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BIODIVERSITY MANAGEMENT PLANS – AN OVERVIEW OF DASU HYDROPOWER PROJECT

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Abstract:

The paper provides an overview of the Studies carried out for the Dasu Hydropower for the Management of Biodiversity including Aquatic Ecology, Terrestrial Ecology, Wildlife, Forestry, Cultural Heritage and Watershed aspects in the context of the Hydropower Project Area. The main objective of this technical paper is to raise awareness and highlight the importance and significance of the conservation and management of biodiversity.

Introduction

Biodiversity term is used to describe the enormous variety of life on Earth. It can be used more specifically to refer to all of the species in one region or ecosystem. Biodiversity refers to every living thing, including plants, bacteria, animals, and humans.

Biodiversity is the biological variety and variability of life on Earth. Biodiversity is a measure of variation at the genetic, species, and ecosystem level.[1] Terrestrial biodiversity is usually greater near the equator,[2] which is the result of the warm climate and high primary productivity.[3]

Biodiversity is not distributed evenly on Earth and is richer in the tropics.[4] These tropical forest ecosystems cover less than ten percent of earth's surface, and contain about ninety percent of the world's species.[5] Marine biodiversity is usually higher along coasts in the Western Pacific, where sea surface temperature is highest, and in the mid-latitudinal band in all oceans.[6] There are latitudinal gradients in species diversity.[6] Biodiversity generally tends to cluster in hotspots,[7] and has been increasing through time,[8][9] but will be likely to slow in the future as a primary result of deforestation.[10]

Rapid environmental changes typically cause mass extinctions and impact the biodiversity adversely.[11][12][13] More than 99.9 percent of all species that ever lived on Earth, amounting to over five billion species,[14] are estimated to be extinct.[15][16] Estimates on the number of Earth's current species range from 10 million to 14 million,[17]

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of which about 1.2 million have been documented and over 86 percent have not yet been described.[18] More recently, in May 2016, scientists reported that 1 trillion species are estimated to be on Earth currently with only one-thousandth of one percent described.[19] The total amount of related DNA base pairs on Earth is estimated at 5.0 x 10^{37} and weighs 50 billion tonnes.[20] In comparison, the total mass of the biosphere has been estimated to be as much as four trillion tons of carbon).[21] In July 2016, scientists reported identifying a set of 355 genes from the Last Universal Common Ancestor (LUCA) of all organisms living on Earth.[22]

Since life began on Earth, five major mass extinctions and several minor events have led to large and sudden drops in biodiversity. The Phanerozoic eon (the last 540 million years) marked a rapid growth in biodiversity via the Cambrian explosion a period during which the majority of multicellular phyla first appeared.[35] The next 400 million years included repeated, massive biodiversity losses classified as mass extinction events. In the Carboniferous, rainforest collapse led to a great loss of plant and animal life.[36] The Permian–Triassic extinction event, 251 million years ago, was the worst; vertebrate recovery took 30 million years.[37] The most recent, the Cretaceous–Paleogene extinction event, occurred 65 million years ago and has often attracted more attention than others because it resulted in the extinction of the non-avian dinosaurs.[38]

The period since the emergence of humans has displayed an ongoing biodiversity reduction and an accompanying loss of genetic diversity. Named the Holocene extinction, the reduction is caused primarily by human impacts, particularly habitat destruction.[39] Conversely, biodiversity positively impacts human health in a number of ways, although a few negative effects are studied.[40]

Decade on Biodiversity

The United Nations designated 2011–2020 as the United Nations Decade on Biodiversity.[41] and 2021–2030 as the United Nations Decade on Ecosystem Restoration,[42] According to a 2019 Global Assessment Report on Biodiversity and Ecosystem Services by IPBES 25% of plant and animal species are threatened with extinction as the result of human activity.[43][44][45] An October 2020 IPBES report found the same human actions which drive biodiversity loss have also resulted in an increase in pandemics.[46]

In 2020, the fifth edition of the UN's Global Biodiversity Outlook report,[47] which served as a "final report card" for the Aichi Biodiversity Targets, a series of 20 objectives set out in 2010, at the beginning of the UN's Decade on Biodiversity, most of which were supposed to be reached by the end of the year 2020, stated that none of the targets – which concern the safeguarding of ecosystems, and the promotion of sustainability – have been fully met.[48].

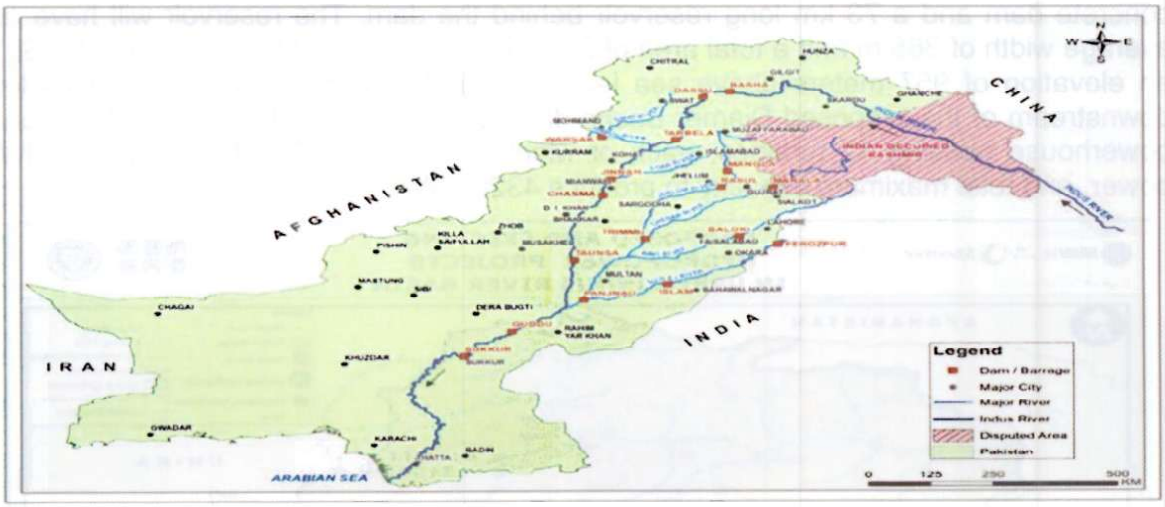
River Indus and Basin

River Indus, one of the longest rivers in Asia, originates from the Tibetan Plateau in the vicinity of Lake Mansarovar and Mount Kailash of China. It flows Northwest through Ladakh region of Jammu and Kashmir for more than 1,000 kilometers in the Indian disputed territory. It enters Pakistan and joins the River Shyok flowing from Skardu and River Hunza and River Gilgit just South of Karakorum Range. The Indus basin in

Pakistan receives a number of major rivers like Swat, Panjkora, Kabul, Kurram and Gomal in the Khyber Pakhtunkhwa, River Jhelum, Chenab, Ravi, Bias and Sutlej Rivers in the province of Punjab. Over the study area, the Indus Cascade receives the waters of a number of major streams also; important of which are the Thuk, Thor, Gabral, Kandia, Kaigah, Jejal Nullahs and Besham, Allai and Nandhiar Khwars near Thakot. The Indus River Cascade offers a potential of about 40,000 MW of hydroelectric power besides the world's largest irrigation system in the downstream plains. Given its multiple tangible and intangible benefits, the River Indus is rightly called the life line of Pakistan. Figure 1 below.

Dasu Hydropower Project

The Dasu Hydropower Project (DHP) is a 4,320 MW hydroelectricity generation project proposed by the Government of Pakistan (GOP). The Project will inject about 18.44 million kWh (18,440 GWh) to the national grid and expand the energy sector of the country, while shifting from thermal generated electricity to low cost and high reward, clean generation of hydropower. Pakistan is suffering from an acute power and energy crisis, which is primarily caused by insufficient energy supply and increasing demand. The total installed capacity of the country was 24,173 MW, yet only a peak demand of 19,924 MW could be served in 2011, indicating significant shortfall of 4249 MW.

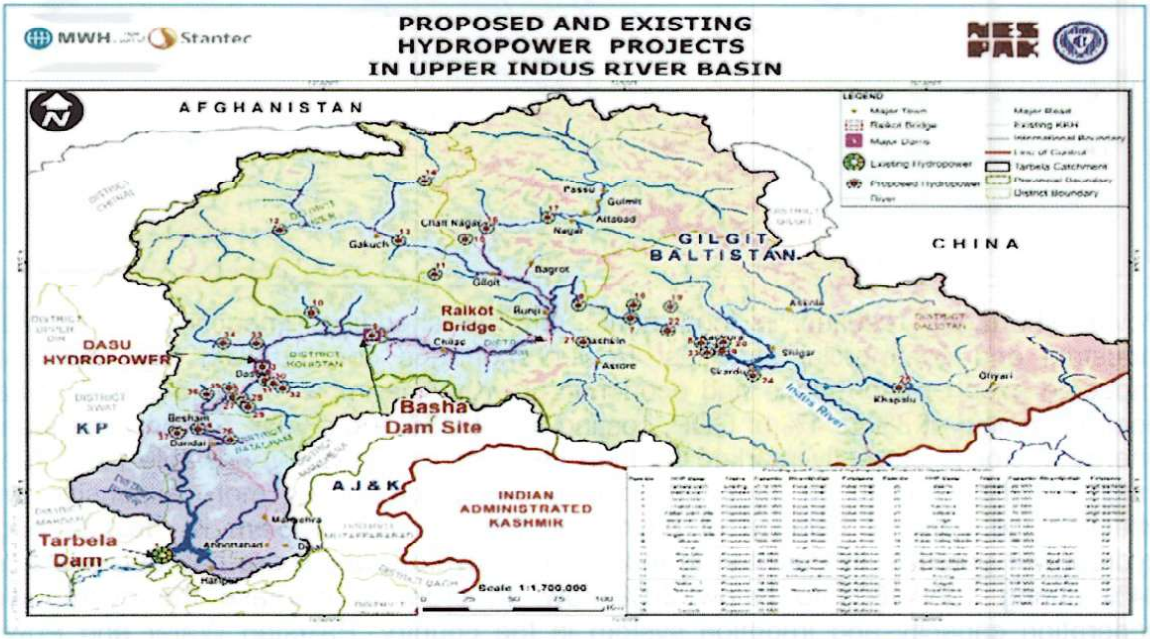


Power shortages resulted in long hours of load shedding, impacting households, industrial and commercial activities. Power shortages coupled with fuel shortages impacted export performance and economic growth. The impact of load shedding has been estimated at 3% to 4% of GDP, costing about US$ 10b a year. Further, Pakistan's energy sector is currently marked by high dependence on non-renewable fossil fuels much of which has to be imported, making energy production more expensive and affecting the national balance of payments. Other major problem is, despite huge hydropower potential in Pakistan in Indus Basin, hydropower share has declined from 64% during 1960s/80s to below 30% now. In order to increase the hydropower generation capacity and irrigation system in the country, Pakistan Water and Power Development Authority (WAPDA) has prepared a "Vision 2025" program. The Dasu Hydropower Project (DHP) is included in this program as one of the priority projects. A

feasibility study for this project was carried out to identify the location of the project and to prepare preliminary engineering designs, cost estimates and an Environmental Impact Assessed (EIA).

The detailed design was prepared by an international consortium of consultants: The Dasu Hydropower Consultants (DHC). Financial assistance for study and design is given by World Bank under their Water Sector Capacity building and Advisory services Project (WCAP). DHP is a run-of-river project planned for the development on the Indus River near 7 km upstream of Dasu town in Kohistan district of Khyber Pakhtunkhwa (KP) province. Location of the Project is shown in **Figure 2**. World Bank is financing some portions of this Project for implementation. The Project also includes construction of 62 km of Karakoram Highway (KKH) realignment due to inundation of part of the current road and about 300 km of two 500 kV transmission lines from Dasu damsite to Pathar Garh, near Hasan Abadal. The design of a transmission route is being carried out through a separate study by National Transmission and Dispatch Company (NTDC) and hence not covered in this study.

DHP is a run-of-river scheme to be used exclusively for power generation. The proposed dam site is located on the Indus River 7 km upstream of Dasu town in Kohistan District of KP, about 350 km North of Islamabad (map 1.1). DHP will comprise a 242 m high concrete dam and a 73 km long reservoir behind the dam. The reservoir will have an average width of 365 m and a total area of 2,400 hectares (ha), at full supply level (FSL), an elevation of 957 meters above sea level (masl). The dam will be situated 74 km downstream of the proposed Diamer Basha dam. The project will have an underground powerhouse housing 12 turbines, each of which will produce 360 Mega Watts (MW) power, and total maximum capacity to produce 4320 MW.



The project will be completed in two stages. Stage 1 will include the construction of the main hydraulic structures and installation of six of the planned twelve turbines. Stage 2

will include installation of the remaining six turbines and will be implemented after completion of the Diamer Basha Dam. The operational concept for Stage 1 of the project is that the water level in the reservoir would always be maintained at 957 m and all inflows to the reservoir would be released downstream either through the powerhouse or over the spillway. This means the reservoir and powerhouse would be operated as a base load type power generation facility. During the high flow season (May to October), water would normally enter the reservoir at a rate greater than water released through the powerhouse intakes, and the excess would pass over the spillway or through the flushing tunnels. During the low flow season (November to April), the reservoir water level would be maintained at 957 m and typically all inflow water would be released through the powerhouse intake, except for a residual 'environmental flow' released from the dam to maintain ecological functioning in the river.

In Stage 2, after completion of the Diamer Basha Dam (DBD) project, the current planning is to continue to use DHP as a base load facility. However, during the feasibility study, the option was identified to operate the project as a peaking operation plant (to meet afternoon evening peak demand) due to guaranteed water releases from Basha reservoir. The peaking operation is based on a daily cycle of approximately 18-20 hours storage followed by 4-6 hours release for power production. This would result in the reservoir level fluctuating strongly on a daily basis within the overall considerable annual fluctuation.

The current concept is for the reservoir to be drawn down up to 2 m/day over the 4-6-hour generation phase, followed by refill. In winter (December to March) the refill would be partial, gradually creating a seasonal drawdown of up to 50 m. The Project also includes construction of 64 km of KKH realignment due to inundation of part of the current road. The realigned KKH includes eight bridges across tributaries of the Indus River (at Dasu, Uchar, Barsin, Kai Gah, Chalash, Gobar, Shori and Sumar Nullah). In addition, the project includes development of a 250 km 765 Kilovolt (kV) Dasu Transmission line (DTL) from Dasu dam site to Pathar Garh, near Hasan Abdal. The design of the transmission route is being carried out by National Transmission and Dispatch Company NTDC).

Various Studies for Dasu Hydropower Project

WAPDA conducted a study in 1981 (known as MONENCO Study, 1981) to identify the potential hydropower sites for the Upper Indus Basin (UIB). The study carried out the Ranking of twenty-five (25) major potential sites (9 on Indus and 16 on tributaries), having potential installed capacity of more than 100 MW. DHP was ranked second in this study following the DBD Project.

Feasibility Study of DHP was conducted during 2006 to 2008 to identify the location of the Project, preliminary engineering designs, Environmental Impact Assessment (EIA). A 'No Objection Certificate (NOC or Legal Environmental Approval)' was obtained from Pak EPA in November 2011. The preliminary design was prepared with a concept that DBD Project will be constructed prior to the DHP.

Detailed Design and Tender Document of DHP was Carried out in September 2011 with TOR mentioning that the Design with the concept that DHP will be implemented prior to

DBD Project. Reason of prior construction was the non-availability of committed funding of DBDP. WAPDA and World Bank agreed on a two phase development of DHP.

- Stage 1 (Before DBDP) with two phases, 2160 MW with Completion time seven (07) years, Phase 1 with 3 Turbine of 360 MW, Phase 2, 3 Turbine of 360 MW)
- Stage 2, (After DBDP), 2160 MW with Completion time four (04) years; Phase 3 (3 Turbine of 360 MW); Phase 4 (3 Turbine of 360 MW)

As a part of Detailed Design Environment Management Action Plan (EMAP) and Social and Resettlement Management Plan (SRMP) were prepared. EMAP comprises eight (8) volumes namely:

Executive Summary; Environmental Impact Assessment; Terrestrial Ecology; Aquatic Ecology; Physical Cultural Resources; Environmental Baseline Quality; Cumulative and Induced Impact Assessment; Environmental Management Plan.

The above studies of the DHP recommended the preparation of various management plans to address impacts on biodiversity and also the completion of a series of studies to develop a sound and comprehensive ecological baseline for the Indus River corridor between Basha and Tarbela.

Hence WAPDA engaged the MWH, International with NESPAK and ACE as local consultants to carry out the additional studies recommended by the ESA and to prepare further detailed Environmental Management Plans, as identified in the ESA. The assignment was to carried out to fulfill the international standards as per the World Bank Safeguard Operational Policies, particularly OP 4.01 Environmental Assessment, OP 4.04 Natural Habitats, OP 4.11 Physical Cultural Resources and OP 4.36 Forests.

Studies for Biodiversity Management Plan

Key Objectives

The overall aim of these studies is to provide additional studies, surveys and analysis as recommended by the ToR, and to prepare DEBMPs, as identified in the ESA. The objectives of the proposed assignment are to:

i. Update detailed environmental and ecological baseline information;

ii. Prepare robust management plans covering Aquatic, Terrestrial, Avifauna, Wildlife Conservation, Forestry, Watershed Management and Physical Cultural Resources and other pertinent issues in light of the impact assessment presented in the Dasu ESA;

iii. Prepare the above management plans, update and develop detailed baseline data on flora and fauna of the project area in order to improve the understanding of the ecological landscape in relation to the DHP and other hydropower projects in the Indus Cascade;

iv. Enhance data interpretation, monitoring and mitigation of the actual impacts of DHP;

v. Prepare plans for protection of PCR; and

vi. Perform capacity assessment and assistance in capacity building for local and provincial institutions, and for WAPDA.

Key Outputs

The key outputs following implementation of the DEBMPs include:

- Updated baseline information on terrestrial flora and fauna;
- Robust management plans and resource evaluation tools;
- Enhanced capacity of implementing organizations; and
- A GIS database containing comprehensive spatial data related to biodiversity / ecological resources.

Area of Study

- The Terms of Reference (ToR) spelled out only linear limits of the overall Study Area, i.e., from Raikot Bridge to Tarbela Reservoir, including part of the Dasu transmission line.
- The DEBMP work treats the Study Area and Area of Influence as one and the same based on the review of ToR and internal planning discussions. The ToR is silent on the study areas of the sub-disciplines.
- Therefore, DEBMP Consultants, in light of the detailed scope of work for each sub-discipline, developed a consensus and consultation-based approach to define the for each sub-discipline the definition of an Area of Concern (AoC)

Sub Disciplines

The DEBMPs comprise nine sub-disciplines

- Aquatic Ecology and Fisheries.
- Terrestrial Ecology.
- Avifauna.
- Wildlife Conservation.
- Forestry.
- Watershed Management.
- Physical Cultural Resources (PCR).
- Capacity Building.
- GIS.

Deliverables

The key outputs following implementation of the DEBMPs include:

- Updated baseline information on terrestrial flora and fauna.
- Robust management plans and resource evaluation tools.

- Enhanced capacity of implementing organizations.
- A GIS database containing comprehensive spatial data related to biodiversity / ecological resources.

Aquatic Ecology and Fisheries Management Plans

Main purpose of the Aquatic Ecology – Fisheries Management Plan (AEFMP) is to provide a detailed management plan based on primary baseline data supplemented by existing information. The AEFMP provides analysis, including impacts and associated mitigation measures that were earlier proposed in DHP's ESIA and EMAP 2014.

The AEFMP mainly focuses on development of specific interventions, development of hatcheries, conservation sites, and recommendations for protection and maintenance of fish habitats like spawning areas, etc.

- DHP Fish Hatchery Program.
- Aquatic Research and Development Centre.
- Maintenance of Snow Carp Spawning Habitat.
- Aquatic Ecology Conservation Areas.
- Development of Fish Hatchery and Research/Development Centre.
- Selection of Fish Species for Production.
- Proposed Mitigation and Monitoring Framework.

Terrestrial Ecology Management Plan (TEMP)

Terrestrial Ecology Management Plan (TEMP) has been prepared to provide substantial inputs to other sub-disciplines of DEBMP, particularly Wildlife Conservation, Forestry and Integrated Watershed Management.

TEMP studies have included extensive flora and fauna data collection mainly comprising occurrence, distribution, seasonal and migratory behavior, breeding needs, threatened species and habitat characterization (supporting diverse mountain species).

Collected primary data cover all macro and micro fauna including amphibians, reptiles, and both terrestrial and aquatic invertebrates.

- Plantation and Restoration of the Natural Habitats.
- Strengthening of Watch and Ward System.

AVIFAUNA – Avian Risk Management Plan (ARMP)

The Indus Valley is known for the occurrence of endemic bird species and falls on the important flyway routes for migratory birds. The purpose of the Avian Risk Management Plan (ARMP) is to provide a plan to carry out mitigation measures based on an assessment of potential risks, conduct avian risk assessment and provide mitigation measures against potential threats to avian life resulting from the construction of proposed 765 kV Dasu Transmission Line (DTL).

Detailed data regarding avian species including both resident and migratory species have been collected on a monthly basis for (one (01) year.

- Avoid blasting during the breeding season of resident birds.
- Dedicated staff needs to be designated.
- Proper vegetation/plantation to reduce sedimentation along with implementation of progressive revegetation.
- All temporarily disturbed areas and/or vegetation shall be returned to pre-construction conditions.
- Installation of Wire-marking devices to increase the line profile, particularly for the smaller-diameter OHS wires.
- Installation of "Passive" marking devices like Bird Flight Diverter (BFD), Swan Flight Diverter (SFD), Spiral Vibration Damper (SVD), and Avian Flight Diverter (AFD), and "Active" marking devices like BirdMARK and FireFly.
- Periodic inspection of transmission lines for nest removal.
- Installation of Stick deflectors.
- In the case of fecal pollution, shifting the bird to a more benign location using perch discouragers may prevent future faults.

Wildlife Conservation Management Plan (WCMP)

The purpose of developing the Wildlife Conservation Management Plan (WCMP) is to carry out baseline studies to identify potential sites for mitigation and enhancement of adverse impacts on wildlife and also to consult with local communities as part of this subject's integration with the TEMP, ARMP and FMP. The WCMP addresses not only the conservation sites and proposed location of a Biodiversity Park but also encompasses species action plans for keystone species and community consultation.

The WCMP also incorporates necessary scientific and administrative details (trends, threats potential/direct/indirect/residual impacts, induced degradation factors, administrative hick-ups, departmental influences & practices, forestry resources dependencies, etc.) of the habitats of identified keystone species.

- Promote Trophy-based hunting programs that involve communities in broader conservation management strategies.
- Strengthening Kai Gah management and implementing similar approaches in enhancement areas.
- Afforestation and improved forest management.
- Community engagement in developing and implementing afforestation programs.
- Alternate fast growing tree species will be promoted for fuel wood use.
- Use of LPG and fuel efficient stoves will be promoted in project foot print area.

- Reduce livestock grazing pressure in key high alpine meadows.
- Avoid contact between wild and domestic animals to minimize risk of disease transfer.
- Maintaining healthy populations of wild species should reduce predation on livestock.
- Use of good herding strategies protects livestock.
- Trophy-hunting programs can compensate for livestock losses.
- Biodiversity Park.
- Kai Gah Conservation Plan.

Forestry Management Plan (FMP)

Forest cover of Northern Pakistan is estimated at about 29%, and is reported to decrease by 2% annually. As both the unique mountain fauna and human settlements are highly dependent on forestry resources, this decline trend should be reversed. The human population around the valleys of the Indus River and its tributaries is dependent on forestry resources for their livelihood. Fire wood is an essential commodity, not only for home cooking and heating, but also for trading. DHP will have indirect impacts on the forest resources and the forest ecosystem, particularly due to increased demand by the immigrants to work and live nearby the dam. Main purposes of the Forestry Management Plan (FMP) is to

- Counteract or reverse negative pressures on forest resources and associated wildlife.
- Restore the degraded forest areas in the study area.
- Support Integrated Watershed Management Plan to design biological interventions to control / minimize sedimentation falling in the Dasu Reservoir.

Currently, there are seven approved management plans operational in the Upper and Lower Forest Kohistan Divisions by KP Forest Department. DEBMP's FMP is more of a strategic and operationally developmental plan that is exclusively focused on the AoC with specific objectives of mitigation, rehabilitation and rejuvenation of the degraded forests.

Restoration and Rehabilitation Measures:

- Objective-oriented rehabilitation plan.
- Area identification for rehabilitation including its present status to be recognized.
- Capacity building needs and planning of relevant training.
- Realistic time schedule to perform and implement the proposed rehabilitation interventions and plan for financial requirements.
- Monitor rehabilitated areas and conduct maintenance activities as required.

- Consider physical and climatic limitations and possible climate change impacts.

Development Measures

- Establishment of Forest Nurseries.
- Seed Stands and Seed Bank.
- Afforestation Measures.
- Block Plantation.
- Linear Plantation.
- Trench Sowing.
- Forest Closures.
- Fruit Trees / Orchards.
- Non-Timber Forest Products (NTFPs).
- Medicinal Plants.
- Aromatic Plant Management, etc.

Watershed Management Plan (WMP)

The Upper Indus Basin is subjected to soil erosion and landslides, which disturb the ecological balance by destroying vegetation cover, removing top soil, causing modification of stream morphology; and also affecting the life of the DHP reservoir through sedimentation.

The main purpose of preparing the Watershed Management Plan (WMP) is to develop an integrated plan, including both engineering and non-engineering measures, for the control of soil erosion to restore ecosystem and biodiversity of project area and control the sedimentation in DHP and Tarbela reservoirs.

- The approach used in the management plan is a two-tier approach in which the sheet erosion from watersheds will be controlled and reduced at first tier through biological measures such as terrace farming, afforestation and pasture management whereas once the eroded sediment is transmitted to rill, gully and streams, it will be controlled and managed at second tier through engineering measures i.e. check dams, weirs, stone bunds etc.
- The engineering, such as check dams, etc. are being proposed across the flow direction, on secondary and tertiary level streams, to trap the sediment from rills, gullies and streams.
- Terracing is a good composite measure for stable slopes to reduce sediment yield from agricultural lands. Terraces will automatically be created with time due to sediment deposition behind these features.

- Afforestation activities conducted on heavily eroded areas can significantly control soil erosion by trees intercepting raindrops, reducing raindrop impact and protecting the soil surface from the energy imparted by raindrop.
- Prevention of overgrazing and trampling of grasslands by livestock lead to reduction in vegetation cover, which hold the soil in place by providing reinforcement.
- Plantation of native trees in the buffer zone along the reservoir and around the resettlement sites.
- Limitation on anthropogenic activities.
- Community's fuel requirements and forest trade (to meet the household expenditures) activities promotes cutting of forest, which leads to reduction in forest cover and hence increases soil erosion. Forest trade can be discouraged by providing alternate business and employment opportunities in the AoC.

Physical Cultural Resources

Physical cultural resources so far identified, near the Dasu project area are:

- Petroglyphs at Shatial.
- Seo mosque.
- Seer Gayal mosque.

Petroglyphs at Shatial are 1st century to 7th century rock carvings consisting of a wide variety of anthropomorphic (having human characteristics and Buddhist jatak tales), zoomorphic (representing animal forms), and inanimate images. Mosques in Seo and Seer Gayal are important historic wooden structures that will be affected by construction activities.

The purpose of developing a Physical Cultural Resources Protection Plan (PCR PP) is to plan and design measures for protection of PCRs and also build the capacity of the provincial Directorate of Archaeology and Museum (DoAM).

Capacity Building Plan (CBP)

DEBMP Capacity Development Model focusses on five key areas to improve the capacity and capability of WAPDA, DHP, NTDC and the line agencies. These themes are relevant across the organizations and will support the integration of efforts to meet the objectives of the DEBMP

OBJECTIVES

- DHP Project Management Unit (PMU), NTDC Dasu Transmission Line (DTL) PMU, NTDC Environmental & Social Impact Cell (ESIC) and key teams within KP Provincial organizations involved in Dasu have the institutional arrangements, resources, people, skills and budget to achieve the objectives of the DEBMP, Dasu EMAP and DTL ESMP.

- DHP, NTDC and Line Agencies have improved data capture and management systems for the effective and sustainable management of wildlife, terrestrial ecology (TE), watershed, forestry and cultural heritage in the Dasu area and KP Province.
- Key teams within WAPDA, DHP and NTDC understand the values of environmental and social risk management and use environmental and social assessment as a key tool in the scoping, planning, development, construction and operation of hydropower schemes in Pakistan.

Special Remarks

List of Abbreviations is attached.

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LIST OF ABBREVIATIONS

AEFMP	Aquatic Ecology – Fisheries Management Plan
AFD	Avian Flight Diverter
AoC	Area of Concern
ARMP	Avian Risk Management Plan
BFD	Bird Flight Diverter
CBP	Capacity Building Program
DEBMP	Detailed Ecological Biodiversity Management Plan
DHC	Dasu Hydropower Consultant
DHP	Dasu Hydroelectric Project
DNA	Deoxyribonucleic Acid
DoAM	Director of Archeology and Museums
DTL	Dasu Transmission Line
EMAP	Environmental Management Action Plan
ESA	Environmental and Social Assessment
FMP	Forestry Management Plan
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
KKH	Karakoram Highway N-35
KP	Khyber Pakhtunkhwa
LUCA	Last Universal Common Ancestor
MW	Mega Watts
NTDCL	National Transmission and Dispatch Company Limited
NTFP	Non-Timber Forest Product
PCR	Physical Cultural Resources
PMU	Project Management Unit
SFD	Swan Flight Diverter
SRMP	Social and Resettlement Management Plan
SVD	Spiral Vibration Damper
TEMP	Terrestrial Ecology Management Plan
TOR	Terms of Reference
UIB	Upper Indus Basin
WAPDA	Pakistan Water and Power Development Authority
WCAP	Water Capacity Building and Advisory Services Program
WCMP	Wild Life Conservation Management Plan
WMP	Watershed Management Plan