiates arcing. The project area has the presence of large birds to create potential streamer issues. Streamer issues may also be related to nesting on structures.

[23] Avian Power Line Interaction Committee (APLIC). 2006. Suggested practices for avian protection on power lines: the state of the art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, DC, and Sacramento, CA.

Figure 7-1: Nests in Towers 220 kV TL from Rawat to University Grid (Ankara Park Islamabad)

(e) Pollution

When feces build up on the insulators from repeated deposits of bird contamination; which can undermine the insulator's material properties and may cause a phase-to-ground flashover across the surface of the insulator string, especially during wet conditions (Electric Power Research Institute 2006).[24] Birds of any size and most commonly associated with flocking birds can create pollution outages by repeatedly perching above an insulator. Pollution issues may also be related to nesting on structures.

7.8.2.1 Mitigation

The ARMP of Dasu Hydropower Project, identified 12 high risk spans for flyway of migratory birds, with a length of 14,533 m. The overhead earth wire/ shield wire or ground wire of the transmission line will be installed with the bird diverters such as colored balls (Figure 7.2), when the transmission line crosses these spans at a cost of $0.2 M. Towers on both sides of the river should have light beams focused on the balls on the power lines, at night, during 'mid-February to end March' and again from 'mid-September to mid-November'. Each tower on the flyway will have blinking light on its top. Bird collision and electrocution data will also be collected during early March and October.

[24] Electric Power Research Institute. 2006. Avian interactions with transmission lines training DVD. EPRI, Palo Alto, CA: 2006-1013618.

Figure 7-2: Ankara Park Islamabad (220 kV TL from Rawat to University Grid)

Anti-perching measures during initial line construction will be fitted in the first three spans close to the dam. ARMP also recommended the establishment of Wildlife Rehabilitation Center in the vicinity of Dhodial Phesantry in KP to address the issues of injured birds and animals.

7.8.2.2 Residual Impacts

After installation of bird markers/diverters/ colored balls, risks of bird collision and electrocution will be adequately mitigated. Hence, the significance of residual impacts will be negligible.

7.9 Significant Social Impacts during Operation and Maintenance

7.9.1 Diminution of land value in the width of Right of Way Corridor

The presence of transmission lines and towers will significantly reduce the market value and real estate potential of the land under the 674 towers and 80 m corridor of transmission line right of way. This impact would be major particularly in the areas between Haripur

and Islamabad where it passes near the towns. Each tower will require an area of 400 m^2 land, which will still be used by the landowner with some difficulty.

7.9.1.1 Mitigation

The routing of transmission line has been selected to avoid existing towns and settlements. Historically, the land under the transmission line right of way has not been acquired by NTDC and also it is not required by law. World Bank has also recommended NTDC to consider adequate compensation for the land under the transmission line corridor. NTDC has agreed to provide compensation in the form of a one-time allowance is considered in the RAP for reduced access to the tower sittings only. The Project will pay a one-off reduced access allowance of $4.72 M to compensate for the decrease of access to these land. Title to the land shall still remain with the owner(s).

7.9.1.2 Residual Impacts

Even after payment of the compensation summarized in Table 7.8, the impacts of the project on land and its value will not be completely mitigated. Hence, the significance of residual impacts will be Low, as shown in Table 7.5.

7.10 Summary of Assessed Hazard Risks

The project's hazard risks and their significance have been assessed using the methodology described in Section 7.2. A summary of these hazard risk and their significance along with the preventive actions are presented in Table 7.10; these high and serious hazards are discussed in the subsequent sections and the medium and low hazards will be prevented through ESCP and standard operating practices. High hazards are addressed in three distinct factors, (a) Standards for the hazard risks management to comply with the Occupational Health and Safety Standards of the WB (General EHS Guidelines, 2007), as well as the applicable provisions of ILO and WHO, in absence of these guidelines best practices will be followed, such OSHA, (b) Expected Site specific OHS hazard risks, and (c) Control and Preventive Measures.

Table 7-10: Summary of Hazard Risks, their Significance and Preventive Measures

Impact of various activities	Severity	Probability	Significance before Preventive Action	Preventive Measures	Significance of Residual Risks
During Construction					
Hazards during transportation and storage of explosives	Catastrophic	Occasional	High	Vehicles transporting explosives will only be driven by a licensed driver. Explosives will not be transported with other materials. Blasting caps and detonators will not be transported in the same vehicle with other explosives. Each vehicle used for transportation of explosives will be equipped with a fully charged fire extinguisher, in good working condition. Explosive Storage should be designed in compliance with the regulatory requirements, especially building make, wall thickness, separation distance from the sensitive receptors, etc. Blasting caps and other detonators will not be stored in the same magazine or container with other explosives or blasting agents. Surplus primers will be disassembled and components stored separately. Details are presented in Section 7.11.1.	Low
Impact of drilling at tower location	Critical	Probable	High	Training and education will be provided to all workers involves in drilling and other related works. Effective PPE's will be provided and ensured to use during all works. Machines will be checked and maintained to efficient level to ensure risk free operations. Details are presented in Section 7.11.2.	Low
Impact of blasting operation	Critical	Probable	Serious	Contractor will prepare a controlled blasting plan based on the recommendations presented in Section 7.11.3 covering the management of flyrock, vibration, airblast	Low

Impact of various activities	Severity	Probability	Significance before Preventive Action	Preventive Measures	Significance of Residual Risks
				overpressure, ground movement, and toxic fumes.	
Operation of heavy equipment and machinery	Critical	Occasional	Medium	Develop safe working procedures, training of the operators and workers and maintain a safe zone, ensuring visibility and stationing flagman. More detail information is available in ESCP 19 for heavy equipment movement.	Low
Excavation and leveling for tower foundation and Mansehra GS	Marginal	Occasional	Medium	Excavation for tower foundation for a depth of 3-6 m will be required. In addition, cut and fill will also be required at the Mansehra GS. The Contractor will be responsible for sloping by cutting back the trench wall at an angle inclined away from the excavation. Shoring will require installing aluminum hydraulic or other types of supports to prevent soil movement and cave-ins. Shielding will be required to protect workers by using trench boxes or other types of supports to prevent soil cave-ins. Contractor will design a protective system that can be complex because consideration should be given to many factors: soil and rock classification, depth of cut, water content of soil, changes due to weather or climate, surcharge loads (e.g., spoil, other materials to be used in the trench) and other operations in the vicinity.	Low
Transportation of construction, tower materials, heavy equipment by road close to tower locations and Mansehra GS	Marginal	Occasional	Medium	The Contractor will develop a traffic management plan based on the Traffic Management ESCP 21 by considering the heavy load, control of traffic in KKH and other local roads, pavement condition and	Low

Impact of various activities	Severity	Probability	Significance before Preventive Action	Preventive Measures	Significance of Residual Risks
				stability, radius of curvature of the local roads to take turns on sharp curve, etc.	
Transportation of heavy loads in difficult terrain	Critical	Frequent	High	The construction material (30-40 m^3 of concrete for tension towers, about 15 m^3 to suspension towers) and tower components (120 t for angle towers and 90 t for suspension towers) will be transported to some of the tower locations using the combinations of donkey, cable wire, small truck and small car. In some mountainous location, this operation will be very risky. Contractor will prepare method statements for these locations devising the steps and vehicle to be used and submit to CSC for approval. In locations, walking trails with fall prevention measures will be constructed for the transportation of heavy loads. More detail measures are presented in 7.11.4.	Low
Working at height along the slope, for tower erection and grid station assembly	Critical	Frequent	High	There are 44 towers located at steep mountain cliffs. Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area. Use of fall prevention devices, including safety belt and lanyard, travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards or self-retracting inertial fall arrest devices attached to fixed anchor point or horizontal life-lines. Define control line to restrict access, where leading edge and other operations are taking place (e.g., curve in the slope). More detailed measures are presented in Section 7.11.5.	Low

Impact of various activities	Severity	Probability	Significance before Preventive Action	Preventive Measures	Significance of Residual Risks
Exposure to extreme heat during summer especially if critical needs such as access to safe drinking water and places for rest are not available.	Marginal	Occasional	Medium	Contractor will ensure potable drinking water to all workers as per the ESCP 17 and shelter for resting, especially during summer time.	Low
Stringing conductors at road, river, and existing transmission line crossings	Critical	Occasional	Medium	Prepare and submit a traffic management plan to the CSC for his approval at least 30 days before commencing work on any project component involved in traffic diversion and management. Ensure the provision of Lifejackets/buoyancy aids with lifeline worn by workers with risk of falling into water. Lifejackets/buoyancy aids should conform to BS EN ISO 12402-1, 2, 3 or 4, or other equivalent international standards according to working conditions. Coordinate with the transmission line staff/ concerned DISCO or NTDC to plan the work. Take necessary shutdown on the live transmission lines. Provide training and appropriate personal protective equipment to workers. Follow ESCP 23.	Low
Transportation of oversized equipment to Mansehra Grid Station	Marginal	Occasional	Medium	Ensure that the vehicle route is surveyed and that its geometric design and condition is appropriate for the transportation of the big and heavy load. Ensure that turning curves are appropriate for the special vehicles. More details are presented in the ESCP 21.	Low
Lifting and Assembly of Heavy Equipment at Mansehra GS	Marginal	Occasional	Medium	Lifting equipment selection shall be based on a risk assessment and shall be suitable for the task for which it will be used. More details are presented in the ESCP 22.	Low

Impact of various activities	Severity	Probability	Significance before Preventive Action	Preventive Measures	Significance of Residual Risks
Frequent accidents and injuries due to various construction activities without the use of PPE	Critical	Probable	Serious	Contractors will be responsible for supplying effective PPEs to all workforces and staffs of consultants and PMU visiting the worksites. Contractors must ensure that all workers and staffs are trained how to use them prior to station and visit to construction sites. Any violation of the supply of PPEs by Contractor and use of PPEs by workers will led to severe penalty as stated in Section 9.8.2.	Low
Community health and safety from construction activities and traffic	Marginal	Occasional	Medium	Construction areas will be secured using fences close proximity to residential development, Design of control blasting and use of blasting mats should be ensured. Traffic, noise, and vibration control measures in accordance with ESCP 17.	Low
Security of workers and asset	Marginal	Occasional	Medium	The Contractor shall: ▪ Provide appropriate security personnel (i.e. security guards) to prevent unauthorized entry into the camp area. ▪ Employ night watchman for periods of significant on-site storage or when the area necessitates. ▪ Ensure there is proper fencing around construction site perimeter. ▪ Ensure construction site has controlled access points (one or two entry points at most), allowing	Low

Impact of various activities	Severity	Probability	Significance before Preventive Action	Preventive Measures	Significance of Residual Risks
				for close monitoring of entry and exit. ▪ Further details are in ESCP 18.	
During Operation and Maintenance					
Workers health and safety during maintenance	Critical	Occasional	Medium	Implementation of Standard operating procedures (SOPs) of NTDC (Annex 7.1)	Low
Impacts from electric and magnetic fields from transmission lines on community health and safety	Severe	Minimal	Negligible	Exposure to EMF has already been considered during the design of the transmission line conductors and right of way to ensure compliance with the internationally recognized standards. The 765 kV transmission line has an electric field generated with the 80 m RoW in the amount of 0.03 kV/m, which is way lower than the ICNIRP standards of 5 kV/m for public exposure and 10 kV/m for Occupational Exposure. On the other hand, Magnetic Field for the DTL will be 23.31 µT, which is again significantly lower than the public exposure limit of 200 µT and Occupational Exposure limit of 1,000 µT. The electric and magnetic fields will be regularly monitored during O&M phase to ensure compliance with the ICNIRP standards and if required additional mitigation measures will be proposed during O&M phase. NTDC will maintain and clear entire RoW from the establishment of permanent structures. Awareness will be created along the TL alignment to avoid long exposures under the line.	Low

Impact of various activities	Severity	Probability	Significance before Preventive Action	Preventive Measures	Significance of Residual Risks
Handling of faulted SF6 in circuit breakers and transformers maintenance	Critical	Probable	Serious	Evacuate the faulted SF6 gas from the circuit breaker and flush with fresh air before working on the circuit breaker. Arc products which do not recombine, or which combine with any oxygen or moisture present, are normally removed by the molecular sieve filter material within the circuit breaker.	Low
Electrical contact during maintenance addressing working near exposed energized overhead lines or grid stations; working on electrical equipment and systems; and wet locations	Catastrophic	Occasional	Serious	Conduct a job hazard analysis to identify the hazard risks. Follow NTDC's standard operating procedure for repair and maintenance. Only, qualified persons using proper test equipment and personal protective equipment must adhere to limited approach boundary with a distance of 7.25 m for 765 kV voltage. Must comply with the working space requirement for the equipment. Receptacles and cord connectors used in damp or wet locations must be designed for use in wet or damp locations and, unless approved for submersion, must not be allowed to lie in water.	Low

7.11 Significant OHS Hazard Risks during the Construction

7.11.1 Transportation and Storage of Explosives

(a) Standards

Surface transportation of explosives and blasting agents will be in accordance with applicable Ministry of Industries and Production, Department of Explosives, Explosives Rules of Pakistan, 2010.

(b) Potential Hazards

Failing to appropriately secure and protect explosives during transportation exposes to possible detonation by impact, friction, fire and/or shock. Transporting in an unsecured manner exposes to possible loss or theft. Other hazards include, lack of segregation (detonators and other explosives), carriage with incompatible or fire risk materials, lack of appropriate explosives signage, inappropriate vehicle design to prevent incidents, overloaded vehicles and lack of training of drivers of vehicles carrying explosives.

(c) Preventive Measures

- Motor vehicles or conveyances transporting explosives will only be driven by, and be in the charge of, a licensed driver. The driver will be familiar with the Provincial and Federal regulations governing transportation of explosives.
- No person will smoke or carry matches or any other flame-producing device, nor will firearms or loaded cartridges be carried while in or near a motor vehicle or conveyance transporting explosives.
- Explosives, blasting agents, and blasting supplies will not be transported with other materials or cargoes. Blasting caps and detonators will not be transported in the same vehicle with other explosives.
- Vehicles used for transporting explosives will have the appropriate specifications to carry the load without difficulty and will be in good mechanical condition.
- When explosives are transported by an open vehicle, original manufacturer's container will be securely attached to the vehicle to contain the cargo.
- All vehicles used for the transportation of explosives will have tight floors and any exposed spark-producing metal on the inside of the body will be covered with wood, or other non-sparking material, to prevent contact with containers of explosives.
- Every motor vehicle or conveyance used for transporting explosives will be marked or placarded on both sides, the front, and the rear with the word "Explosives" in red letters, not less than 4 inches in height, on white background. This would be subject to security situation in the project area and country in general. During the days of heightened security alerts by law enforcement agencies, this would not be applicable.
- The motor vehicle or conveyance may also display, in such a manner that it will be readily visible from all directions, a red flag 0.46 m by 0.76 m, with the word "Explosives" painted, stamped, or sewed thereon, in white letters, at least 6 inches in height. This would be subject to security situation in the project area and country in general. During the days of heightened security alerts by law enforcement agencies, this would not be applicable.
- Each vehicle used for transportation of explosives will be equipped with a fully charged fire extinguisher, in good working condition. An extinguisher, approved by a nationally

recognized testing laboratory, of not less than 10-ABC rating will meet the minimum requirement. The driver will be trained in the use of the extinguisher on the vehicle.

- Motor vehicles or conveyances carrying explosives or blasting agents, will not be taken inside a garage or shop for repairs or servicing.
- No motor vehicle transporting explosives will be left unattended.
- In order to prevent explosives hazards, explosive materials will be transported to the storage or blast site without delay.
- Explosive storage should be designed in compliance with the regulatory requirements, especially building make, wall thickness, separation distance from sensitive receptors, etc.
- Blasting caps and other detonators will not be stored in the same magazine or container with other explosives or blasting agents. Surplus primers will be disassembled and components stored separately.
- Smoking and open flames will not be permitted within 14 m of explosives, detonators, or blasting agents storage.
- No explosives or blasting agents will be permanently stored in any underground operation unless the operation has at least two modes of exit.
- Permanent explosive materials storage will be at least 300 m from residential development.
- Permanent explosive materials storage containing detonators will not be located closer than 15 m to any storage containing other explosives or blasting agents.

7.11.2 Drilling Operation at Tower Locations

(a) Standards

Ensure all employees engaged in drilling operations are protected by entanglement, to prevent getting crushed by and struck by hazards with proper enclosing of the machines and equipments.

(b) Major Hazard in Drilling Operations

There is a risk of entanglement with drill rigs / steels of personnel trying to manually thread drill steels, unplug clogged suction hoses, or staying close to the rotating steels. Other risks include being hit by falling rocks, falling from height (steep mountain cliff). Respiratory and hearing impairment due to heavy dust and noise.

(c) Preventive Measures

Training and education will be provided to all workers involved in drilling and other related works. Standard PPE's will be provided and their use ensured during all works. Machinery will be checked and maintained to ensure risk free operations.

(i) Avoid Surface Entanglements:

Entanglements can be avoided by the following best practices:

- All personnel involved in operation, (operator and assistants) will be trained to accomplish the task safely.
- Manually threading drill steels will be prohibited when the drill head is rotating and immediate work area will be barricaded.

- Loose clothing, long hair and shawls will not be allowed while working around drills.
- No maintenance, repair while equipment is working.
- Warning signs will be posted related to hazards.

(ii) Being hit by falling rock/material

- The equipment operator will assure proper clearance before moving equipment and clearance shall be monitored by a spotter, workers shall not be allowed on a drill mast while the drill bit is in operation or the drill machine is being moved.
- When drill machines are being moved from one drilling area to another, drill steel, tools, and other equipment will be secured and the mast placed in a safe position.
- Accessible areas within the swing radius of the rear of the equipment's rotating superstructure, either permanently or temporarily mounted, shall be barricaded to prevent an employee from being hit.
- Only workers assisting the operator will be allowed to ride on drilling rig, unless it meets the requirements for adequate seating arrangements that protect passengers from being struck, or caught between equipment or surfaces, and has safe access.
- Employees working under jumbo decks shall be warned whenever drilling is about to begin.
- Scaling bars shall be available at scaling operations and shall be maintained in good conditions at all times. Blunted or severely worn bars shall not be used.
- Before commencing the drill cycle after a blast, the face and any remaining blasting holes will be examined for misfires which, if found, shall be removed.

(iii) Fall from height (Steep Mountain Cliff)

Fall protection while drilling will be provided by the following:

- Body harness, warning lines and other suitable methods will be used to avoid falls.
- By using the proper working platforms during drilling operations for drillers.
- Downside area will be protected by demarcations or clearance.

(iv) Compressed Air

- Safety appliances, such as valves, indicating devices, and controlling devices will be installed on the relevant equipment.
- Air hose, pipes, valves, filters, and other fittings shall be pressure rated by the manufacturer and this pressure shall not be exceeded. Defective hose will be removed from service.

- Hose shall not be laid over ladders, steps, scaffolds, or walkways to create a tripping hazard.

(v) Dust and noise

- Appropriate measures will be taken to avoid dust emission. Wet drilling will be preferred to avoid dust generation and appropriate dust mask will be provided to workers involved if there is residual risk.
- Similarly ear protection will also be provided where required by the standards.

(vi) Uneven terrain

Safe access will be ensured at all working levels of drill sites intended to be slip-resistant and secured to prevent accidental displacement. Appropriate fall protection will be provided as required and applicable in the form of guard rails, safety harness with lanyards anchored in a solid support system etc.

7.11.3 Management of Blasting Operation

During construction, blasting will be required at tower locations for siting of the towers. Extent of blasting will be higher in tension towers than in suspension towers. The Contractor will carefully design the blast based on the site conditions, the scale of the blast and its proximity to roadways, homes and businesses. The type of rock will also influence the drilling patterns and explosives used in each method.

(a) Standards

Take due precautions to prevent accidental discharge of electric blasting caps from current induced by radio transmitters. Safety procedures will be strictly followed for pre, during and post blasting operations.

(b) Hazards associated with blasting operation

The following are the common hazards associated with blasting operation:

- Flyrock,
- Vibration,
- Airblast overpressure,
- Ground movement,
- Toxic fumes due to blasting operation, and
- Miss fire.

(c) Preventive Measures

The WBG EHS Guidelines on Construction Material Extraction recommend the following safety measures prior to blasting to prevent and control explosion hazards:

- A consistent blasting schedule should be adopted, minimizing blast-time changes;
- Specific warning devices (e.g. horn signals and flashing lights) and procedures should be implemented before each blasting activity to alert all workers and third parties in the surrounding areas (e.g., local communities);
- Warning procedures should include traffic limitation along local roadways and railways;

- Specific personnel training on explosives handling and safety management should be conducted;
- Blasting-permit procedures should be implemented for all personnel involved with explosives (e.g. handling, transport, storage, charging, blasting, and destruction of unused or surplus explosives); and
- Blasting sites should be checked post-blast by qualified personnel for malfunctions and unexploded blasting agents, prior to resumption of work.

Following measures will be taken during blasting operation:

(1) Flyrock

- The Blaster should inspect any free rock faces for irregularities and geologic conditions that may affect the blast and adjust the drill hole locations accordingly.
- Profiling the rock face.
- Driller's notes and logs should be kept and used by the Blaster.
- Use of Borehole Deviation Surveys to determine boreholes that were installed too close to each other or too close to the rock face.
- Monitoring of drilling operations will also provide feedback to the drillers so that they may make adjustments to their methods.
- Flyrock can also be controlled by using blasting mats or soil cover to retain the exploded rock. It's important that the Blaster make sure that all personnel are outside the blasting area where fly rock can be expected

(2) Vibration

- Blasting generated vibrations can damage fragmented rocks due to earlier blasting and loose materials in the slope. The Contractor will use a vibration meter to monitor vibrations before and during the blasting operation. Proper placement and operation of the meter is critical for obtaining accurate readings.
- Vibrations can be controlled by modifying the weight of explosives per delay, the loading density, and the delay pattern.
- Contractor will conduct a pre-blast condition survey of all structures in the proximity of the site prior to blasting to minimize the vibration impact.

(3) Displacement of bedrock

- Blasting can displace rock and damage fragmented rocks due to earlier blasting and loose materials in the adjacent slope.
- Contractor will conduct a pre-blast condition survey of adjacent slopes both up and downhill prior to blasting to minimize the impact.
- Slope stability or rockfall protection measures should be put in place prior to blasting to prevent major accidents.

(4) Noxious fumes

- Blasting generates carbon monoxide and other noxious fumes. The fumes generated during blasting operations, can migrate and collect in excavations, and nearby houses. The buildup of significant concentrations of gases can occur 12 hours or

more after the blast. All blasting shall be conducted so that the noxious gases generated by the blast do not affect the health and safety of individuals.

- When site conditions and blasting procedures indicate that there is the potential for the migration and accumulation of gases, the Contractor should specify information collection activities, modification of blasting procedures, and an action plan in the event of a high concentration of noxious gases.
- Information collection activities should also include monitoring of carbon monoxide levels before, during, and after the blast.
- Modification of blasting procedures should include limiting the size and frequency of blasts to limit the production of noxious fumes, and stripping of the overburden prior to blasting and excavating the shot rock immediately after blasting to allow the venting of gases.

(5) Airblast Overpressure

- Although unusual, blasting generated air waves can reach a level where they can damage buildings.
- Air waves not at a level sufficient to cause damage can disturb individuals, resulting in complaints.
- Factors that affect air blast overpressure include topography, blast design, and atmospheric conditions.
- Blasts may have to be redesigned or rescheduled for more favorable atmospheric conditions to minimize air waves.

(6) Misfires

- Misfires happen when a loaded hole, portion of a loaded hole or several loaded holes fail to detonate during a blast.
- Misfires can be caused by failure of the detonation system or by explosive column cutoffs. Sometimes it is apparent immediately after a blast that a misfire has occurred.
- Contractor's Blaster-in-Charge will be responsible for checking the shot immediately after the blast for misfired holes and, if discovered, re-detonating the loaded holes. If re-firing a misfired hole presents a hazard, the explosive should be removed by washing out with water.
- No drilling or digging shall be permitted until all missed holes have been addressed.
- All personnel involved with excavating shot rock should be vigilant for the presence of unexploded explosives.

7.11.4 Transportation of Heavy Loads in Difficult Terrains

(a) Standards

Transportation of material for the construction on towers in steep slopes and areas with difficult access should comply with the Occupational Health and Safety Standards of the WB (General EHS Guidelines, 2007), as well as the applicable provisions of ILO and WHO.

(b) Potential Hazards

Transporting of heavy loads (tower components, construction materials, equipment and machinery) to tower locations through difficult terrain without vehicle access may expose personnel to physical hazards (slip, trip, fall) or cause myoskeletal injuries. Other hazards include working at heights and working in harsh climatic environments.

(c) Preventive Measures

It is understood that in all cases where a tower location cannot be accessed through existing roads or new access roads due to difficult terrain conditions, tower components, construction materials, equipment and machinery will be transported by cable cars or mules/donkeys (as it is traditionally done in Pakistan).

The following measures will apply to prevent/mitigate OHS risks:

- Construct a walkable track from the last point of vehicle access to the tower location. Apply gravel to ensure a non-slippery surface
- Install guardrails at the edge of any fall hazard area
- Use of mechanical assists to eliminate or reduce exertions required by staff to lift materials, hold tools and work objects, and requiring multi-person lifts if weights exceed thresholds.
- Incorporate rest and stretch breaks into work processes, and conducting job rotation
- Monitor weather forecasts for outdoor work to provide advance warning of extreme weather and scheduling work accordingly
- Adjustment of work and rest periods according to temperature stress management procedures depending on the temperature and workloads
- Provide temporary shelters to protect against the elements during working activities or for use as rest areas
- Use of protective clothing, including safety issues
- Provide easy access to adequate hydration such as drinking water or electrolyte drinks and avoiding consumption of alcoholic beverages
- Provide a basic occupational training program and specialty courses, as needed, to ensure that workers are oriented to the specific hazards of the individual work assignment.
- Provide workers with rescue and first-aid duties dedicated training so as not to inadvertently aggravate exposures and health hazards to themselves or their coworkers.

7.11.5 Working at Height

(a) Standards

Fall prevention and protection measures will be implemented whenever a worker will be exposed to the hazard of falling more than two meters; from the mountain cliff, into operating machinery; into water; or through an opening in a work surface. Contractor shall provide and install all fall protection systems required for an employee/worker, before the employee begins the work that necessitates fall protection.

(b) Hazard Risks

Working at heights in different worksites, such as walking and carrying materials along a steep slope, slope/embankment preparation, tower erection, installation of grid station

materials, stringing of conductors, etc. Falls from height and falling material are a serious issue regarding work at height.

(c) Preventive Measures

- Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area.
- Use of fall prevention devices, including safety belt and lanyard, travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards or self-retracting inertial fall arrest devices attached to fixed anchor point or horizontal life-lines.
- When used to control access to areas where leading edge and other operations are taking place (e.g., curve in the slope) the controlled access zone will be defined by a control line or by any other means that restricts access.
- When control lines are used, they shall be erected not less than 1.8 m nor more than 7.7 m from the unprotected or leading edge, except when erecting precast concrete members.
- The control line shall extend for a distance sufficient for the controlled access zone to enclose all employees performing overhand rock-scaling and related work at the working edge and shall be approximately parallel to the working edge.
- The Contractor will designate a competent person to monitor the safety of employees and will ensure that the safety inspector complies with the following requirements:
    - The safety inspector will be competent to recognize fall hazards;
    - The safety inspector will warn the employee in case the employee is unaware of a fall hazard or is acting in an unsafe manner;
    - The safety inspector will be on the same walking/working surface and within visual sighting distance of the employee being monitored;
    - The safety inspector shall be close enough to communicate orally with the employee;
    - The safety inspector will not have other responsibilities which could take the inspector’s attention from the monitoring function.
    - Mechanical equipment will not be used or stored in areas where safety monitoring systems are being used to monitor employees engaged in working at heights
- Each employee working in a controlled access zone will be directed to comply promptly with fall hazard warnings from safety inspector

7.11.6 Usage of Personal Protective Equipment

(a) Standards

In order to protect all project personnel and visitors, Contractor will provide personal protective equipment (PPE) for workers, such as, safety boots, helmets, masks, gloves, protective clothing, goggles, fully face eye shields and ear protection. Contractor will also provide training to workers how to use them and maintain in a sanitary and reliable condition, and replace the damaged ones immediately with new one.

(b) Hazard Risks

Frequent accidents and injuries and illness during construction work. Permanent disability and impairment in the function of any part of the body through absorption, inhalation or physical contact.

(c) Preventive Measures

PPE is considered to be a last resort that is above and beyond the other facility controls and provides the worker with an extra level of personal protection. Table 7.11 presents general examples of occupational hazards and types of PPEs to be used for different purposes. Table 7.12 presents estimated number of PPEs for Contractor, Consultants and PMU staffs during the entire duration of the Project. Contractor will make sure that he makes his own estimate and submit the cost in his bid.

Establish PPE management stated as follows.

- Purchase the effective and usable PPEs from the qualified manufacturer,
- Provide proper and suitable PPEs to different workers according to potential of their professions,
- Replace the broken PPEs with new one immediately,
- Provide training/education to workers and staffs on the proper use and importance of PPEs,
- The foreman shall monitor the PPEs usage situation of his team during work and maintain a record. CSC will verify the usage and report them in the monthly progress report, and
- The OHS team shall conduct regular inspections of PPEs inventory and usage at all sites and instruct the worker and foreman to comply with the mandatory usage of PPEs at all worksites.

Table 7-11: Selection of PPEs as per workplace hazards

Objective	Workplace Hazards	Suggested PPE's
Face and eye protection	Flying particles, liquid chemicals, gases or vapors, light radiation	Safety glass with side shields, protective shades, etc.
Head protection	Falling objects, inadequate height clearance	Helmets with top and side impact protection
Hearing protection	Noise	Ear plugs or ear muffs
Foot protection	Falling or rolling object, pointed object	Safety shoes and boots
Hand protection	Hazardous material, cut or laceration, vibration and extreme temperatures	Gloves made of rubber or synthetic material, leather, steel, insulating material etc.
Fall protection	Working at height and hill slopes, other structure above 1.5 m	Safety harness, Guard rail system

Respiratory protection	Dust, fog, fumes, mist gases, smoke, vapors	Facemask with appropriate filters for dust removal and air purification (chemical, mist, vapor and gases)
Respiratory protection	Oxygen deficiency	Portable or supplied air (Fixed lines) Onsite rescue equipment

Table 7-12: Estimated number of PPEs required in the project

Sl	Items	Unit	Quantity
1	Safety Shoes	No	9,750
2	Gum boot	No	290
3	Canvass Shoes	No	2,800
4	Helmet	No	2,438
5	Earplug	No	8,125
6	Earmuff	No	290
7	Full Body Harness	No	60
8	Reflective Jacket	No	6,500
9	Cotton Gloves	No	69,600
10	Leather Gloves (14")	No	2,320
11	Leather Gloves (8")	No	1,740
12	Goggles	No	480
13	Welding Shields	No	120
14	Respirators	No	72
15	First Aid Boxes	No	276

7.12 Significant OHS Hazard Risks during O/M

7.12.1 Handling of Faulted SF6

(a) Standard

Faulted SF6 will be handled carefully ensuring standard industry practices. World Bank Group's EHS Guidelines on Electric Transmission and Distribution will also be followed to handle SF6.

(b) Potential Hazards

Toxic decomposition products are formed when SF6 gas is subjected to an electric arc. The decomposition products are metal fluorides and form a white or tan powder. Toxic gases are also formed which have the characteristic odor of rotten eggs.

Because of the arc-quenching ability of SF6, corona and arcing in SF6 does not occur until way past the voltage level of onset of corona and arcing in air. SF6 will slowly decompose when ex posed to continuous corona. All SF6 breakdown or arc products are toxic. Normal circuit breaker operation produces small quantities of arc products during current interruption which normally recombine to SF6.

(c) Preventive Measures

Maintenance staff should observe the following guidelines:

- Do not breathe the vapors remaining in a circuit breaker where arcing or corona discharges have occurred in the gas.
- Evacuate the faulted SF6 gas from the circuit breaker and flush with fresh air before working on the circuit breaker.
- Arc products which do not recombine, or which combine with any oxygen or moisture present, are normally removed by the molecular sieve filter material within the circuit breaker.

7.12.2 Electrical Contact during Maintenance

(a) Standard

NTDC standards will cover the exposed or operating elements of an electrical installation such as lighting, equipment, motors, machines, appliances, switches, controls, and enclosures, requiring that they be constructed and installed to minimize workplace electrical dangers. Also, NTDC standards ensures that certain approved testing organizations test and certify electrical equipment before use in the workplace to ensure it is safe.

(b) Potential Hazards

Workers may be exposed to occupational hazards from contact with live power lines during maintenance and operation activities.

(c) Preventive Measures

Prevention and control measures recommended in World Bank Group's EHS Guidelines on Electric Transmission and Distribution associated with live power lines include:

- Only allowing trained and certified workers to install, maintain, or repair electrical equipment;
- Deactivating and properly grounding live power distribution lines before work is performed on, or in close proximity, to the lines;
- Ensuring that live-wire work is conducted by trained workers with strict adherence to specific safety and insulation standards. Qualified or trained employees working on transmission or distribution systems should be able to achieve the following:
    - Distinguish live parts from other parts of the electrical system
    - Determine the voltage of live parts
    - Understand the minimum approach distances outlined for specific live line voltages
    - Ensure proper use of special safety equipment and procedures when working near or on exposed energized parts of an electrical system
- Workers should not approach an exposed energized or conductive part even if properly trained unless:
    - The worker is properly insulated from the energized part with gloves or other approved insulation; or,
    - The energized part is properly insulated from the worker and any other conductive object; or,

  - The worker is properly isolated and insulated from any other conductive object (live-line work).

- Where maintenance and operation is required within minimum setback distances (7.25 m for 765 kV connection), specific training, safety measures, personal safety devices, and other precautions should be defined in a health and safety plan;
- Workers not directly associated with power transmission and distribution activities who are operating around power lines or power substations should adhere to local legislation, standards, and guidelines relating to minimum approach distances for excavations, tools, vehicles, pruning, and other activities;
- Minimum hot stick distances may only be reduced provided that the distance remaining is greater than the distance between the energized part and a grounded surface.
- NTDC will prepare an SOP based on the guidelines above for all maintenance work.

8 CUMULATIVE IMPACT ASSESSMENT

This Chapter discusses the cumulative impacts of the proposed Dasu Transmission Line developments along the Indus valley within the influence area of the Project.

8.1 Overview

The GoP is planning to build several hydropower projects in Pakistan including cascade of dams on Indus on upstream of Tarbela, and also to construct new transmission lines and grid stations to evacuate power from these new hydropower plants. The objective of the current cumulative impact assessment is to evaluate the combined effects of proposed developments within the influence area of DTL.

Cumulative impact studies, as part of ESIA, have been carried out for Dasu Hydropower Project (2013) and Tarbela Expansion 5 (2016) for the Indus between Diamer Basha and Tarbela (Upper Indus Basin). DHP has a component of 132 kV transmission line, which is also under construction. In addition, Karakoram Highway (KKH) II under CPEC is a major investment connecting Havelian to Thakot, a 118 km limited access highway. In addition, tourists also commute existing KKH during the peak season between March-July, crossing Mansehra and DHP construction sites.

8.2 Cumulative Impacts in Context of Dasu Transmission Line Project

8.2.1 Study Boundaries

In the context of DTL project, the spatial boundaries of cumulative impact assessment (CIA) have been based on the Indus valley along the DTL alignment. The spatial boundary is the Upper Indus Basin between Diamer Basha and Tarbela Dam and then south up to Islamabad. The projects considered for the assessment are the existing developments in the region and the proposed development projects for next 20 years. According to GoP development plans, the proposed development projects in the region in addition to the DTLP are cascade of dams on Indus and China Pakistan Economic Corridor (CPEC). Locations of all these projects are shown in Figure 8.1 and locations of individual projects are given in subsequent maps. Salient features of these projects are presented below.

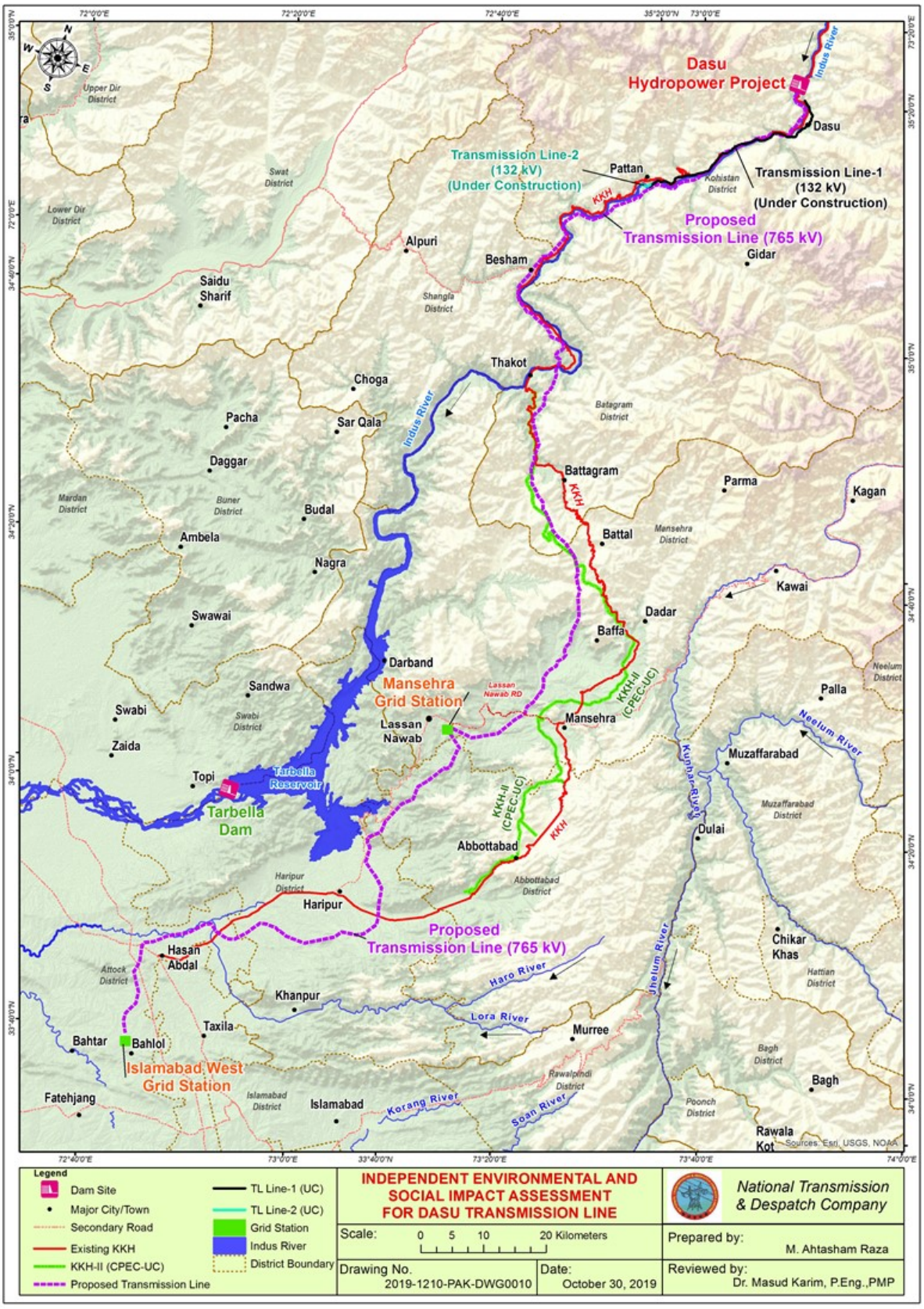

Figure 8-1: Locations of Projects for Cumulative Impact Assessment

8.2.1.1 Cascade of Dams from Diamer Basha to Tarbela

A cascade of dams has been planned between the Tarbela Dam up to Diamer Basha to exploit all water and hydropower resources in this segment, followed by investments further upstream. This segment has an annual water flow of about 60 billion cubic meters (BCM) and an elevation drop of about 700 meters between upstream of Diamer Basha to the Tarbela reservoirs. At this stage, this segment is planned to be developed by four major structures on the Indus River going upwards from Tarbela Dam, Thakot, Pattan, Dasu and Diamer-Basha (Figure 8.2). Two of these projects (DHP and DB) are currently under implementation, expecting to generate about 8,800 MW of installed capacity.

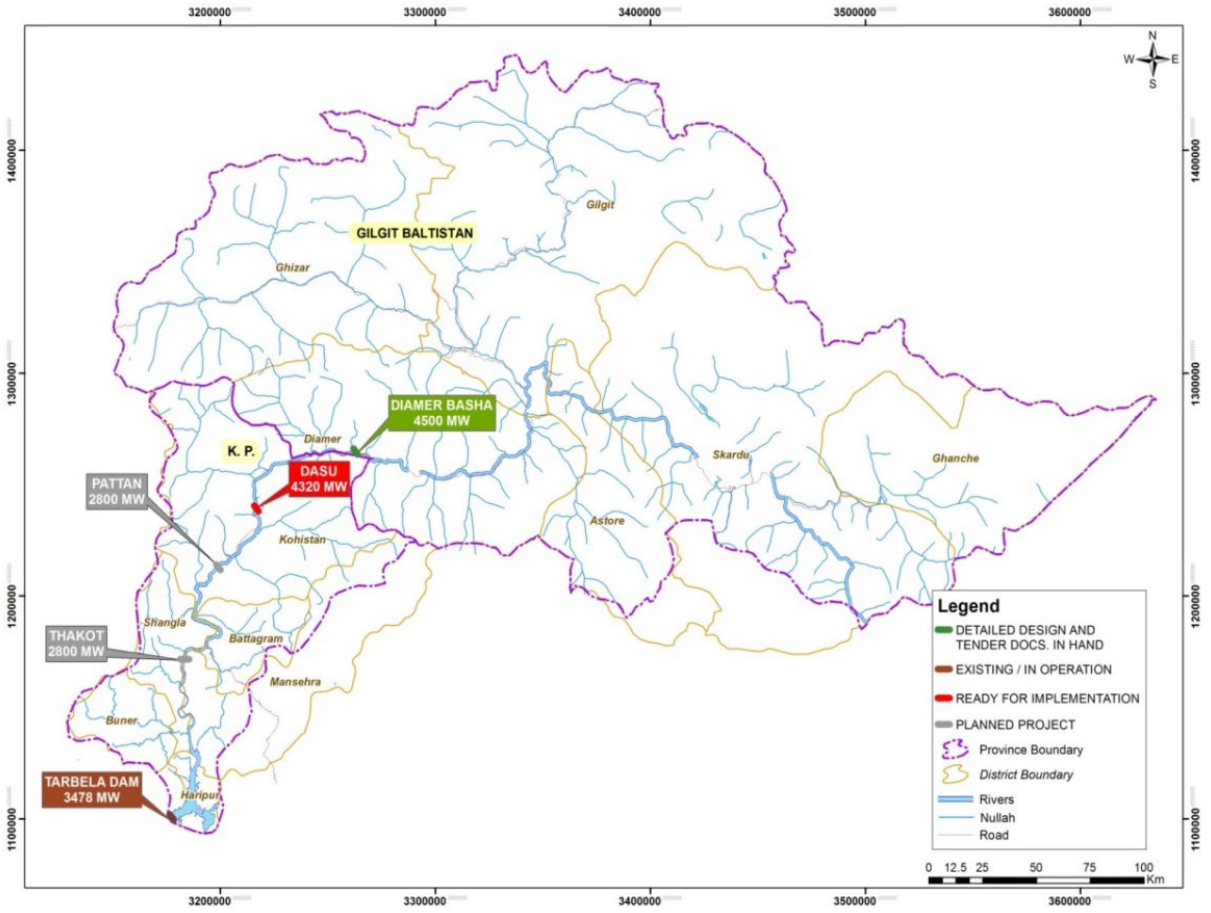

Figure 8-2: Locations of Tarbela and Proposed Hydropower Projects in UIB

Other two projects of vision 2025, Pattan and Thakot, are still in the planning stage. Implementation of dam projects worldwide are very slow, due to the complex nature and the availability of funds. In last 50 years in Pakistan only two dam projects were implemented. Due to the huge investments required to develop these mega projects, it can be assumed that Basha and DHP are the only major projects that could be completed in next 20 years timeframe in the project influence area. In addition, six hydropower projects are located in the tributaries, of which two are under construction. A list of these hydropower projects currently designed or under construction is given in Table 8.1. In these projects, Basha is the only storage project and others are run-off-river (ROR) hydropower projects.

Table 8-1: Hydropower Development in the Upper Indus Basin

Sr. No.	Name of Project	River	Location	Storage (BCM)	Installed Capacity (MW)	Expected Completion Date
	Major Hydropower projects					
1.	Diamer Basha [3)]	Indus	Diamer	7.90	4500	2030
2.	Dasu [3)]	Indus	Dasu	RoR (0.67)	5400	2022
3.	**Minor Hydropower projects**					
3.1	Keyal Khwar [4)]	Indus tributary	Besham	RoR	122	2018
3.2	Dubair Khwar [2)]	Indus tributary	Besham	RoR	130	2013
3.3	Khan Khwar [1)]	Indus tributary	Besham	RoR	72	2012
3.4	Allai Khwar [1)]	Indus tributary	Besham	RoR	121	2013
3.5	Lower Spat Gah [4)]	Indus tributary	Kohistan	RoR	496	2025
3.6	Lower Palas Valley [4)]	Indus tributary	Pattan	RoR	665	2025

Status: [1)] Existing; [2)] Under construction; [3)] Ready for construction; [4)] Under Planning (expected completion date is uncertain).

8.2.1.2 China Pakistan Economic Corridor

The CPEC worth's USD 46 billion, comprising almost 3,000 (2,700)- kilometer highway stretching from Kashgar to Gwadar covering 19 districts from Gilgit-Baltistan to Sindh. It aims to promote bilateral cooperation in multiple areas of major projects, as well as information and communication technology, and to set up more industrial parks. A motorway is under construction with a length of 118 km from Havelian to Thakot in the Project area. The approximate location of CPEC with in the study boundaries is shown in Figure 8.1.

8.2.1.3 Transmission Line Network

NTDC operates and maintains 5,970 km and 16 grid stations for 500 kV and 11,322 km and 45 grid stations for 220 kV transmission lines. The exiting transmission line network map of Pakistan is shown in Figure 8.3. The planned 500 kV and 765 kV transmission line network for the year 2021-2022 is show in Figure 8.4.

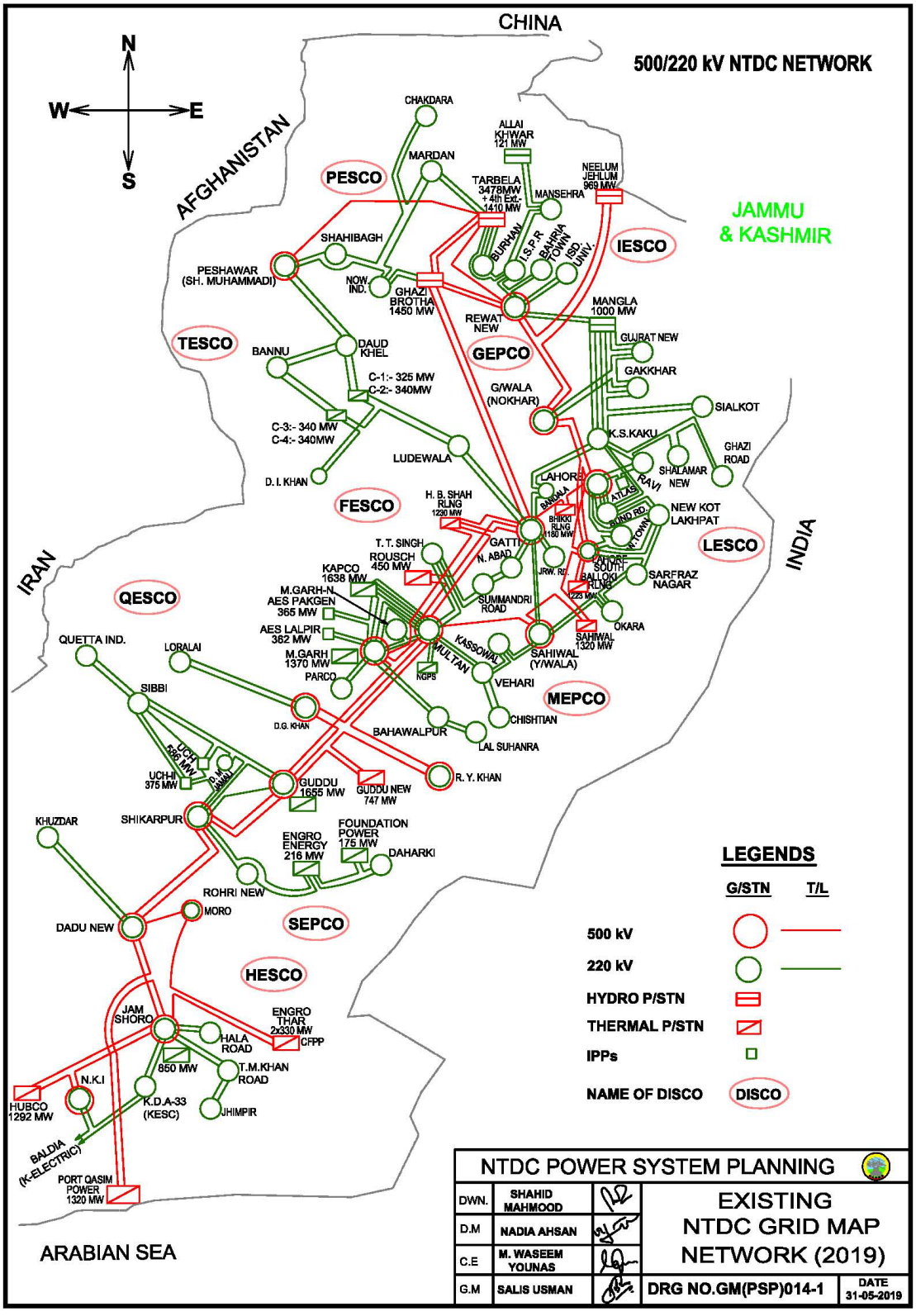

Figure 8-3: Existing Transmission Line Network in Pakistan (May 2019)

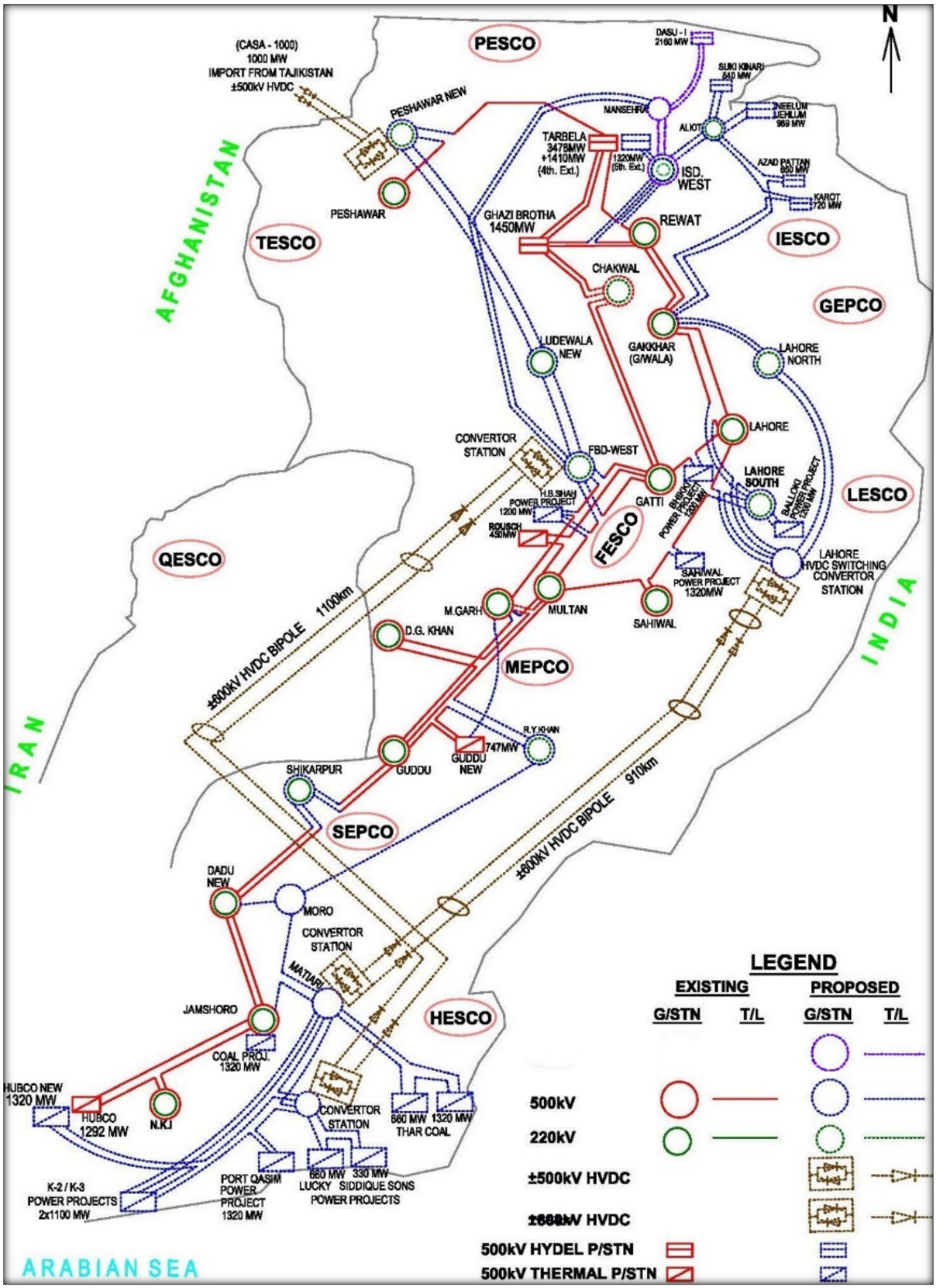

Figure 8-4: Future Planned 500 kV Transmission Line Network in Pakistan (2021-2022)

8.2.2 Identification of Valued Environmental Components for CEIA

Based on the review of secondary information, ongoing construction projects like Dasu Hydropower Project, 132 kV transmission line connecting Dasu site, KKH II under CPEC, and consultations with various stakeholders, three valued environmental components (VECs) are identified for the CEIA study. These VECs and their significance are described below:

- **Traffic Movement**: There are two major ongoing construction projects in the Project area. Dasu Hydropower Project, first stage of 2,160 MW is expected to be on the grid by December 2023 while its full capacity of 5,400 MW is expected to be achieved by December 2025. KKH Phase II (Thakot-Havelian Section) under CPEC is at the advance stage of construction. This is a 118 km road construction of which 39 km with 4 lane Access Controlled Motorway (Havelian to Mansehra) and 79 km 2-lane Class-II Highway (Mansehra to Thakot). The construction is expected to be completed by March 2020.
- **Project Induced Labor Influx**: DHP will require a maximum of 8,000-10,000 workforces during its peak construction. Currently, 3,000 to 3,500 workers are engaged in 8 construction contracts. More contracts are in the bidding stage. In KKH II there are about 2,100 workers (10,000 for the entire project) engaged in road construction including tunnels. Most of the communities are remote and rural with small population. Project induced labor influx in the project area from other parts of the country and overseas, are putting pressures on the existing infrastructures.
- **Bird Migration**: Indus valley is flyway for migratory birds from Central Asia to Indian Subcontinent. Thousands of birds will travel through this flyway for searching resting grounds in the sub-continent due to desired climatic conditions of the birds. In addition, spring migration to their breeding grounds to north with the opening of leaves on the trees, allowing migrating birds to take advantage of a huge increase in insect populations, hatching in time to eat those fresh new leaves.

8.3 Induced Construction Traffic in KKH

8.3.1 Baseline Condition

KKH is the only highway connecting the northern Pakistan with the rest of the country. About 2,590 vehicles per day including 15% heavy trucks are currently using the KKH for transportation of goods.

8.3.2 Cumulative Impacts

Currently there are about 200 to 300 construction trucks per day using the existing KKH to supply cement, steel, fuel and other construction materials to the DHP site. It will become 600-900 per day during dam construction. Additional project vehicles using the KKH and exceptional heavy transports of turbine sections will also cause traffic congestions and safety hazards when electro-mechanical contractor of DHP is on-board. Construction materials for KKH II under CPEC is also using the existing KKH. In addition, after the commencement of DTL additional traffic will be added to the over pressured KKH. The condition of the existing KKH in many locations are very poor due to the construction of KKH II, damaged caused by the construction traffic close to DHP, and natural landslide and rockfall due to slope failures. The condition will be further aggravated due to increasing volume of heavy loaded construction traffic. Estimated DHP, KKH II under CPEC, and DTL construction materials are presented below:

Sr. No.	Materials	Unit	Quantity			Total
			DHP	CPEC KKH II	DTL	
1	Aggregate Coarse (stones)	t	9,200,000	109,396	31,200	9,340,596
2	Aggregate Fine	t	5,000,000	54,700	17,400	5,072,100
3	Cement	t	800,000	9,720	7,800	817,520
4	Pozzolan	t	500,000			500,000
5	Reinforcement steel	t	100,000	5,400		105,400
6	Structural steel	t	50,000		75,000	125,000
7	Fuel	kl	300,000			300,000
8	Explosives	t	20,000			20,000
9	Asphalt	m^3	116,000		13,500	129,500

8.3.3 Recommendations

Coordination among the agencies and Contractors will be required to manage the pavement and traffic of existing KKH. It is expected that KKH II will be completed upto Thakot before the commencement of DTL. Therefore, Thakot to Dasu section of existing KKH will be used by all Contractors to transport materials. In addition, axel load regulations must be followed/enforced and overloading of trucks will not going to be permitted to ensure that roads are not damaged because of DHP/DTL.

8.4 Project Induced Labor Influx

8.4.1 Baseline Condition

(a) Population: There are about 200 villages along the DTL corridor, the estimated population in these villages are about 693,620. These are extremely remote villages with no development intervention except few towns and cities. People are very conservative and highly receptive towards migrants.

(b) Common Facilities: Health care facilities are very limited in KPK with 277 hospitals, 911 dispensaries, 132 maternity and child care facilities, and 22,154 beds in all hospitals and dispensaries. On the hand, Punjab has a better statistics with 388 hospitals, 1,286 dispensaries, 285 maternity and child care facilities, and 60,191 beds in all hospitals and dispensaries. KKH is the main national highway (N35) connecting the project area, there are other very limited paved roads connecting the villages. Most of the local access are usually through walking trails in the mountain range. Among the 8 districts only 4 of them have piped water, and they are, Mansehra, Abbottabad, Haripur, and Attock. Gas stations are limited in between Dasu to Dhodial, about 28 gas stations. After Mansehra availability of gas for vehicles are not an issue. Therefore, Dasu to Dhodial section (185 km) is critical and hence, precautionary measures are necessary, especially during emergency events when extended road closures might emerged. About 12 local markets are available to buy food essentials in between Dasu to Dhodial.

(c) Forests and Wildlife: The wildlife habitats threatened by several intrinsic and external factors. Consequently, their long-term survival is dependent on active conservation and careful management of the habitat. Major ongoing threats include: declining populations due to poaching, thin habitats as compared to their vast home ranges, human-wildlife conflicts, habitat degradation due to human encroachment and tourism, capturing of young and wildlife trade, transmission of diseases from livestock, prey-depletion for predators, inadequate protected areas, lack of planning, and poor management, and habitat shrinking/fragmenting due to climate change.

8.4.2 Cumulative Impacts

Construction of proposed hydropower projects, transmission lines and road corridors are expected to exacerbate the situation, by aggravating existing threats and introducing new challenges for the species survival. The cumulative impacts of all these developments may be significant on the very limited common infrastructures available in the Project area, like hospitals and dispensaries, schools, water supply and sanitation scheme, local road, food and fuel supply, forests and wildlife of the area. Further, there is a large influx of 21,500 workers including construction workers, operational staffs, and business people together with their dependents to work in these projects will add tremendous pressures on the common facilities and have adverse social and environmental impacts on local communities, especially if the communities are rural, remote or small. During natural emergencies, due to frequent landslides, KKH has to face closures for an extended period of time. And KKH being the only access for transportation of goods, road closure will significantly affect the life of the communities exacerbated with the food demand of migrant workers in the Project area, especially on the daily essentials.

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

The potential impacts on the forests will be mainly from cutting of 50,158 trees due to DTL, 21,000 for DHP, and 10,000 for KKH II (E35) implementation, along with population pressure on collection and commercial trade in fire wood and herbs, illegal deforestation, logging, reclamation of land for agriculture and other activities.

The potential impacts on wildlife are habitat loss, habitat fragmentation, increased human habitations, habitat intrusion and road mortality. Habitat loss is expected not only due to the new construction of roads, DHP, and 132 kV TL implementation, but it will also facilitate access to remote valleys for the various constructions, which will attract new housing, hoteling, tourism, and even fast removal of forests. The habitat fragmentation, appears to be the most severe consequence of future developments, as it can affect species in diverse ways:

- Movement becomes difficult, and even potentially fatal for wildlife crossing barriers between habitat patches.
- Fragmented populations become small and lose their genetic diversity.
- Smaller habitat patches support fewer species, both in number and types of species.
- Through enhanced edges, species are more susceptible to poaching and diseases.
- Smaller populations are also more at-risk from natural disasters

8.4.3 Recommendations

Following mitigation measures will be adopted by the implementing agency to minimize the Gender Based Violence (GBV)/SEA related risks and impacts of labor influx:

- The contractor will be required to provide qualified key personnel to address the specific risks identified in the project including SEA risks. Contractors will specify key staff with the technical skill and experience to implement the SEA related recommendations.

- The bidding documents will include specific requirements that minimize the use of expatriate workers and encourage hiring of local workers, thereby minimizing labor influx.
- The Contractor will develop code of conduct for locals and in-migrant workers (for instance, respect to local values and cultures; workers strictly forbidden to establish contacts and relationship with local women;
- All project consulting firms will also be required to submit Codes of Conduct with their proposals.
- The project will ensure the implementation of recommendations related to GBV/SEA as described in section 8.4.3.
- The contractor will be required to establish anti-sexual harassment policies that governs conduct in the workplace.
- The contractor will be required to provide mandatory and repeated training to workers on sexual exploitation and abuse and HIV/AIDS prevention and on the content and obligations derived from the code of conduct
- Provisions will be set in contracts for dedicated payments to contractors for SEA prevention activities (e.g. training) against evidence of completion. The portion of the contract price will be guaranteed by a performance security linked to environmental and social contractor performance.
- The PMU office will consider adopting the "code of conduct" used for in-migrants in Dasu Hydropower Project.

In addition, to minimize the Project Induced Labor Influx the project has allocated a provision of $6 million for benefit-sharing and community support program. The following would likely be potential community-based projects.

- **Improve drinking water supply**: In the project area of influence facilitated in the provision of regular power supply as shortage of safe drinking water has been an issue in most of area. Water supply schemes need considerable improvement and repairs which will be provided with community and government partnership. Improvements envisaged under this activity include provision of pumping stations, replacement of worn out pipelines, building of water storage tanks, etc. under tripartite approach to ensure sustainability.
- **Educational facilities**: Most primary and elementary school require additional resources like teachers and equipment to improve quality of education. Some of the schools are defunct because of lack or absenteeism of teachers. Some schools require additional classrooms, repairs, furniture, equipment and amenities. In addition, schools located close proximity of construction may require health and safety awareness training.
- **Establish health clinics**: Project will strengthen health clinics presently provided to neighboring villages with training of LHWs. New health clinic with community support will be established along the alignment through consultation need assessment basis.

- **Access Roads**: Rural access roads are beneficial for connecting villages to markets or central locations for goods and services
- **Assistance in Sports and Culture clubs**: Provide goodwill grants for promotion of sports and culture activities to engage youth. Provide support to local government, sports clubs, sports competitions, local festivals and cultural events to generate goodwill for the NTDC.

8.5 Bird Migration

8.5.1 Baseline and Trends

Indus valley is flyway for migratory birds from Central Asia to Indian Subcontinent. Thousands of birds will travel through this for wintering grounds in sub-continent. The birds which breed in northern latitudes need to travel long distance to reach their wintering destinations in tropical areas of the southern latitudes for warmer climatic condition. These birds fly in large flocks, and follow land marks. Each year they arrive and go back on the same routes or flyways. Some examples of long-distance migrants wintering or passing through Pakistan are: Northern wheatear from Siberia; Spanish Sparrow from Eastern Europe; Short-toed Lark from Siberia to Pakistan and India; Common Shelduck is a winter visitor to the coastal areas of Pakistan from coasts of Caspian Sea.

In addition to long distant migration, there will be regular annual movement of birds between their breeding areas and wintering areas within Pakistan from higher altitudes in Himalayas to the deep valleys and the plains of Pakistan. There is also local migration within the Indo-Pakistan subcontinent, which is again of two types: a) north – south (Pakistan) migration; and b) east-west (Indo-Pak subcontinent) migration. Currently there is only a 220 kV transmission line existing in Indus valley from Thakot (Allai Khwar Hydropower Project).

8.5.2 Cumulative Impacts

A 132 kV transmission line is under construction from Dubair to Dasu, a distance of 45 km along the existing KKH. About 7 km of new distribution line will be constructed from the grid station to work areas of DHP. Development of 765 kV DTL and other transmission lines along Indus and the rest of the country will affect the birds' migration through collision and electrocution.

8.5.3 Recommendations

The following recommendations are made to address the cumulative impacts on migration of avifauna through development and implementation of the following:

- Coordinate with PMU of Dasu Hydropower Project for the implementation of avian risk management plan (ARMP), developed under Detailed Ecological and Biodiversity Management Plans (DEBMP) of DHP. Consider the recommendations of ARMP in the detailed design of Dasu 765 kV transmission line.
- Install bird markers to divert migratory birds to prevent collision and electrocution. The cost of installing the markers will be $193,068 and is included in the ESMP.
- Capacity Assessment and assistance in capacity building of NTDC and implementation of the capacity building programs

The above recommendations are found to be adequate to address the cumulative impacts of the DTL project.

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

This chapter describes the environmental, health, safety, and social management plan (ESMP) of the Project. The Chapter is prepared based on ESMP implementation practices in DHP and other good practices in the region. Special emphasis was given to prepare an implementable ESMP during project implementation.

9.1 Objectives of ESMP

The basic objective of the ESMP is to manage adverse impacts and hazards of proposed project interventions in a way that minimizes the adverse impact and risk on the environment, workers, and community during construction and operation stages of project. The specific objectives of the ESMP are to:

- Facilitate the implementation of the mitigation measures discussed earlier in the document.
- Maximize potential project benefits and control negative impacts;
- Address occupational health and safety (OHS) hazards and corresponding preventive measures during construction and operation stages;
- Draw responsibilities for NTDC, contractors, consultants, and other members of the project team for the environmental, health, safety, and social management of the Project;
- Define a monitoring and supervision mechanism and identify monitoring and inspection parameters in order to:
    - Ensure the complete implementation of all mitigation measures and preventive actions,
    - Ensure the effectiveness of the mitigation measures and preventive actions;
- Assess environmental, health, safety training requirements for different stakeholders at various levels.

9.2 Contractors Certifications

It is recommended all contractors procured under the Project be compliant of ISO 9001 Quality Management, ISO 14001 Environmental Management and OHSAS 18001 Occupational Health and Safety Management. These will be done by the client giving preference to the contractors having ISO and OHSAS certifications during prequalification or technical evaluation.

9.3 Various mitigation measures and Preventive Actions

The ESMP includes different types of mitigation measures and preventive actions and subplans for significant impacts and hazard risks: (i) general and non-site-specific measures in the form of environmental and social codes of practices (ESCPs) presented in Annex 9-1 to address general construction and operation matters identified as medium and minor/low in significance prior to mitigation and prevention in Table 7.5 and Table 7.10; (ii) project specific and to the extent possible, site-specific mitigation measures discussed in Chapter 7 and summarized in Table 7-4; (iii) construction environmental and social action plan with site-specific and contract-specific management plans to be prepared by the Contractors; (iv) Occupational health and safety (OHS) plan to be prepared by the Contractors; and (v) proposed ESMP Sub-plans to address significant and cumulative impacts.

9.3.1 Environmental and Social Code of Practices for Construction

The environmental and Social codes of practice (ESCPs) are generic, non-site-specific guidelines for the construction phase. The ESCPs consist of environmental and social management guidelines and OHS practices to be followed by the contractors for sustainable management of all environmental, social, health and safety issues. The ESCPs are listed below and details are presented in Annex 9.1.

- ESCP 1: Waste Management
- ESCP 2: Fuels and Hazardous Goods Management
- ESCP 3: Water Resources Management
- ESCP 4: Drainage Management
- ESCP 5: Soil Quality Management
- ESCP 6: Erosion and Sediment Control
- ESCP 7: Top Soil Management
- ESCP 8: Topography and Landscaping
- ESCP 9: Quarry Areas Development and Operation
- ESCP 10: Air Quality Management
- ESCP 11: Noise and Vibration Management
- ESCP 12: Protection of Flora
- ESCP 13: Protection of Fauna
- ESCP 14: Road Transport and Road Traffic Management
- ESCP 15: Construction Camp Management
- ESCP 16: Cultural and Religious Issues
- ESCP 17: Workers Health and Safety
- ESCP 18: Construction and Operation Phase Security
- ESCP 19: Operation of Heavy Equipment Management
- ESCP 20: Excavation
- ESCP 21: Transportation of Oversized Equipment
- ESCP 22: Lifting and Materials Handling
- ESCP 23: Stringing conductors at road, river, and existing transmission line crossings

9.3.2 Construction Environmental and Social Action Plan

The Contractor will prepare a 'Construction Environmental and Social Action Plan' (CESAP) demonstrating the manner in which they will comply with the requirements of Site-Specific Management Plans, ESCPs and the mitigation measures proposed in the ESMP of this ESIA Report. The CESAP will be submitted within 90 days of Contractor's mobilization be approved by the Engineer. The CESAP will form the part of the contract documents and will be used as monitoring tool for compliance. Violation of the compliance requirements will be treated as non-compliance leading to the corrections or otherwise imposing penalty on the contractor.

9.3.3 Occupational Health and Safety Plan

The Contractor will also prepare an occupational health and safety plan devising the general guidelines for the identified hazards and preventive measures presented in the site specific actions and ESCPs in this ESIA. World Bank General Environmental Health and Safety Guidelines, Chapter 2: Occupational Health and Safety, 2007, Khyber Pakhtunkhwa (KPK) Factories Act 2013, Punjab Occupational Safety and Health Act, 2019, KPK Industrial Relations Act, 2013, and KPK Workers Compensation Act 2013. If the guidelines stated before cannot address a specific OHS management in the project,

international good practices will be applied, as for example, OSHA, ILO, etc. Review and update of the OHS plan will be done (a) when there is a change in the scope of the project, (b) there is a change in construction methodology/technique based on site condition, (c) following significant OHS hazard or a major accident, and (d) at the end of the Project (to allow for improvements in subsequent projects).

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. For the ease of understanding, Transportation and Storage of Explosives, Drilling Operation at Tower Locations, Management of Blasting Operation, Transportation of Heavy Loads in Difficult Terrains, and Working at Heights are presented for the Contractor as an outline to complete other potential worksite hazards in their OHS Plan as per this guideline.

9.4 Job Hazard Analysis

Job hazard analysis (JHA) will be conducted for each construction component focusing on job tasks as a way to identify hazards before they occur. It will focus on the relationship between the worker, the task, the tools, and the work environment. Ideally, after identifying uncontrolled hazards, steps should be taken to eliminate or reduce them to an acceptable risk level. Many workers are injured and killed at the worksite every day. The JHA should be one of the major components of the larger commitment of the Contractor's health and safety management system. The JHA should be conducted on many jobs in the worksite. Priority should be given to the following types of jobs:

- Jobs with the highest injury or illness rates;
- Jobs with the potential to cause severe or disabling injuries or illness, even if there is no history of previous accidents;
- Jobs in which one simple human error could lead to a severe accident or injury;
- Jobs that are new or complex to the construction or have undergone changes in construction processes and procedures; and
- Jobs complex enough to require written instructions.

9.5 EHS in Method Statement

The Contractor will include an EHS Chapter in each Method Statement. This EHS section will be based on the JHA and environmental issues of the site and specific to construction methods to be followed by the Contractor. This section will be reviewed by the EHS Specialists of the Construction Supervision Consultant (CSC) and confer approval along with other technical parameters to be reviewed by the engineering team of the CSC. Each revision of the method statement should also be reviewed by the EHS Specialists and their concurrence will be required to get them approved.

9.6 Request for Inspection

Poor temporary structures such as scaffold, stairs, and ladders are one of the major causes of the accidents in construction industry. For technical verifications of the temporary structures, specifications in the bidding documents define the material, stability, strength and deflections of each temporary structures. However, this clause is often ignored in construction industry as the main focus is the permanent structures. Therefore, Request for Inspection (RFI) for temporary structures will be required, as a pre-requisite for the readiness of site. Along with the technical requirements (e.g., complete drawings, calculations relating to stability, strength, and deflections) health and safety parameters

will also be inspected for all temporary structures. During these RFI, both technical and EHS personnel of the CSC will inspect the requirements and certify the technical quality and the readiness of the site to commence the work.

9.7 Field Engineer's EHS Oversight

There will be limited supervision staffs available in EHS to cover all project sites and project shifts in the project. Therefore, it will become impossible to supervise and monitor EHS parameters in every site on a continuous basis. Therefore, site engineers can be delegated certain EHS oversight. Engineers monitoring forms including RFI and Daily Monitoring Forms and checklists will be designed to include EHS aspects. EHS should be made also a key responsibility of site engineers.

Training program will be devised by CSC on engineers' oversight in EHS and will be offered by EHS specialists of CSC to address EHS immediately when identified and raise it to EHS specialists if further action is required. The training on engineers' oversight should convey the following messages:

- Engineers would assume greater responsibility for overseeing the EHS as part of their daily routine work,
- Engineers would review and approve each site's readiness to commence the work as per the design specifications, certifying whether Contractors are meeting the requirements of the Method Statements and withholding funds from them that are not complied with.
- Engineers would impose financial penalties on the Contractor with nonexistent or non-compliant EHS matters; and
- Engineers will assist workers in recognizing environment friendly and safe work measures and procedures necessary to protect the natural environment and occupational health and safety of workers and prevent illnesses, injuries and fatalities during construction.

9.8 Inclusion of Relevant Components of ESMP in Contract Documents

The ESMP of the Project along with the ESCPs and occupational hazards and risks will be included in the contractors' bid documents. The technical specifications of the bid documents will clearly state that contractor will need to comply with the mitigation measures and preventive actions provided in the ESMP and ESCPs; World Bank Group EHS General Guidelines; and NEQS.

9.8.1 BOQs in Bidding Documents

The following items will be included in the bills of quantities (BoQs) of bidding documents

- After the award of the contract and before mobilization, the Contractor will prepare and submit two separate plans, CESAP and OHS Plan in compliance with ESMP, WBG EHS Guidelines and NEQS. The preparation and their revisions and updates will also be quantified and presented as line items in the Contract.
- Quantities of personal protective equipment (PPE), first-aid boxes, ambulance, health facility with PMDC licensed doctors and nurses.
- Provision of Environmental and OHS Staffs for the entire construction period. Detail staff requirements are presented in Section 9.10.
- Providing and maintenance of Vibration Meters and Dust Measurement Meters for spot measurements (5 number).
- Quarterly 24-hour Air Quality Monitoring PM_{10}, NO_2, SO_2, CO_2, CO at Mansehra GS.

- 15 minutes continuous noise monitoring at Mansehra GS (4 locations) and tower locations close proximity of settlements (200 locations) during the construction work.

9.8.2 Payment Mile Stones

Payments to contractors will be linked to environmental, health and safety performance, measured by completion of the prescribed environmental and social mitigation measures in the CESAP and preventive actions described in the OHS plan. In addition, for any non-compliance causing damages or material harm to the natural environment, workers, public or private property or resources, the contractor will be required to either remediate / rectify any such damages in a timeframe specified by and agreed with the engineer, or pay NTDC for the cost (as assessed by NTDC) of contracting a third party to carry out the remediation work. For repeated non-compliance the Contractor will be penalized. The penalty of non-compliance of the requirements of the CESAP and OHS Plan will be 3% of the total Civil Works in the Instruction of Payment Certificate (IPC). The penalty will be imposed after all contractual instruments are applied and a Non-compliance Report (NCR) is issued by the Engineer.

9.9 Institutional Arrangements

9.9.1 Project Management Unit

The Project implementation will be led by the Project Management Unit (PMU) that has already been established within NTDC for Dasu Transmission Line Project. The PMU will be responsible for the procurement of contractors for construction, two consulting firms one for construction supervision and the second one for monitoring and evaluation (M&E). The PMU is headed by the Project Director (PD) and includes an Environment and Social Impact Cell (ESIC). PMU will be responsible for the following:

- Ensure that all project activities are well-managed and coordinated.
- Procurement of works and goods.
- Payment of compensation to the project affectees prior to the mobilization of the Contractors
- Recruitment and supervision of Construction Supervision Consultants
- Recruitment of third-party M&E Consultants

The organogram of PMU is shown in **Figure 9.1**.

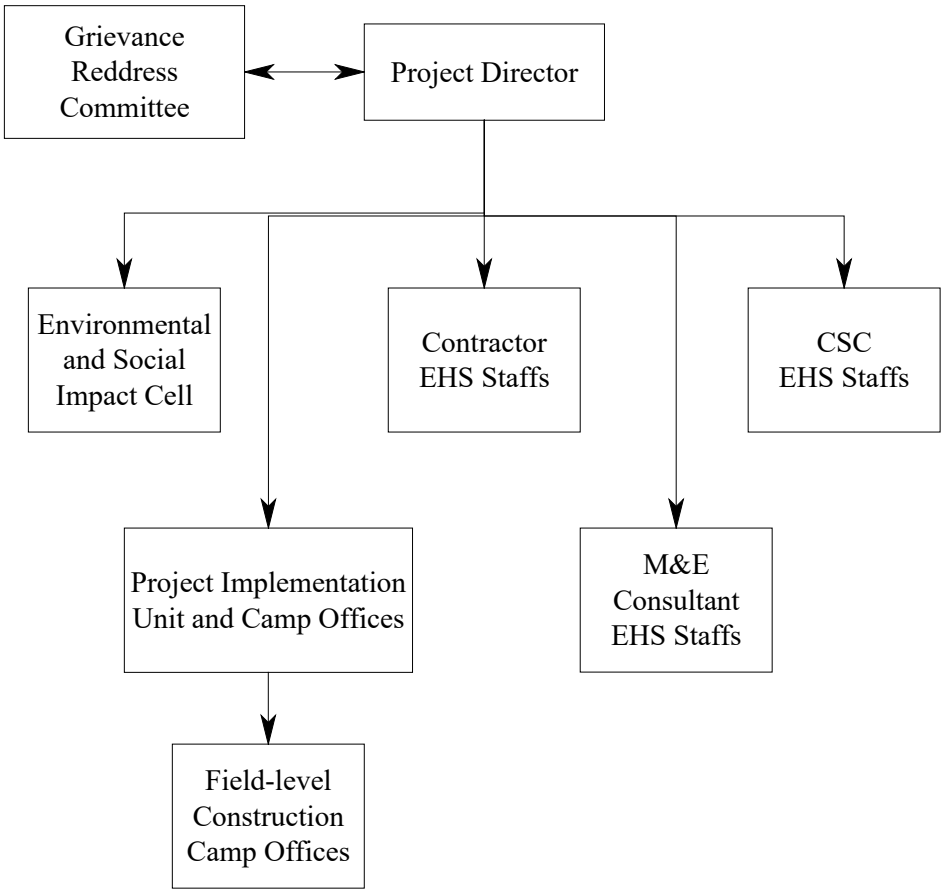

Figure 9-1: Organogram for Environmental and Social Management of the Project

9.9.2 Environmental and Social Impact Cell

The ESIC is already in place within PMU and is mandated to ensure compliance with the national regulatory as well as WB safeguard policy requirements pertaining to environment, social, and resettlement aspects. ESIC will be responsible for the following tasks:

- Obtaining environmental clearances from the provincial EPAs
- Responsible for implementation of RAP
- Responsible for assisting PD in reviewing bid documents for inclusion of ESMP measures, overseeing and monitoring construction activities, producing periodic monitoring reports,
- Ensuring inclusion of ESMP including OHS aspects, ESCPs, and ESMP budget with detailed BoQ in bidding documents
- Advising on ESMP principles and requirements to CSC, contractors, and providing training to NTDC field staff, and others as needed to ensure effective implementation of the ESMP
- Supervising CSC for the implementation of ESMP
- Closely coordinate with other concerned agencies, local governments and communities to support implementation of ESMP and RAP
- Preparation of progress reports on implementation of ESMP and RAP.

Currently the ESIC has the following specialists:

- Deputy Manager, Social and Environment: focal person for EHS, social and resettlement aspects

- Assistant Manager (Social): member;
- Assistant Manager (Environment): member.

PMU will strengthen ESIC with one Assistant Manager (OHS) and 5 field level EHS supervisors. Assistant Manager (OHS) can be recruited either through open competition or can be deputed from WAPDA's staff with engineering background and construction experience. The ESIC team will also be strengthened by hiring three (3) more social specialist to support implementation of ESMP and RAPs.

In addition, the PMU will engage the following specialists, to support the ESIC during project implementation for the review of preparedness of the Contractors with regard to implementation of the elements of ESMP and including dedicated staffing and capacity:

- Independent Review Consultant on Environment, Health and Safety
- Independent Review Consultant on Social/Development Management

9.9.3 Field-level Construction Camp Offices (CO)

The PMU will set up a field level Construction Camp Office (CO) for facilitating land acquisition and implementation of RAP and monitoring the implementation of CESAP and OHS Plan. These units will consist of representatives from local district and revenue departments, PMU and CSC. PIU will be responsible for the following:

- Maintain liaison and interaction with the APs and local communities to address their concerns;
- Provide proper guidance to APs for the submission of their requests for compensation as per eligibility and entitlement;
- Help the APs to forward their complaints, if any, to the GRC;
- Maintain close liaison with PMU, ESIC, contractor, and relevant government departments for RAP implementation;
- Distribute the notices to the entitled APs regarding payment of compensation; and
- Facilitate the APs for completing the necessary documentation to receive their entitled payments; and
- Maintain close liaison with PMU, ESIC, contractor, and relevant government departments for RAP implementation and traffic management.

9.9.4 Construction Supervision Consultant

CSC will be responsible for the following tasks:

- Responsible for the supervision of RAP and ESMP implementation
- Updating the RAP before start of RAP implementation;
- Supervise civil works, ensuring compliance with all design parameters including quality requirements
- Ensure Contractors include EHS parameters based on Job Hazard Analysis in their Method Statement
- Supervising contractors for ESMP implementation and issuance of noncompliance reports
- Conduct EHS trainings
- Provide input, advice and approval on activity specific method statements relating to ESMP
- Prepare monthly reports and submit to PMU

The environmental staff of CSC appointed at the site:

- International Environmental, Health and Safety Specialist

- Environmental Specialist including Biodiversity
- Senior OHS Specialist
- Junior OHS Specialist (3 numbers)
- Field OHS Supervisors – 4 numbers
- Field Environment Supervisors – 2 numbers

The social staff of CSC appointed at the site:

- International Social and Resettlement Specialist
- Social/ Land Acquisition and Resettlement Specialists – 3 numbers
- Communication Specialist
- Social Surveyors – 5 members.

Person-month for each CSC positions are listed below:

Sr. No.	Expertise	Input (PM)
A	**International Consultants**	
1	Int'l Environment, Health and Safety Specialist	16
2	International Social and Resettlement Specialist	16
	Subtotal (A)	*32*
B	**National Consultants**	
1	Sr. Occupational Health and Safety Specialist	48
2	3 Jr. Occupational Health and Safety Specialists	132
3	Environmental Specialist including biodiversity	48
4	3 Social/ Land Acquisition and Resettlement Specialists	36
5	Communication Specialist	48
6	6 OHS Supervisors (1@5 camps of TL and 1 @MGS)	276
7	3 Environment Supervisors (3 Contracts)	132
8	5 Social Surveyors	60
	Subtotal (B)	*780*
	Total (A+B)	**812**

9.9.5 Contractor

Contractors will be responsible for the following:

- Preparation of CESAP with site specific mitigation plans for approval of CSC before mobilization.
- Preparation of Occupational Health and Safety Plan based on construction methods, site specific hazards. Revise OHS Plan (a) when there is a change in the scope of the project, (b) there is a change in construction methodology/technique based on site condition, and (c) following significant OHS hazard or a major accident.
- Responsible for implementation of mitigation and monitoring measures and preventive actions proposed in the ESMP
- Prepare separate monthly reports for addressing environmental and social impacts and OHS issues

The following personnel are required in the contractor's environmental and social team:

- International EHS Manager
- Environmental Specialist
- Social Specialist
- OHS Specialists (6 numbers)
- Community Liaison/Communication Officer
- OHS Supervisors (6 numbers)
- Flagman (16 numbers)
- Medical Doctor (with PMDC Licensed and all medical facilities including ambulance)

9.9.6 Monitoring and Evaluation (M&E) Consultants

The M&E Consultants will carry out external monitoring on implementation of ESMP and RAP, and will consist of the following team members on intermittent basis:

- International Environmental, Health and Safety Specialist
- EHS Specialists - 2 numbers
- Biodiversity Specialist
- International Social and Resettlement Specialist
- Social and Resettlement Specialist – 2 numbers

9.10 Environmental and Social Management

9.10.1 Construction Stage Site Specific Management Plans

Contractor will be required to prepare site specific management plans, before contractor mobilization and commencement of construction works, for approval of PMU and CSC.

- **Material Transportation Plan** will be prepared by the contractor to prevent accidents during transportation by using motor-vehicles to the closest tower and grid stations, and then to the tower locations using other means. The plan should address specific details on the site conditions, given extremely mountainous terrain and complexity of transporting both construction and tower materials. Since, most of the cases transportation of materials will be done using manual labor, donkey, or cableways. Extreme precautions will be required in terms of safety and security.
- **Blasting Management Plan** will be prepared by the contractor to control impacts associating with blasting such as fly rock, ground vibration, airblast overpressure, dust, health and safety, traffic management, and storage of explosives. Blasting techniques, its design, and the proportion of explosives used to remove all rocky outcrops should be with least disturbance to surrounding environment. During blasting an exclusion zone will be cordoned off, siren will be provided, flagmen will be stationed and all-clear signal only after satisfactorily completing the inspection.
- **Spoil Management Plan** will be prepared by the contractor on the management of excess spoils from various excavation activities, especially at the tower locations with very steep slope.
- **Emergency Preparedness Plan** will be prepared by the contractor after assessing potential risks and hazards that could be encountered during construction.
- **Communication Plan** to deal with the interaction of the community, complaints management, workers recruitment, notice of works and workers conduct with locals.

9.10.2 Plans to Address Project and Cumulative Impacts

Six ESMP Sub plans were prepared to address direct project and cumulative impacts, to direct environmental and social management procedures and the implementation of prescribed mitigation and enhancement measures during the construction and operational phases of the Project. The following sub-plans have been developed and presented in Sections 9.10.2.1 and 9.10.2.6:

9.10.2.1 Induced Construction Traffic in KKH

Existing KKH is the only lifeline of connect northern cities of Gilgit exacerbated with construction traffic of DHP, KKH II, 132 kV transmission line and regular traffic of goods for the population at large. It is estimated that 9,340,596 t of aggregate coarse materials, 5,072,100 t of fine aggregates, 5,072,100 t of cement, 105,400 t of reinforcement steel, 125,000 t of structural steel, 300,000 kl of fuel, more than 20,000 t of explosives, and 129,500 t of asphalt will be required by these projects.

Additional project vehicles using the KKH and exceptionally heavy loaded turbines, transformers will also cause road damage, traffic congestions and safety hazards when electro-mechanical contractor of DHP is on-board. The condition of the existing KKH in many locations are very poor due to the construction of KKH II, damage caused by the construction traffic close to DHP, and natural landslide and rockfall due to slope failures. The condition will be further aggravated due to increasing volume of heavy loaded construction traffic.

It is expected that KKH II will be completed upto Thakot before the commencement of DTL. DHP is currently considering periodic maintenance of Dasu to Barseen section. Therefore, Thakot to Dasu section will require periodic maintenance under DTL. In addition, axle load regulations must be followed/enforced and overloading of trucks will not going to be permitted to ensure that roads are not damaged because of DHP/DTL.

9.10.2.2 Project Induced Labor Influx Management Plan

Currently, the plan is for three construction camps for DTL - one every 50 km and one for Mansehra GS. The estimated workforce to be employed for DTL will likely be 1,000 to 1,200 workers (300 in civil works, 300 in tower erection, 250 in conductor stringing, and 150-250 in other works). The work will be phased – for instance, civil works and tower erection will be first, and stringing will follow. In total, there may be between 500 and 600 people in five camps, making an average of 100 to 120 workers in one camp; of this, between 30 to 60% could be local. In Mansehra GS, there will be approximately 200 to 250 staffs employed in various work – civil, installation, electrical, and others during project construction. Again, 30 to 50% could be local. Thus, the percentage of non-local, expatriate or in-migrants will vary from moderate to high at construction camp sites, depending entirely on the contractor. Further, there is a large influx of 21,500 workers including construction workers, operational staffs, and business people to work in various projects in different timeframe, in the project area (a span of 250 km length, 8 districts, and 200 villages), which will add tremendous pressures on the common facilities and have adverse social and environmental impacts on local communities, especially as the communities are rural, remote and small.

The construction work, with the promise for more development along the transmission line – particularly in selected central places/markets, will further attract diverse groups of in-migrants, namely, families/followers, traders/entrepreneur, small business/shop owners, suppliers of construction-related materials and various others service providers will move

into the area to benefit from the project construction over three to four years. These will likely lead to potential negative socio-cultural impacts, including a wide range of concerns such as gender-based violence, sexual exploitation and abuse of women/children, generating tensions between the local residents of the remote and isolated and rather conservative communities and the in-migrant groups.

The Contractor will undertake proactively, in line with World Bank's recommended guidelines,[25] measures or strategies to (i) raise awareness and engage all stakeholders (e.g., project management, contractors, consultants, community groups/leaders, local NGOs) in responding to the social and cultural risks to local communities; (ii) inter-cultural understanding with a view to minimize the risks; (iii) better management of construction and labor camps; (iv) development and implementation of code of conduct for locals and in-migrant workers (for instance, respect to local values and cultures; workers strictly forbidden to establish contacts and relationship with local women; workers must not leave camps without prior permission from the supervisors; and workers or local resident must report any suspicious contact or activities to the camp officers); and (v) improvement in local law and order to ensure positive environment and build a community of mutual trust and respect for project construction. In this respect, the PMU will adopt the "code of conduct" used for in-migrants in Dasu Hydropower Project.[26]

9.10.2.3 Skill Development for Employment with the Contractor

Dasu Hydropower Project (DHP) is currently under implementation. The experience in DHP is crucial for the DTL project. Due to the high unemployment rate in the country, communities who are affected due to the land acquisition for project implementation are come to the Contractors and implementing agency with the demand to be employed in the Project. Most of the cases they are unskilled and has no experience in infrastructure project. Therefore, Contractors are reluctant to employ them at the beginning in the construction activities. This cause protest and agitations in the project area and often lead to Contractors' work stoppages and extreme delay in project implementation.27 It is proposed that skill development by the Contractor be considered in the project. One-week job specific skill development training will be provided with pay to the land owners and their relatives prior to their employment. Certificates should be provided to the participants after completion of the training. The training should be hands-on and specific to the job, e.g., masonry work for tower foundation, machine operation with proper license, tower erection, stringing of conductors, etc. This will bring two prong benefits, one in the development of skills in the country and the second one in quick project implementation. The skill development will cost about $105,000 and will be included in the Contractor's contract.

The Contractor will provide training in the following areas:

(a) Communication Skills

Communication forms the backbone of almost any construction project. Whether it is to present an idea to the supervisor or foreman, discuss an alternate plan when construction hits a snag, or even just request new supplies, communication is important to making sure

25 World Bank Group, *Working Together to Prevent Sexual Exploitation and Abuse: Recommendations for World Bank Investment Project* (Report of the Global Gender-Based Violence Task Force), 2017.

26 SRMP Vol. 8: *Management Plan for Construction Related Impacts*, March 2014. Dasu Hydropower Project, WAPDA.

27 DHP is currently employing 50% of the workforce from local communities, after repeated negotiation by all parties.

the project stays on track. The Contractor will always prefer construction workers who already have this soft skill, therefore, a good communicator will payoff the construction site by this skill.

(b) Teamwork Skills

Construction workers have to work in teams. Teamwork skills help get the job done. Much like good communication skills keep everyone on the same page, good teamwork skills allow everyone to work together in a harmonious way. The job stays on track and will likely be finished sooner if everyone works together.

(c) Time Management Skills

Time management skills are incredibly important for construction workers in any number of roles. Construction work has deadlines to meet. Some tasks are time-sensitive (e.g., concrete creeping). Delays are very common on the sites of construction projects. Contractor need workers who can manage their time effectively. Contractor needs workers who know how to prioritize and reorganize their schedules when faced with unexpected delays.

(d) Technical Skills

Specific construction skills include manual and mechanical excavation, stone-laying, pouring cement, erecting and installing specific types of equipment. Contractors typically appreciate versatile workers who can take on additional tasks as needed. Construction tasks may include:

(i) Masonry
(ii) Electrical
(iii) Framing
(iv) Concrete
(v) Sheet metal work
(vi) Environmental codes
(vii) OSHA safety requirements
(viii) Reading and interpreting drawings
(ix) Erecting
(x) Crane and Rigging
(xi) Operation of Construction equipment
(xii) Use of Power tools

(e) Occupational Health and Safety at Worksite

Construction industry comes next to agriculture and cotton industry in providing jobs in Pakistan; though it is the third largest source of livelihood, it is highly informal and unorganized, with unskilled and semi-skilled workers. These workers, mostly migrants, fall into the trap of contractors and middlemen and lose their jobs and a decent life. The only way to reconstruct their lives is by training them in functional skills and equipping them with safety and health information at the earliest. In fact, such intervention can be effectively carried out on the construction premises itself with bare minimum infrastructure.

The classroom training apart from technical aspects also has soft skill trainings focusing on the social and behavioral habits of the trainees, including health, sanitation and safety to bring significant improvements in their worldview and way of life. Such skill trainings will help construction worker to gain self-confidence. Once they undergo the trainings, raw/unskilled workers look forward to handling semi-skilled jobs and semi-skilled workers to jobs requiring skilled manpower. As a result, Wage Enhancement is almost assured for all of those undergoing such trainings. These trained workers can then pursue semi-skilled jobs in the middle-east.

9.10.2.4 Community Support Program

During consultation meetings, it was clear that the affected persons and communities were not entirely happy with the short-term benefits of the project during construction (e.g., employment opportunities, and other many indirect benefits and development). The APs wanted additional benefits beyond compensation and temporary employment to having public amenities and services they lack in these remote and rural communities. In addition, project induced labor influx will may lead to negative impacts on the common facilities of the host community. Through this project, as an example of "good practice," NTDC is committed to share development benefits with the community and wants to support community projects with ensured sustainability of benefits.

For this purpose, NTDC will assist communities and aims to build synergies of community and government for bringing about social and economic development in the project area through a community led approach. The project has kept provision of a total USD 6 million for the DTL and Mansehra GS for benefit-sharing and community support program (CSP). The following were identified as priority needs of the community that represent likely sector for community-based projects: (i) improved drinking water supply, (ii) safety awareness of children in schools, additional resources like equipments supplies to educational institutions to improve quality of education in these remote villages, (iii) access roads, (iv) improvement in health care services, and similar other programs. The beneficiaries of the community support program are spread over the entire length of DTL and Mansehra grid station.

The NTDC, in consultation with affected communities, will identify central locations or markets along the TL alignment where maximum villages around or population will benefit from the benefit sharing projects. All relevant social and environmental guidelines will be followed for screening, identifying and preparing project proposals. The PMU will develop Terms of Reference (ToR) and select an NGO/Consultant experienced in such assessments for undertaking need assessment, based on detailed consultations with the affected villages and main market centers including women, small and marginal land holders, landless, and other vulnerable groups. The NGO/Consultant will recommend the specific CSP schemes/projects, including detailed implementation and monitoring plans and budget. The selection criteria of the sub-projects under CSP will be on infrastructures that have direct and induced impacts due to the project construction. PMU will ensure collaboration with the government departments and finalize the recommendations. ToR and the final CSP should be cleared by the Bank.

9.10.2.5 Tree Plantation Program

There will be around 50,185 trees affected. ESMP planned to compensate by planting 250,925 saplings in the project area. Tree plantation will be done at all suitable locations such as at the boundary slopes, around the office building, staff colony, mosque, health center, and playground of Mansehra GS. Saplings will also be distributed to the affected owners of privately-owned wood/ timber trees, district government, and state-owned wood/ timber forest departments. The estimated land areas under each category of tree coverage and the number of trees are shown in Table 9.1.

Different types of local trees are listed in Table 9.2 will be planted. Green areas will be developed in Mansehra GS.

Table 9-1: Tree Plantation

Tree Species	Spacing of Tree Species	Total Area (m^2)		No. of Trees		Total No of Trees
		TL	MGS	TL	MGS	
Timber (50%)	2m	300,000	210,000	74,323	51,140	635,463
Fuelwood (40%)	3m	550,000	375,000	59,458	40,912	1,025,370
Fruit (10%)	3m	133,785	100,000	14,865	10,228	258,878
Total		**983,785**	**685,000**	**148,646**	**102,280**	**1,919,711**

Table 9-2: Suitable Tree Species

Sr. No.	Fruit Trees	Timber Trees	Fuel Wood Trees
1	Walnut (*Juglans regia*),	Deodar *(Cedrus deodara)*	Acacia nilotica (Linn.) (Kikar)
2	Amlok (*Diospyrus lotus*)	Chir Pine *(Pinus roxburghii)*	Acacia modesta (Phullai)
3	Zaytoon, *(Olea ferruginea)*	Akasmoni (*Acacia auricoliformis)*	Dalbergia sissoo (Shisham)
4	Mulberry *(Morus alba)*	Rain tree (*Samanea saman*)	Poplar Salicaceae (Hybrid Poplar)
5	*Ber (Zizyphus mauritiana)*	Silver Fir (*Abies pindrow)*	Walaiti Kikar *(Robinia pseudoacacia)*
6	Jujube (*Zizyphus spp.*),	Kail (*Pinus wallichiana*)	Oak (*Quercus incana*)
7	fig (*Ficus glometra*)	Sanatha (*Dodonaea viscosa*)	Shinai (*Pistachia*)
8	Kachnar (*Bauhinia variegate)*	Baikarh (*Adhatoda vasica*)	Sum (*Fraxinus xanthozoloides)*.
	pomegranate (*Punica granatum*)	Spruce (*Picea smithiana*)	Common Yew (*Taxus wallichiana*)

9.10.2.6 Resettlement Action Plan

Two separate RAPs have been prepared – one for the DTL and the other for Mansehra GS. The social impacts for the DTL largely include loss of agricultural crops and trees with associated temporary loss of income and livelihoods while those impacted by Mansehra GS also lost lands – largely barren and with limited crop cultivation. Table 9.3 provides a brief comparative summary of impacts and cost estimates for RAP implementation.

Table 9-3: Comparative Impacts and Cost Estimates for RAPs

Project	Impact Summary					
	Land Area/acres	Affected HHs	Affected APs	Affected structure	Affected Trees	Cost Estimates (Million USD)
DTL	4,953	1,088	7,740	50	29,729	USD13.57

Project	Impact Summary					
	Land Area/acres	Affected HHs	Affected APs	Affected structure	Affected Trees	Cost Estimates (Million USD)
Mansehra GS	158	293	2,080	0	20,456	USD16.42

Since here will be no permanent acquisition of lands – and only temporary use for the construction of the line and towers – the Land Acquisition Acts of 1894 will not be used in the case of DTL. Instead, the Telegraphic Act of 1885 and the WAPDA Act of 1958, which have been traditionally used for construction of transmission lines in Pakistan, provide the legal framework for compensation and entitlements for crop losses, tress and other kinds of losses. Land used for the towers sittings is not acquired from the owner, nor the title of the land transferred. However, in this case, NTDC has agreed to provide compensation in the form of allowances for the reduced access to lands under the towers. This entitlement will be equivalent to the market price of the land under the towers.

In the case of Mansehra GS, NTDC will follow a mix method combining the use of eminent domain under the 1894 LA Act and private negotiations for land acquisition in the Mansehra grid station. It is expected that this will help to put the acquisition process on a fast track for the construction of the grid station. The LA Act will be used to issue Section 4 to "freeze" the land area from any future transitions. The NTDC 'negotiation committee" will take the responsibility for negotiation and agreement with the land owners on rates. Once the agreement is reached, the agreed compensation will be routed through the office of District Collector. The RAP Policy Framework will ensure that the negotiation processes are fair and transparent, and as a result of the outcomes, APs will be well off or at least regain the pre-project condition as per the World Bank OP 4.12 *Involuntary Resettlement Policy.*

Both RAPs are based on the findings of the inventory and census surveys as well as meetings and consultations with various project-affected persons. The key elements of RAP include: (i) type and extent of loss of assets including land, structures and trees; (ii) principles and legal framework applicable for mitigation of these losses; (iii) the entitlement matrix; (iv) relocation strategies and plans, including provision for livelihoods and additional assistance to vulnerable groups; (v) costs and budget of resettlement and rehabilitation; and (vi) institutional framework for the implementation of the plan, including monitoring and evaluation. The implementation of the RAPs will be financed by the Bank under the loan agreement. NTDC will ensure timely and proper implementation of the RAPs.

9.10.3 Mitigation and Prevention Plan

The mitigation, safety inspections, and audit plans are the key element of ESMP to be prepared on the basis of impact and risk assessment described in Chapter 7. The Plan describes the potentially negative impacts and risk of each construction activity, lists mitigation and prevention measures to address the negative impacts and risks, and assigns responsibilities for implementation, prevention and monitoring and inspecting of these measures. The Mitigation Plan is given in Table 9.4 and Prevention Plan is presented in Table 9.5. Contractor will make sure they present the implementation status of mitigation

and preventive measures identified in this Table in every monthly report, with quantifiable information.

Table 9-4: Mitigation Plan

Project Activities	Environmental and Social Impact	Mitigation/Compensation/ Enhancement Measures	Institutional Responsibilities	
			Implementation	Supervision
A. PRE-CONSTRUCTION STAGE				
A.1 Contractor's Mobilization	If the contractor is made responsible to comply with ESMP, there will be several constructions related impacts	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 the ESIA as well as IFC EHS guidelines. The Contractor must be made accountable through contract documents for the obligations regarding the environmental and social components of the project. Contractor need to prepare site-specific construction environmental and social action plans (CESAP) to manage and mitigate potential adverse environmental and social impacts. CESAP will be reviewed and approved by CSC and ESIC. CESAP should include the following but not limited to: • Material Transportation Plan • Blasting Management Plan • Construction Camp Management Plan • Landslides and Rock falls Protection Plan • Spoil Management Plan • String of conductors in the river, road, and existing transmission line crossings • Emergency Response Plan • Communication Plan	Contractor	CSC, ESIC
A.2 Social Impacts during Pre-Construction				
A2.1 Land acquisition, site clearance, relocation of structures, construction camp setup	▪ Land acquisition of 158 acres for Mansehra GS with only 2.63 acres of cultivable land. ▪ Impacts on about 2,349 acres of cultivated land for DTL (for two cropping	▪ Compensation at negotiated price for land acquisition, cash compensation at market price for crops damage of 2 seasons, relocation and replacement cost for structures and roads, and trees as per RAPs. ▪ For DTL, compensation in the form of allowances for land under the towers due to reduced access; the owners will retain ownership and no acquisition would be undertaken. ▪ Contractors will lease the land for Contractors' camp on temporary basis. Proper documentation will be carried out for this leasing. Site selection	Contractor	CSC, ESIC

Project Activities	Environmental and Social Impact	Mitigation/Compensation/ Enhancement Measures	Institutional Responsibilities	
			Implementation	Supervision
	seasons only), relocation of 50 structures with 3.5 acres land. ▪ Reduced access to land for tower sitting	will be carried out in consultation with the community and local officials; approval from NTDC will also be required for the selected sites.		
A2.2 RoW clearance	Impact on 1,381 households (consisting of 9,820 affected persons) including 318 vulnerable households	Cash compensation of livelihood assistance and vulnerability assistance as per RAPs	Contractor	CSC, ESIC
A2.3 Excavation work for land development at MGS	Impact on 1.94 km local road to access Sawan Maira, Nakkah, and Bareela villages	Realignment and reconstruction of these access roads around the property line in better quality for the affected communities.	Contractor	CSC, ESIC
A2.4 Clearance of land for MGS and towers footprint and line alignment	Felling of 50,185 trees due to the clearance of land for Mansehra GS, installation of towers and clearing along the TL RoW	Cash compensation for trees and afforestation through planting of 250,925 saplings (five times the number of trees cut) are considered in the ESMP. Slope stability measures will be considered in the engineering design to protect the slope, which will become unstable due to the trees cut.	Contractor	CSC, ESIC
A2.5 Forest Clearance	Impact on wildlife habitats due to RoW clearance	The project will affect 532.87 acres of forest land, which are the habitats of wildlife. Contractor will follow the recommendations developed under wild life conservation programs through Dasu Hydropower Project's Wildlife Conservation Management. Also, Contractor will follow ESCPs 12 and 13.	Contractor	CSC, ESIC
B1. Environmental Impacts during Construction				
B1.1 Tower foundation	In average, tower foundation will be 3-6 m depth. Spoil will be generated due to the excavation work. Management of spoils at	Contractor will be responsible to develop a blasting and spoil management plan. Emphasis will be given on control blasting and use of blasting mat to avoid impacts on the community's close proximity of the towers. Generated spoils will be utilized for back filling and excess materials will be disposed to designated locations approved by the CSC.	Contractor	CSC, ESIC

Project Activities	Environmental and Social Impact	Mitigation/Compensation/ Enhancement Measures	Institutional Responsibilities	
			Implementation	Supervision
	tower locations, especially at high altitude and steep slopes			
B1.2 Stringing of conductor	Collision of birds during stringing operation	Contractor will be responsible to prepare a schedule for stringing operation avoiding migration period February-March and September-November.	Contractor	CSC, ESIC
	Traffic management at the crossing of major roads during stringing of conductors	Contractor will be responsible to prepare a standard operating procedure (SOP) for traffic management for the 5 major highway crossings as per the Traffic Management ESCP 23.	Contractor	CSC, ESIC
B1.3 Excavation and leveling	Risk of soil pollution and soil erosion	Contractor will take extra measures to prevent fuel and other hazardous material spillage. Fill materials should be covered and slope stabilization should be ensured to prevent erosion as per the ESCP 6. General guidelines for excavation is presented in ESCP 20.	Contractor	CSC, ESIC
B1.4 Blasting and spoil disposal	Risk of water pollution	Contractor will ensure zero disposal of spoils in the water bodies and take measures to prevent water pollution from his activities as per the ESCP 3.	Contractor	CSC, ESIC
B1.5 Excavation and blasting	Dust and air pollution from construction activities	Maintenance of construction equipment and vehicles; usage of blasting mats, dust control measures as specified in ESCP 10.	Contractor	CSC, ESIC
	Noise and vibration from construction activities	Control blasting and maintenance of construction equipment and vehicles; noise control measures as specified in ESCP 11.	Contractor	CSC, ESIC
	Generation of solid waste and hazardous waste	Minimize generation of waste. Proper collection and disposal of wastes in approved sites by CSC or to vendors as per ESCP 1.	Contractor	CSC, ESIC
B2. Social Impacts during Construction				
B2.1 Construction work	Potential of 900 employment opportunities for local communities in un-skilled and semi-skilled category	Preference to the local communities in the construction works is given. A skill development program for 900 local workers is developed under the ESMP with a budget of $0.115 M to assist local communities in improving their skills, so that Contractor can engage them in semi-skilled work.	Contractor	CSC, ESIC

Project Activities	Environmental and Social Impact	Mitigation/Compensation/ Enhancement Measures	Institutional Responsibilities	
			Implementation	Supervision
B2.2 Easing radius of curvature	Impacts on access roads and damages to local infrastructure	Improvement of Lassan Nawab Road (Mansehra to Lassan Nawab to MGS) 26 km and tracks to access the RoW will be required to carry construction materials and heavy mechanical equipment. The cost will be included in the Civil Works Contract.	Contractor	CSC, ESIC
B2.3 Accessing tower location line alignment	Blocked access due to construction activities	Traffic management plan to be implemented; Alternate routes to be identified in consultation with communities; GRM is prepared and GRC will be established. A provision of $54,210 is included in ESMP budget for GRM.	Contractor	CSC, ESIC
B2.4 Six construction camp setup	1,450 workers will be stationed in 4 construction camps (3 for TL and one for Mansehra GS). Labor Influx in the project area will have risk of social conflict, illicit behavior and privacy of women, crime, burden on and competition for public service provision, increased risk of communicable diseases and burden on local health services, water resources, inadequate waste disposal and illegal waste disposal, camp related land use, access roads, noise and lights	• Engagement of local population in construction work will be encouraged through skill development by the Contractor. • Camps to be established at least 500 m away from communities; contractor to enforce code of conduct to respect local norms and culture; liaison with local communities to be maintained; GRM to be established. • Contractor to obtain water in a manner not to affect the local communities; liaison with local communities to be maintained; GRM to be established. A provision of $54,210 is included in ESMP budget for GRM. Project Induced Labor Influx management plan is proposed in the ESMP and a community support program is recommended with a budget of $6 million. • The Contractor will prepare the construction camp management plan as per the ESCP 15, including the labor influx management. This will be reviewed and approved by NTDC and World Bank.	Contractor	CSC, ESIC
B2.5 Labor influx	Migrant labor may create social and gender issues due to the unawareness of local customs and norms and can hinder the mobility of local women for	The contractor will provide qualified personnel to address the specific risks identified in the project including Sexual Exploitation and Abuse (SEA) risks and implement the recommendations and mitigations included in this ESIA. The contractor will be required to provide mandatory and repeated training to	Contractor	CSC, ESIC

Project Activities	Environmental and Social Impact	Mitigation/Compensation/ Enhancement Measures	Institutional Responsibilities	
			Implementation	Supervision
	working in the field, herding livestock, picking fuel wood, etc.	workers on sexual exploitation and abuse and HIV/AIDS prevention and on the content and obligations derived from the code of conduct.		
	Damage to sites/places of religious/cultural significance, such as graves	Such sites to be demarcated and avoided during construction activities; liaison with local communities to be maintained; GRM to be established. A provision of $54,210 is included in ESMP budget for GRM.	Contractor	CSC, ESIC
C1. Environmental Impacts during O&M				
C1.1 Transmission line operation	12 high risk spans are identified with a length of 14,533 m for bird collision and electrocution	Placing of bird markers on the transmission line cables is included in Civil Works at a cost of $0.193 M.	Contractor	CSC, ESIC
	Pollution outages by repeatedly perching above an insulator	First three spans close to Dasu reservoir are proposed to be fitted with appropriate anti-perching measures during initial line construction, the cost will be included in the Civil Works contract.	Contractor	CSC, ESIC
	Audible noise and radio interference from the transmission lines	Design considerations to comply with the standards. In addition, NTDC will conduct noise monitoring at the operation stage to ensure the compliance with NEQS.	Contractor	CSC, ESIC
C1.3 TL RoW maintenance	Impacts from tree cutting during maintenance activities	Bird nests will be preserved by minimizing trimming of trees during the bird breeding season. Trim the hollow bearing trees in a manner which reduces the potential for fauna mortality. Follow the ESCP 13.	Contractor	CSC, ESIC
C2. Social Impacts during O&M				
C2.1 Transmission line operation	Diminution of land value at the tower location	Landowners will be compensated a reduced access allowance at the tower locations in the amount of $4.72 M. More details in RAPs.	NTDC	ESIC

Table 9-5: Prevention Plan

Project Activities	Hazard Risks	Preventive Actions	Institutional Responsibilities	
			Implementation	Supervision
A. PRE-CONSTRUCTION STAGE				
A.3 Mobilization	Work related hazards	Contractor prepare and submit an occupational health and safety plan (OHS) addressing potential common hazards of the project construction. OHS Plan will be reviewed and approved by CSC and ESIC. The plan should include but not limited to the following:	Contractor	CSC, ESIC
A.2 Specific construction	Specific construction related hazards	Contractor conduct a job hazard analysis (JHA) for each construction component focusing on job tasks as a way to identify hazards, accordingly devise preventive measures. Outcome of JHA should be included in contractors' method statements. It will focus on the relationship between the worker, the task, the tools, and the work environment. Ideally, after identifying uncontrolled hazards, steps should be taken to eliminate or reduce them to an acceptable risk level. The JHA should be one of the major components of the larger commitment of the Contractor's health and safety management system. JHA should also contain a dedicated section on the emergency response and recovery system.	Contractor	CSC, ESIC
A.3 Provision and supply of PPEs	Frequent accidents and injuries	Contractors will keep provision of the PPEs and training how to use them. ESMP made an estimate for the total number of PPEs required for the Contractors', PMU, and Consultants' staffs. The detail estimates will be included as separate line items in the bidding documents. Contractor will ensure that all required PPEs are supplied to 100% workers and staffs at all worksites.	Contractor	CSC, ESIC
B3. OHS Hazard Risks during Construction				
B3.1 Transportation of explosives	Hazards during transportation and storage of explosives	Vehicles transporting explosives will only be driven by a licensed driver. Explosives will not be transported with other materials. Blasting caps and detonators will not be transported in the same vehicle with other explosives. Each vehicle used for transportation of explosives will be equipped with a fully charged fire extinguisher, in good working condition. Explosive Storage should be designed in compliance with	Contractor	CSC, ESIC

Project Activities	Hazard Risks	Preventive Actions	Institutional Responsibilities	
			Implementation	Supervision
		the regulatory requirements, especially building make, wall thickness, separation distance from the sensitive receptors, etc. Blasting caps and other detonators will not be stored in the same magazine or container with other explosives or blasting agents. Surplus primers will be disassembled and components stored separately. Details are presented in Section 7.11.1.		
B3.2 Drilling operation	Impact of drilling at tower location	Training and education will be provided to all workers involves in drilling and other related works. Effective PPE's will be provided and ensured to use during all works. Machines will be checked and maintained to efficient level to ensure risk free operations. Details are presented in Section 7.11.2.	Contractor	CSC, ESIC
B3.3 Blasting operation	Impact of blasting operation	Contractor will prepare a controlled blasting plan based on the recommendations presented in Section 7.11.3 covering the management of flyrock, vibration, airblast overpressure, ground movement, and toxic fumes.	Contractor	CSC, ESIC
B3.4 Movement and operation of heavy equipment	Operation of heavy equipment and machinery	Develop safe working procedures, training of the operators and workers and maintain a safe zone, ensuring visibility and stationing flagman. More detail information is available in ESCP 19 for movement of heavy equipment management.	Contractor	CSC, ESIC
B3.5 Excavation and leveling for tower foundation and Mansehra GS	Slope failure and cave-ins	Excavation for tower foundation for a depth of 3-6 m will be required. In addition, cut and fill will also be required at the Mansehra GS. The Contractor will be responsible for sloping by cutting back the trench wall at an angle inclined away from the excavation. Shoring will require installing aluminum hydraulic or other types of supports to prevent soil movement and cave-ins. Shielding will be required to protect workers by using trench boxes or other types of supports to prevent soil cave-ins. Contractor will design a protective system that can be complex because consideration should be given to many factors: soil and rock classification, depth of cut, water content of soil, changes	Contractor	CSC, ESIC

Project Activities	Hazard Risks	Preventive Actions	Institutional Responsibilities	
			Implementation	Supervision
		due to weather or climate, surcharge loads (eg., spoil, other materials to be used in the trench) and other operations in the vicinity.		
B3.6 Transportation of construction, tower materials, heavy equipment by road close to tower locations and Mansehra GS	Equipment over-turn, traffic accident, road blockage	The Contractor will develop a traffic management plan based on the Traffic Management ESCP 14 by considering the heavy load, control of traffic in KKH and other local roads, pavement condition and stability, radius of curvature of the local roads to take turns on sharp curve, etc.	Contractor	CSC, ESIC
B3.7 Transportation of heavy loads in difficult terrain	Fall from height	The construction material (30-40 m^3 of concrete for tension towers, about 15 m^3 to suspension towers) and tower components (120 t for angle towers and 90 t for suspension towers) will be transported to some of the tower locations using the combinations of donkey, cable wire, small truck and small car. In some mountainous location, this operation will be very risky. Contractor will prepare method statements for these locations devising the steps and vehicle to be used and submit to CSC for approval. In locations, walking trails with fall prevention measures will be constructed for the transportation of heavy loads. More detail measures are presented in 7.11.4.	Contractor	CSC, ESIC
B3.8 Tower erection and equipment assembly	Working at height along the slope, for tower erection and grid station assembly	There are 44 towers located at steep mountain cliffs. Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area. Use of fall prevention devices, including safety belt and lanyard, travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards or self-retracting inertial fall arrest devices attached to fixed anchor point or horizontal life-lines. Define control line to restrict access, where leading edge and other operations are	Contractor	CSC, ESIC

Project Activities	Hazard Risks	Preventive Actions	Institutional Responsibilities	
			Implementation	Supervision
		taking place (e.g., curve in the slope). More detailed measures are presented in Section 7.11.5.		
B3.9 Construction work during extreme summer	Exposure to extreme heat during summer especially if critical needs such as access to safe drinking water and places for rest are not available.	Contractor will ensure potable drinking water to all workers as per the ESCP 17 and shelter for resting, especially during summer time.	Contractor	CSC, ESIC
B3.10 Stringing conductors at road, river, and existing transmission line crossings	Traffic accident, drowning, electrocution	Prepare and submit a traffic management plan to the CSC for his approval at least 30 days before commencing work on any project component involved in traffic diversion and management. Ensure the provision of Lifejackets/buoyancy aids with lifeline worn by workers with risk of falling into water. Lifejackets/buoyancy aids should conform to BS EN ISO 12402-1, 2, 3 or 4, or other equivalent international standards according to working conditions. Coordinate with the transmission line staff/ concerned DISCO or NTDC to plan the work. Take necessary shutdown on the live transmission lines. Provide training and appropriate personal protective equipment to workers. Follow ESCP 23.	Contractor	CSC, ESIC
B3.11 Transportation of oversized equipment to Mansehra Grid Station	Traffic accidents, road closures	Ensure that the vehicle route is surveyed and that its geometric design and condition is appropriate for the transportation of the big and heavy load. Ensure that turning curves are appropriate for the special vehicles. More details are presented in the ESCP 21.	Contractor	CSC, ESIC
B3.12 Lifting and Assembly of Heavy	Electrical hazards, overloading, and materials	Lifting equipment selection shall be based on a risk assessment and shall be suitable for the task for which it will be used. More details are presented in the ESCP 22.	Contractor	CSC, ESIC

Project Activities	Hazard Risks	Preventive Actions	Institutional Responsibilities	
			Implementation	Supervision
Equipment at Mansehra GS	falling/slipping from overhead hoists			
B3.13 All construction activities and traffic movement	Community health and safety	Construction areas will be secured using fences close proximity to residential development, Design of control blasting and use of blasting mats should be ensured. Traffic, noise, and vibration control measures in accordance with ESCP 17.	Contractor	CSC, ESIC
B3.14 All construction activities and use of PPE	Accidents and injuries	Contractors will be responsible for supplying effective PPEs to all workforces and staffs of consultants and PMU. A line item is included in the ESMP for PPEs and will be available in the Contractors' specifications as well. Contractors must ensure that all workers and staffs are trained how to use them prior to station and visit to actual construction sites. Any violation of the supply of PPEs by Contractor and use of PPEs by his workers will led to severe penalty as stated in Section 9.8.2.	Contractor	CSC,ESIC
B3.15 Work area and camp safety and security	Security of workers and asset	The Contractor shall: • Provide appropriate security personnel (i.e., security guards) to prevent unauthorized entry into the camp area. • Employ night watchman for periods of significant on-site storage or when the area necessitates. • Ensure there is proper fencing around construction site perimeter. • Ensure construction site has controlled access points (one or two entry points at most), allowing for close monitoring of entry and exit. • Further details are in ESCP 18.	Contractor	CSC, ESIC

Project Activities	Hazard Risks	Preventive Actions	Institutional Responsibilities	
			Implementation	Supervision
C3. OHS During Operation and Maintenance				
C3.1 Project operation	Workers health and safety during maintenance	Implementation of Standard operating procedures (SOPs) of NTDC (Annex 7.1)	NTDC	ESIC
	Hazards from electric and magnetic fields from transmission lines on community health and safety	Exposure to EMF has already been considered during the design of the transmission line conductors and right of way to ensure compliance with the internationally recognized standards. The 765 kV transmission line has an electric field generated with the 80 m RoW in the amount of 0.03 kV/m, which is way lower than the ICNIRP standards of 5 kV/m for public exposure and 10 kV/m for Occupational Exposure. On the other hand, Magnetic Field for the DTL will be 23.31 µT, which is again significantly lower than the public exposure limit of 200 µT and Occupational Exposure limit of 1,000 µT. The electric and magnetic fields will be regularly monitored during O&M phase to ensure compliance with the ICNIRP standards and if required additional mitigation measures will be proposed during O&M phase. NTDC will maintain and clear entire RoW from the establishment of permanent structures. Awareness will be created along the TL alignment to avoid long exposures under the line.	NTDC	ESIC
C3.2 Maintenance of Circuit breakers and transformers	SF6 breakdown or arc products are toxic	Evacuate the faulted SF6 gas from the circuit breaker and flush with fresh air before working on the circuit breaker. Arc products which do not recombine, or which combine with any oxygen or moisture present, are normally removed by the molecular sieve filter material within the circuit breaker.	NTDC	ESIC
C3.3 Working near exposed energized overhead lines or grid stations;	Electrocution from overhead power lines, damaged tools and equipment, inadequate wiring and overloaded circuits, exposed	Conduct a job hazard analysis to identify the hazard risks. Follow NTDC's standard operating procedure for repair and maintenance. Only, qualified persons using proper test equipment and personal protective equipment must adhere to limited approach boundary with a distance of 7.25 m for 765 kV voltage. Must comply with the working space requirement for the equipment. Receptacles and cord connectors	NTDC	ESIC

Project Activities	Hazard Risks	Preventive Actions	Institutional Responsibilities	
			Implementation	Supervision
working on wet locations	electrical parts, improper grounding, damaged insulation, and wet conditions.	used in damp or wet locations must be designed for use in wet or damp locations and, unless approved for submersion, must not be allowed to lie in water.		

9.11 Monitoring Program

As one of the key elements of the ESMP, a two-tier monitoring program has been proposed comprising compliance monitoring and effects monitoring. The main purpose of this monitoring program is to ensure that the various tasks detailed in the ESMP particularly the mitigation measures are implemented in an effective manner, and also to evaluate program impacts on the key environment and social parameters. Both these types of ESMP monitoring are discussed below.

9.11.1 Compliance Monitoring

The purpose of the compliance monitoring is to ensure that the contractor implements the mitigation measures and preventive actions presented in the ESMP are effectively and timely implemented. This monitoring will generally be carried out by the CSC with the help of checklists prepared on the basis of the mitigation measures and preventive actions given in Chapter 7 and Table 9.4.

9.11.2 Effects Monitoring

Effects monitoring is a very important aspect of environmental management to safeguard the protection of environment. The effects monitoring plan proposed for the project is presented in Table 9.5. The monitoring will comprise surveillance to check whether the contractor is meeting the provisions of the contract during construction and operation of the project including the responsible agencies for implementation and supervision. Compliance indicators or threshold limits for the monitoring are also given in Table 9.5. Actual monitoring time and location will be decided by CSC and PMU.

Table 9-6: Effects Monitoring Plan

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implementation	Supervision
During Construction						
Hydrocarbon and chemical storage and handling	Construction camps and yards	Visual Inspection of storage facilities	No leakages from the containers in the storage. Handling follows procedures to avoid spillages.	Monthly	Contractor	CSC

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implementation	Supervision
Landslides	At land slide potential points	Visual inspections	Engineering measures to arrest sliding	Monthly	Contractor	CSC
Flyrock	All blasting locations	Visual inspections and community consultations	Control blast design with installation of blast mat	During Before and after blasting	Contractor	CSC
Spoils	At tower locations	Visual inspections	Disposal in approved locations	Monthly	Contractor	CSC
Traffic Safety	Access Roads	Visual inspection to see whether proper traffic signs are placed and flag-persons for traffic management are engaged	Smooth flowing of traffic; and placement of traffic signs and flag-person	Monthly	Contractor	CSC
Dust	Construction sites	Visual inspection to ensure good standard equipment is in use and dust suppression measures (e.g., spraying of waters) are in place.	No dust generation from the construction activities	Weekly	Contractor	CSC
	Construction Sites	Spot measurements with potable meters	Compliance with NEQS.	Monthly	Contractor	CSC
Noise	Construction sites	Noise measurement	Compliance with NEQS	Monthly	Contractor	CSC

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implementation	Supervision
		using potable noise meter;				
Ground vibration	Blasting sites	Vibration measurement using potable noise meters	Compliance with NEQS	Monthly	Contractor	CSC
Waste Management	Construction camps and construction sites	Visual inspection that solid waste collection facilities are in place and waste is disposed at designated site	Facilities are clean and waste collection and disposal facilities are in place	Monthly	Contractor	CSC
Drinking water quality	Camps, offices	Testing of water quality of workers camp water supply for drinking water standards	NEQS drinking water standards	Quarterly	Contractor	CSC
Air ((PM, CO_2, SOx, NOx)	At Mansehra GS	24 hour continuous monitoring with appropriate equipment	Compliance with NEQS	Quarterly during civil works	Contractor	CSC, NTDC
Noise Level	200 villages along TL and Mansehra GS	15 minutes continuous monitoring during day and night	Compliance with NEQS	Once at 200 villages close to tower, Quarterly 4 locations in MGS during	Contractor	CSC, NTDC

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implementation	Supervision
				civil works		
Cultural and archeological Sites	At all work sties	Visual observation for chance finds	Indication of chance finds	Daily	Contractor	CSC, NTDC
Restoration of Work Sites	All Work Sites	Visual Inspection	The facilities are clean with no waste at the works sites	After completion of all works	Contractor	CSC, NTDC
Plantation	Designated approved locations	Visual inspection	Number of saplings planted and survival rate	Monthly	Forest Department	CSC/ ESIC
Safety of workers Monitoring and reporting accidents	At work sites	Induction training, Toolbox talk, and worksite based training	Records of training	Continuous	Contractor	CSC, NTDC
Walk-through health and safety inspection and audit	At all work sites	Visual inspection and use of audit form	Inspection record with photo evidence	Weekly	CSC, Contractor	NTDC
PPE usage by workers	At work sites	Usage of PPE vs the number of workers and implementation of contractor ‘s OHS plan	All workers should be provided with, and use necessary PPEs	Monthly	Contractor	CSC, NTDC
Grievances	In the project area	Number of grievances registered and addressed	Minutes of grievance redress meetings	Monthly	PMU	CSC, NTDC

Parameter/ Activity	Location	Means of Monitoring	Compliance indicator/ threshold limits	Frequency	Responsible Agency	
					Implementation	Supervision
During Operation and Maintenance						
Land slides	At tower locations that have land slide potential	Visual inspection	Retaining walls are in place	SBi-annual	PMU	NTDC
Inspection as per Standard Operating Procedures	Tower locations	Visual Inspection of environmental related issues	Comply with NTDC SOPs	Monthly	PMU	NTDC
Bird injury and electrocution data	At locations crossed by major rivers	Walk over surveys and interviews	Zero mortality	Bi-annual – in March and October	Consultant	NTDC
Electromagnetic fields	Near the residential areas along the TL alignment	Measurement through appropriate equipment	WHO recognized standards	Yearly	PMU	NTDC

9.12 Performance Indicators

For evaluating the performance of the environmental and social management and monitoring plan, performance indicators are identified for efficient and timely implementation of measures/actions proposed in ESMP. The indicators are defined both for implementation phase and for operation phase. CSC will be responsible for compiling the information on these indicators and report to NTDC.

To measure the overall environmental performance of the project, a list of performance indicators is given below:

- Number of inspections carried out by CSC per month.
- Number of non-compliances observed by CSC or ESIC.
- Availability of environmental, social, and OHS specialists in CSC.
- Availability of environmental, social, and OHS specialists with contractors.
- Timely reporting of documents (as defined in ESMP and monitoring plan).

- Number of trainings imparted to stakeholders/other capacity building initiatives
- Timely disbursement of compensation/ timely resettlement of project affectees
- Timely implementation of resettlement schedule.
- Number of grievances received.
- Number of grievances resolved.
- Number of construction related accidents.

9.13 Grievance Redress Mechanism

Based on past project implementation experience, NTDC has established its own Grievance Redress Mechanism (GRM) to facilitate timely resolution of project-specific complaints and grievances of the project-affected persons and communities regarding social/resettlement and environmental aspects of the project. The intention of GRM is to resolve a complaint as quickly and at as low a level as possible to avoid a minor issue becoming a significant grievance. The GRM outlines the processes for documenting, addressing, responding and employing methods to resolve project grievances (and complaints) that may be raised by APs or community members regarding major project specific activities such as, environmental and social performance, the stakeholder engagement process, land acquisition and resettlement and/or unanticipated social impacts resulting from project activities that are performed and/or undertaken by NTDC. The document describes the scope and procedural steps and specifies roles and responsibilities of the parties involved. It applies to all World Bank, ADB and other foreign donor funded projects, including the proposed one.

The two-tier system includes a Grievances Redress Committee (GRC) at the PMU-level (GRC-P) and GRC at NTDC (GRC-HQ). The committees consist of NTDC/PMU and CO staffs, and representatives of ESIC, Project consultants, project-affected persons and the *patwari* (revenue clerk) of the project area. The grievance redress mechanism is gender responsive (i.e., ensures appointment of female members in both GRCs), culturally appropriate, and readily accessible to the PAPs at no cost and without retribution. A provision of $54,210 is included in ESMP budget for GRM. GRC will maintain the following steps:

- The GRC-P will try to quickly resolve any complaints with 21 days; unresolved cases will be referred to the GRC-HQ.
- GRC Complaint Boxes will be available in the field and at PMU office a dedicated telephone number for registration of any complaints.
- At the field level Construction Camp Office (CO), a designated person, not below the rank of an Office Assistant, shall record the complaints and immediately report them to field CO Head/Executive Engineer and concerned officials.
- The decision made by the GRC is mandatory and shall be carried out by the project (If any disputant is unhappy with the outcomes, he/she can pursue the grievance through the court as his or her legal right in accordance with law of the country).
- The outcomes of GRC deliberations and decisions will be notified in written form by the Chair of the GRC within a week from the date of the meeting.

- The decisions taken are mandatory on the NTDC with regard to any additional awards or compensation to be paid to the disputants. The records of all GRC cases must be available for review and verification by NTDC, WB, Independent monitoring consultants and other interested stakeholders.

9.14 Capacity Building and Training

Capacity building for effective implementation of the environmental and social safeguard requirements is a key element of the ESMP. Capacity building for environmental and social safeguard management will need to be carried out at all tiers of the project, including NTDC, ESIC, CSC, and contractors. At the construction site, CSC will take the lead in implementing the capacity building plan, though the contractors will also be responsible to conduct trainings for their own staff and workers. The various aspects that are covered under the capacity building will include general environmental and social awareness, key environmental and social sensitivities of the area, key environmental and social impacts of the project, ESMP requirements, OHS aspects, and waste disposal. Table 9.7 provides a summary of various aspects of the environmental, OHS, and social trainings to be conducted at the construction site. ESIC may revise the plan during the project implementation as required.

During the O&M phase of the project, these trainings will continue to be conducted by NTDC staff for all relevant O&M personnel.

Table 9-7: Environmental and Social Trainings

Contents	Participants	Responsibility	Schedule
General environmental and socioeconomic awareness; Environmental and social sensitivity of the project influence area; Mitigation measures; Community issues and workers' code of conduct; Grievance Mechanism; ESMP Awareness of transmissible diseases Social and cultural values.	PMU; CSC; selected contractors' crew	CSC	Prior to the start of the field activities. (To be repeated as needed.)
OHS Plan Job Hazard Analysis Incorporation of EHS in Method Statement	Construction crew	Contractors	Prior to the start of the construction activities. (To be repeated as needed.)
Road safety; Defensive driving/; Waste disposal; Cultural values and social sensitivity.	Drivers;	Contractors	Before and during the field operations. (To be repeated as needed.)

Contents	Participants	Responsibility	Schedule
Importance and use of PPEs and emergency communication Excavation, Cranes and Rigging, Working at heights, scaffolding,	Workers	Contractors	Before and during the field operations. (To be repeated as needed.)
Application of Contractual Instruments during OHS violations Excavation and trenching Blasting Methods in Road construction and related OHS OHS in handling and transportation of mechanical equipment	Contractor, CSC, ESIC	CSC	During construction.
Overseas training on EHS for ESIC Staffs	ESIC Staffs	CSC	During Construction

Overseas training for ESIC staffs is proposed in the ESMP alongwith a field visit to high-voltage transmission line. This training will cost $116,750.

9.15 Documentation

Both Contractors and CSC will prepare two separate monthly reports, one for Environmental and Social Management and the second one for OHS Management. The ESIC with assistance from CSC and contractors will also produce quarterly reports.

Contractor and CSC Monthly Report: Implementation schedule of the mitigation plans and safety inspections and preventive actions suggested in the ESMP (Table 9.4 in the EIA) should be reported in all monthly reports. The outcome of the field inspections and audits based on the should be reported in all monthly report. Contractors should present the implementation schedule of mitigation measures and preventive actions in all monthly report along with monitoring and auditing and CSC should confirm the status of mitigation and preventives claimed by the Contractors.

Quarterly Progress Reports on Environment, Health and Safety: The environmental, Health and Safety monitoring reports will include environmental mitigation measures and preventive actions undertaken, environmental monitoring activities conducted, details of monitoring data collected, analysis of monitoring results particularly the non-compliances, recommended mitigation and corrective measures, EHS training conducted, and environmental and OHS regulatory violations observed. The environmental monitoring reports will be submitted quarterly during the construction period and annually for three years after completion of construction.

Quarterly Progress Reports on Social: The quarterly social progress reports will cover the progress on implementation of RAP and community development assistance programs.

Project Completion Environmental, Health and Safety Monitoring Report: One year after completion of construction, the ESIC will submit a Project Completion Environmental Monitoring Report which will summarize the overall environmental impacts from the project.

9.16 ESMP Implementation Cost

Detailed cost estimates for implementation of mitigation measures and preventive actions given in ESMP are is given in Table 9.7 and implementation of RAP are given in Table 9.8 and Table 9.9. Total cost of ESMP implementation is USD 41.89 million including the RAPs budget, which is USD 30.99 million.

Table 9-8: Budget for Implementation of ESMP

Sr. No.	Items	Unit	Quantity	Unit Rate (USD)	Amount (USD)
1	**Civil Works**				
	Camp Management				2,071,688
	Preparation & Submission of CESAP	No	3	15,625	46,875
	Revision of CESAP	No	9	3,125	28,125
	Preparation and Submission of OHS Plan	No	3	18,750	56,250
	Revision of OHS Plans	No	9	4,688	42,192
	Dust management by Water Sprayer/Watering	Veh-day	270	150	40,500
	Top Soil Stripping, Storage and Reuse	m3	28,667	2	57,334
	EHS Staff (Contractor)				3,948,000
	Environmental Quality Monitoring				231,000
	Skill Development of Locals				115,469
	Personal Protective Equipment				500,006
				Sub-Total	**7,137,439**
2	**Environmental Management and Monitoring Plan**				
	Trees Plantation Program				307,085
	Environmental Quality Monitoring ESIC				10,500
				Sub-Total	**317,585**
3	**Institutional Arrangements**				
	Construction Supervision Consultant				1,912,000
	ESIC (9 Staff for 7 years)				341,918
	Capacity Building & training of NTDC Staff				116,750
	Monitoring and Evaluation Consultant				650,500
	Independent Review Consultant				366,000
	Grievance Redress Management				54,210

Sr. No.	Items	Unit	Quantity	Unit Rate (USD)	Amount (USD)
				Sub-Total	**3,441,378**
4	**Social Management Plan**				
	Resettlement Action Plan				30,990,00
				Sub-Total	**30,990,000**
				Grand Total	**41,886,402**

Table 9-9: Budget for Implementation of RAP -TL

	Resettlement Activity	Unit	Quantity	Unit Rate (PKR)	Amount (million PKR)
A	**Crops Compensations**				
i)	Crop damage within RoW	Acres	2313	18,073	83.6
ii)	Crop damage on access tracks	Acres	230	18,073	8.3
A	**Sub-Total (A)**				**91.9**
B	**Compensation for Trees**				
i)	Private timber/ fuel trees	No	27,321	5,700	155.7
ii)	Private fruit trees	No	880	7,100	6.2
iii)	Government owned timber trees	No	1,528	5,700	8.7
B	**Sub-Total (B)**				**170.7**
C	**Commercial/ Residential Structures**				
i)	*Pacca* structures (17 structures)	m2	1,297.7	11,222	14.6
ii)	Semi-*Pacca* (24 structures)	m2	1,897.8	8,535	16.2
iii)	*Katcha* (3 structures)	m2	141.45	6,380	0.9
iv)	Boundary walls (4 structures)	M	99.9	3,604	0.36
v)	Gate (1 structure)	M	9	3,604	0.03
vi)	Poultry Farm (1 structure)	m2	160.7	8,535	1.4
C	**Sub-Total (C)**				**33.4**
D	**Compensation for Land under Towers/Allowances/ Livelihood Restoration (Estimated)**				
i)	Business interruption allowance.	No	1	60,903	0.06
ii)	Relocation assistance (transport)	No	29	5,000	0.15
iii)	Livelihood assistance for relocation.	No	29	60,903	1.8
iv)	Compensation for land taken for towers	No. of towers	674	1,120,000	754.9
v)	Vulnerability allowance for poor and women-headed households	No	98	60,903	6.0
vi)	Community Support programs	Lump sum			640.0
D	**Sub-Total (D)**				**1,402.8**

	Resettlement Activity	Unit	Quantity	Unit Rate (PKR)	Amount (million PKR)
E	**RAP Implementation**				
i)	RAP Implementation Consultants	Lump sum			85.0
ii)	Training and Capacity Building	Lump sum			10.0
iii)	Independent Monitoring Consultant	Lump sum			15.0
iv)	GRM Implementation	Lump sum			10.0
E	***Sub-Total (E)***				**120.0**
F	***Total (A to E):***				**1,818.8**
G	***Contingencies @ 20% of F***				**363.8**
	Grand Total (m PKR) (F+G)				**2,182.6**
	Grand Total (m US Dollars)				**13.64**

Table 9-10: Budget for Implementation of RAP -Mansehra GS

No.	Description	Quantity/Total Number	Unit	Rate/Unit (PKR)	Total Cost (million PKR)	Cost (Million USD)
A	**Land Acquisition Cost**					
1	Land Compensation	158	Acre		1,617.9	10.11
B	**Public Infrastructure**					
2	Local road	1.94	Km	50	97.0	0.61
C	**Crop Compensation**					
3	Crop Compensation (Wheat Crop)	2.63	Acre for two crop	72,704	0.2	0.0012
	Sub Total (A+B+C=1+2+3)				**1,715.1**	**10.72**
D	**Trees**					
4`	Total timber Trees	20,456	No.	7,500	153.4	0.96
	Total (D=4)				**153.4**	**0.96**
E	**Allowances**					
5	Livelihood Allowance	3	Family	60,903	0.2	0.0011
6	Vulnerability Allowance	220	Family	60,903	13.4	0.0837
7	Training Cost		Lump sum		10.0	0.0625

No.	Description	Quantity/Total Number	Unit	Rate/Unit (PKR)	Total Cost (million PKR)	Cost (Million USD)
	Total (D=5+6+7)				**23.6**	**0.15**
	Sub - Total (A+B+C+D+E)				**1,892.1**	**11.83**
F	Monitoring and Evaluation @ 5% of the Total Cost				94.6	0.59
G	Community Support Program		Lump sum		320.0	2.00
H	GRM Implementation		Lumpsum		10.0	0.06
I	Contingencies @ 20% of the Total Cost				463.3	2.89
	Total (F+G+H+I)				**887.9**	**5.54**
	Grand Total				**2,780**	**17.35**

10 STAKEHOKDERS CONSULTATION AND DISCLOSURE

10.1. Introduction

This Chapter describes the process and outcomes of the consultations carried out with various groups of stakeholders as part of the ESIA and resettlement/safeguard planning. It includes a brief discussion on the concerns expressed by the stakeholders during the consultation meetings and responses addressing the concerns and potential mitigations. Also provided in this chapter is a framework for the consultations to be carried out during project implementation. Finally, further disclosure requirements for the present ESIA are described at the end of the Chapter.

10.2. Objectives of Consultations

Stakeholder consultation has two important functions. First, it provides community feedback on project impacts and perceived benefits. For project-affected people, this provides an opportunity to obtain project information, to raise issues and concerns, and ask questions and/or provide suggestions that can potentially help shape the project. Second, it enhances the quality of decisions making ultimately leading towards sustainable development. Therefore, the primary purpose of consultation in this project was to develop a more acceptable project design on a consultative basis and address the concerns raised in the process to share the benefits of the project, particularly by those immediately affected by the project construction. The national/provincial legislations and WB safeguard policies require consultations to be carried out particularly with the affected communities as part of the environmental and social assessment process.

The specific objectives of the consultation were: (i) obtaining local and indigenous knowledge about the environment and people living in the nearby areas of project alignment; (ii) interaction with the project affected population and other stakeholders for the collection of primary and secondary data on environment and people; and (iii) engaging stakeholders for maximization of the project benefits. The consultation carried out during the present ESIA and reported in this Chapter meet these requirements.

10.3. Stakeholder Identification

Stakeholders are considered to be individuals or organizations which have an interest in the proposed project or knowledge that would provide insight into issues or affect decision making related to the proposed project. On the basis of interest and role criteria there are two types of stakeholders for the proposed project as described below.

10.3.1. Primary Stakeholders

The primary stakeholders are primarily the project affected persons and general public including women residing in the project area - for example, people living in the project area particularly those in the ROW of the TL and those affected by the footprint of the Mansehra GS. These are the people who are directly exposed to the project's impacts though in most cases they may not be receiving any direct benefit from the project.

10.3.2. Secondary Stakeholders

The secondary stakeholders are typically institutional stakeholders – for instance, related government department/agencies, local government, and organizations that may not be directly affected by the project; however, they may influence the project and its design. They include

project proponent NTDC, other concerned departments such as WAPDA that may have a role during various phases of the project, regulatory agencies such as EPA, other relevant departments such as Forest and Wildlife, non-governmental organizations (NGOs), the broader interested communities including academia and journalists, and general public.

10.4. Consultation Framework

The guiding principle underlying consultations was that the environmental and social safeguards planning and implementation must follow a consultative and participatory process to ensure success of the project. This was further reinforced by the requirements of the World Bank OP 4.12 and Bank's Access to Information Policy (2010), which give high priority to public consultation and participation in designing and implementation of a socially and environmentally compliant project (see Table 10.1).

Table 10-1: **Framework for Consultation**

Legal/Policy Sources	Regulations/Safeguard Policy Requirements
Government of Pakistan	▪ Pakistan Environmental Protection Agency (PEPA) Regulations 2014 and 2000 ▪ Environmental Protection Agency (EPA) 1997 Guidelines for Public Consultation requires public consultation and involvement in project planning and implementation. The policy and procedures require proponents to consult with affected community and relevant NGO during preparation reports.
World Bank	▪ OP.4.01, Clause 14, notes that for all Categories A and B projects proposed for IBRD or IDA financing, during the EA process, the borrower consults project-affected groups and local nongovernmental organizations (NGOs) about the project's environmental aspects and takes their views into account. The borrower initiates such consultations as early as possible. For Category A projects, the borrower consults 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 consults with such groups throughout project implementation as necessary to address EA-related issues that affect them. ▪ OP 4.12/Involuntary Resettlement: (i) Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement plans; (ii) APs should be informed about their options and rights pertaining to resettlement; (iii) APs may be involved in the planning, implementation, and monitoring of the resettlement program, especially in the process of developing and implementing the procedures for determining eligibility for compensation benefits and development assistance; (iv) Establish appropriate and accessible grievance mechanisms; and (v) Particular attention be paid to the needs of vulnerable groups among those

Legal/Policy Sources	Regulations/Safeguard Policy Requirements
	displaced, especially those below poverty line, the landless, the elderly, women and children or other displaced persons who may not be protected through national land compensation legislation. ▪ WB Access to Information Policy (2010)– RAP should be disclosed to the APs for local inputs, including documentation of the consultation process, in a timely manner, before appraisal formally begin, in an accessible place and in a form and language that are understandable to key stakeholders. All documents will be disclosed in a language that the community and APs understand.

10.5. Consultation Process

As part of the present ESIA, detailed consultations were carried out through village meetings and focus group discussions (FGDs) with the communities, including women in the project area. Newspaper advertisement (Annex 10.1) was done for the national workshop to invite people. Separate meetings were held with the institutional stakeholders in the form of one-to one meetings. Details of this consultation process are described below.

10.6. Community Consultations

Consultation meetings were held in 2016 by three separate teams individually covering social, resettlement, and environmental aspects of the project. The environmental assessment team conducted consultations in a total of 34 villages of the project area. A total of 170 people participated in these consultation meetings. The social assessment team conducted consultations in 17 villages with a total of 295 community members to obtain feedback particularly on social issues. Separate consultations were held with women in the project area in 17 separate focus group discussions (FGDs) involving 248 participants, making a total of 713 participants. During 2019 updates of the ESIA, both environment and social team conducted consultations in 70 locations with 1,357 participants. Sample participants are shown in Figure 10.1 and the locations of all consultation meetings are presented in Figure 10.2. Summary of these consultation meetings are presented in Table 10.2.

In addition, consultations were also conducted with district level government departments and institutional stakeholders such as EPA, NHA, Wildlife, Forestry, IUCN to obtain their views on the project. In 2016, one national stakeholder consultation in Islamabad and two Public Hearings, one in District Attock and the second one in District Battagram were also organized. This ESIA draft was disclosed in two locations (Mansehra and Besham) during October 29-30, 2019 with 81 participants. A total of 2,151 people were consulted during the entire project preparatory stage.

Table 10-2: Consultation Meetings – Summary

Year	Team	Number of Villages Covered	Number of Participants
2016	Environmental Team	34	170
	Social Team	17	295

Year	Team	Number of Villages Covered	Number of Participants
	FGDs with Women	17	248
	Subtotal	68	713
2019	Environment and Social Team	70	1,357
	Environmental and Social Implementation Cell (ESIC), NTDC	2 District-level (Mansehra and Besham) ESIA Disclosure Meetings held in October 2019	81
		Total	2,151

Figure 10-1: Consultation participants

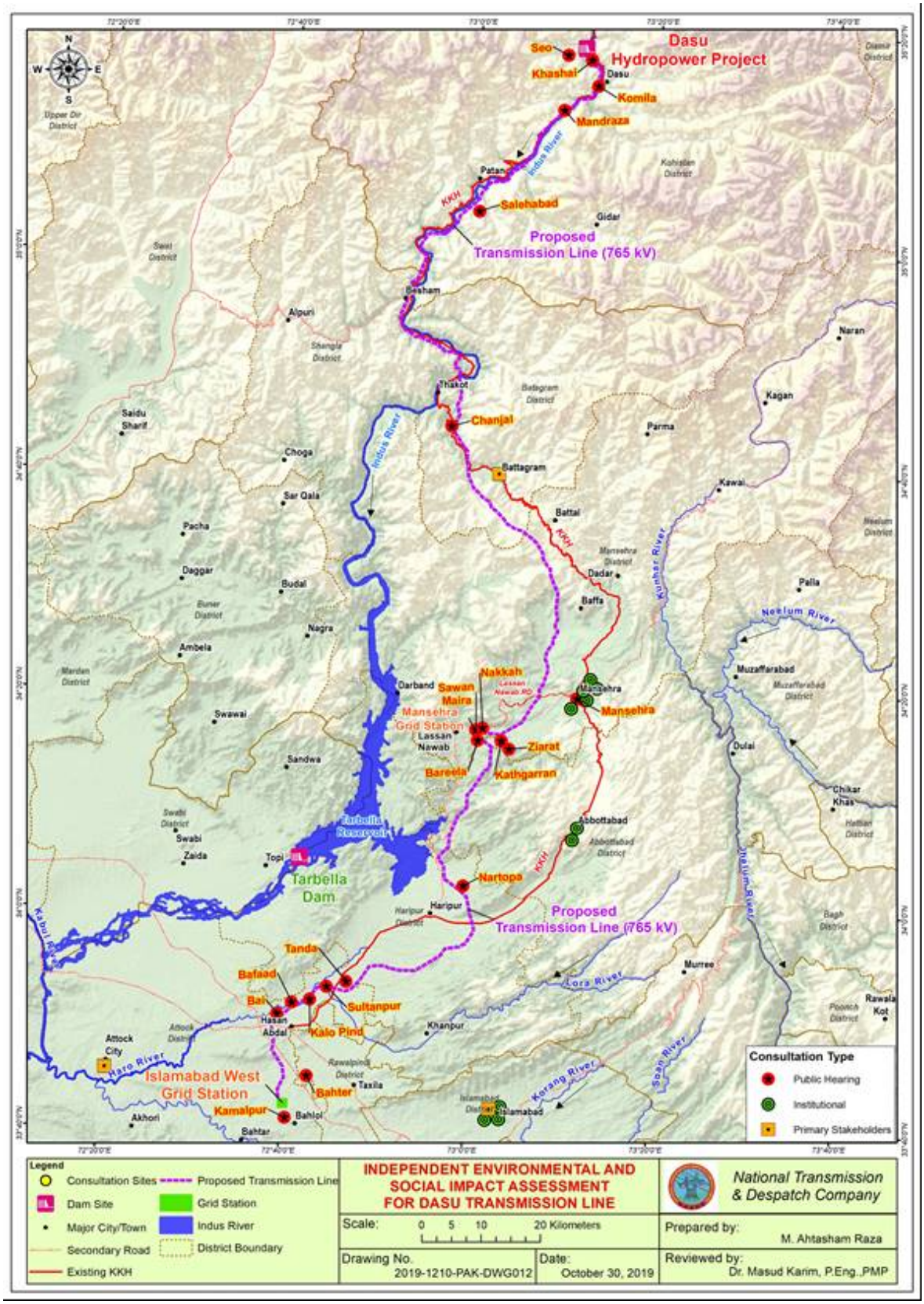

Figure 10-2: Location of consultation meetings

10.7. Disclosure of Updated ESIA

In 2019, the Environment and Social Team conducted further consultation along the DTL route and in Mansehra Grid Station covering 70 villages in which 1,357 participants attended. Public disclosure of the ESIA was conducted in Mansehra and Besham on October 29-30, 2019. The ESIA and the RAPs for DTL and Mansehra GS will be disclosed through NTDC website and in World Bank website, once finalized. The executive summary of ESIA and short brochures featuring the main elements of the RAPs will be translated in to Urdu and will be disclosed through NTDC website and made available to the affected communities.

10.8. Community Concerns and Responses

During the consultations, participants were briefed on the proposed DTL project and its various elements as well as activities, its need and objectives, and its potential/likely impacts on the local environment and people. Subsequently, their concerns and comments regarding the proposed project were recorded in order to identify appropriate alternatives and mitigation measures. A sample of the concerns raised during meetings in 2016 and 2019 and those by institutional stakeholders is presented in Table 10.3 including the summary of concerns and project responses. Details of these consultations are in Annex 10.2.

Table 10-3: Summary of Concerns and Project Responses

Sr. No.	Concerns	Responses	Responsibility
1	Who and how the prices for loss of crops and trees would be determined?	NTDC will use their own staff (i.e., surveyor and patwaris) in valuation of crops and trees with rates provided by relevant government departments. Once the rates are determined, they will be shared with all the APs.	NTDC with assistance and support from relevant government depts./agencies
2	What rates will be adopted for compensation?	Compensation will be given on replacement cost basis.	Based on assessment by its patwaris and surveyors
3	When will payments be made for the lost assets?	Payments will be made prior to project construction work	NTDC through PMU
4	Who should we contact in case of any complaint/ objection?	A GRM will be established for complaint resolution and APs will be given the representation in the GRC and they can contact their representatives in case of any grievance.	NTDC
5	Is the contractor going to hire local people for the TL construction purposes?	Local people will be preferred for employment during construction stage. For this purpose, contractor will be bound by a clause in contract documents to hire local labor during construction phase, if available. This will be monitored through internal monitors.	NTDC & Construction Contractor
6	How can NTDC ensure Transparent and	Effective monitoring mechanism will be introduced to make the compensation process more transparent and APs representative will be a part of this process.	NTDC Third party independent

Sr. No.	Concerns	Responses	Responsibility
	fair compensation procedures	Monitoring report will be prepared periodically and in case of non-compliance, correction action will be proposed/implemented for immediate remedial measures.	monitoring
7	Is the daily and regular normal life of the people and communities be affected during construction?	NTDC and the contractors will ensure to minimize disturbances and disruption by the construction of the TL line and Grid Station. If necessary, the contractor will provide temporary alternative route for smooth movement of people and community members.	Contractor & NTDC
8	How would the community and project affected people know of the project construction schedule?	NTDC through the PMU and field staff will regularly inform the affected communities along the ROW of the TL and around Grid Station. Pamphlets, brochures etc. will be distributed to the community on the project details	NTDC/PMU and Field Staff
9	Consultation process should be continued throughout the project cycle.	Meaningful and informed consultation and information disclosure will be carried out by the Resettlement Unit (RU). The issues along with the proposed measures discussed during the meetings will be documented.	NTDC/PMU
10	What happens if local infrastructures like roads, water channels are affected or destroyed during project construction?	NTDC will ensure with the help of design consultant that impact on the infrastructure is minimized and affected infrastructure is restored. If any local infrastructures are affected, these will be repaired by the contractors.	NTDC & design consultant
11	How can the project benefit the local affected people and communities to improve their living standards?	The TL project will design a benefit-sharing program to benefit the affected communities through establishment of community support/area development program in consultation with communities in the alignment	NDTC through PMU and field staff

10.9. Community Attitudes to the Project

During consultations, a positive attitude was generally found among the public. People look at DTL construction as a source of employment and improved quality of life through electrification needed for industrialization in the country. Their main concerns, as reflected in the section above, are related to compensations for those affected by the construction of the project and likely impacts to their life style and culture.

10.10. Consultation with Women

Special attention was given to make the consultation process gender inclusive and responsive and tailored to the needs of disadvantageous and vulnerable groups. To explore gender related issues, female staff were included in the Social/Environment Team. Formal meetings with women were held to explore their needs, problems and priorities related to project execution. In addition, individual interviews were also held with the affected women to effectively integrate their voices in the planning and implementation of the project. Women actively participated in the meetings and showed their support for the project. A list of consultation participants including women is given in Annex 10.3. Some snapshot of various consultation meetings are presented in Annex 10.4.

10.11. Communications and Consultation Framework during Implementation

10.11.1. Communication Plan

The Project will prepare a Communication Plan (CP) and hire a communication specialist during the implementation phase of the project. The CP should provide detailed roadmap that will guide all communications on the project with internal and external stakeholders. This, in turn, would contribute to increased support from the stakeholders and ultimately, smoother implementation of the project. A CP will strengthen project internal communication flow, enhance teamwork, and increase support for the project. It will also manage relationships with key stakeholders and increase the public visibility of all project activities, benefits, impacts, and progress and lessons learned. Finally, a CP will promote accountability, transparency, participation and dialogue in project implementation.

10.11.2. Consultation and Stakeholders Participation Framework

A broad framework with a detailed roadmap is presented in Table 10.4, which explains participation of the stakeholders in various stages of DTL implementation.

Table 10-4: Consultation and Participation Framework

Description	Target Stakeholders	Timing	Responsibility
- Consultations and participation during verification of resettlement impacts and AP list - Location: various places in project area	- Potential APs and communities within and around project area	- Before implementation of the project	PMU and RAP Consultants
- Consultations with the APs/ communities during each RAP implementation - Location: various places in project area	- APs/ Communities within ROW of DTL and around Grid Station.	- Before commencement and during implementation of project activities.	PMU and RAP Consultants
- Establishment of GRM and GRCs	- APs/ Communities within ROW of DTL and around Grid Station.	- Before commencement of project	PMU and RAP Consultants

Description	Target Stakeholders	Timing	Responsibility
- Location: various places in project area		activities and quarterly during implementation.	
- Grievance redress - Location: various places in project area	- PIU staff, consultants, relevant line departments, and APs (as needed).	- Implementation Stage	PMU and RAP Consultants
- Consultations with the APs/ communities during internal monitoring - Location: various places in project area	- APs/ Communities within ROW of DTL and around Grid Station.	- Construction Stage	PMU and RAP Consultants
- Fortnightly meetings at project sites - Location: Site offices	- PMU staff, consultants, and APs (as needed).	- Construction Stage	PMU and RAP Consultants
- Consultations with the APs/ Communities during the Independent Monitoring - Location: various places in project area	- APs/ Communities within ROW of DTL and around Grid Station	- Construction Stage	M&E Consultants
- Consultation workshops to review RAP implementation, any outstanding issues and grievances, views and concerns of APs; and actions needed to address them. - Location: site offices within project area.	- APs/ Communities within ROW of DTL and around Grid Station, relevant line department, relevant NGOs.	- Six-monthly during implementation phase	PMU and RAP Consultants
- Consultations with the APs/ Communities during the site visits by the World Bank Review Missions. - Location: various places in project area.	- PMU, project consultants, Aps	- Construction/ Operation Stage	PMU, WB Mission