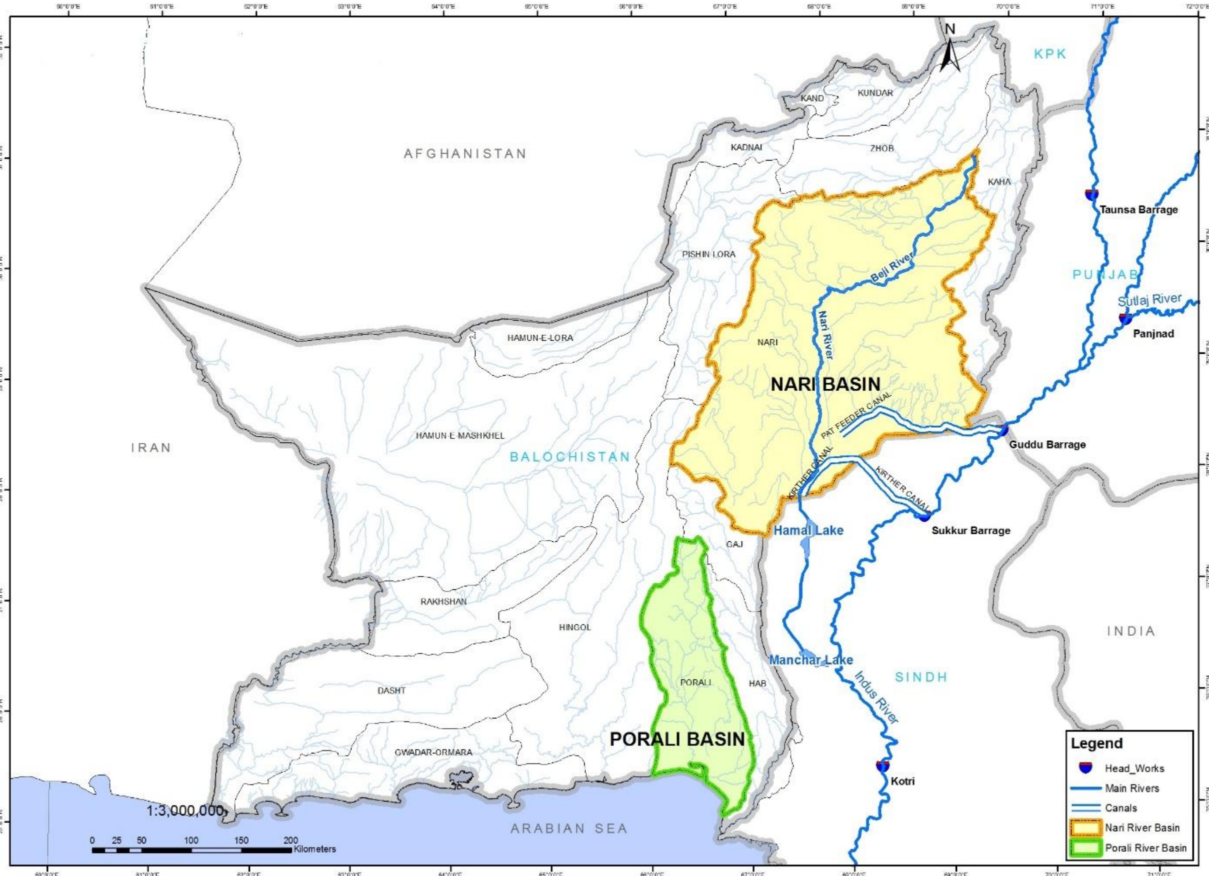
Irrigation Department
Government of Balochistan

Balochistan Integrated Water Resources Management and Development Project



ENVIRONMENTAL ASSESSMENT
Reviewed Draft for Disclosure
January 2016

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List of Acronyms

AASHTO	American Association of State Highway and Transportation Officials	*GFP*	Grievance Focal Points
ADB	Asian Development Bank	*GOB*	Government of Balochistan
AP	Affected Party	*GRC*	Grievance Redress Committee
BAP	Biodiversity Action Plan	*GRM*	Grievance Redress Mechanism
BCM	Billion Cubic Meters	*FO*	Farmers' Organization
BEPA	Balochistan Environmental Protection Agency	*GA*	Government Agency
BID	Balochistan Irrigation Department	*GIS*	Geographic Information System
BIDA	Balochistan Irrigation Drainage Authority	*HEIS*	High efficiency irrigation scheme
BIWRMD	Balochistan Integrated Water Resources Management Development	*HNP*	Hingol National Park
BSSIP	Balochistan Small Scale Irrigation Project	*IEE*	Initial Environmental Examination
CARD	Coastal Association for Research & Development	*IPM*	Integrated Pest Management
CCA	Cultivable Command Area	*IUCN*	International Union for Conservation of Nature
CGM	Community Grazing Monitors	*IBIS*	Indus basin irrigation system
CIA	Cumulative Impact Assessment	*IRBM*	Integrated River Basin Management
CIFO	Community Irrigation Farmers' Organization	*IWRM*	Integrated Water Resources Management
CITES	Convention on "International Trade in Endangered Species	*LAA*	Land Acquisition Act
DAD	Delay Action Dam	*MARPOL*	Convention for the Prevention of Pollution from Ships
DDT	Dichlorodiphenyltrichloroethane	*MEA*	Multilateral Environmental Agreement
EA	Environmental Assessment	*M&E*	Monitoring and Evaluation
ECP	Environmental Code of Practices	*MEC*	Monitoring and Evaluation Consultant
EFA	Environmental Flow Assessment	*MCM*	Million Cubic Meters
EHS	Environmental, Health and Safety	*MDG*	Millennium Development Goals
EHSG	Environmental, Health and Safety Guidelines	*MIGA*	Multilateral Investment Guarantee Agency
EIA	Environmental Impact Assessment	*NCS*	National Conservation Strategy
EMP	Environmental Management Plan	*NEQS*	National Environmental Quality Standards
EPA	Environmental Protection Agency	*NGO*	Non-governmental Organizations
ESMP	Environmental and Social Management Plan	*NRB*	Nari River Basin
ESIA	Environmental and Social Impact Assessment	*NSL*	Natural Surface Level
ESSU	Environmental and Social Safeguard Unit	*OFWM*	On-farm Water Management
FAO	Food and Agriculture Organization	*OHS*	Occupational Health and Safety

FIS	Flood Irrigation Schemes
PAP	Project Affected Person
PCC	Public Complaints Centre
PCRWR	Pakistan Council of Research in Water resources
PEPA	Pakistan Environmental Protection Agency
PEPC	Pakistan Environmental Protection Council
PIS	Perennial Irrigation Scheme
PIU	Project Implementation Unit
PMU	Project Management Unit
POP	Persistent Organic Pollutants
PPE	personal protection equipment
PRB	Porali River Basin
PSC	Project Steering Committee
PSIA	Project Supervision and Implementation Assistance
PSIAC	Project Supervision and Implementation Assistance Consultant
RCD	Regional Cooperation for Development
RSA	Regional Safeguard Advisor
OP	Operational Policy
RSC	Residual Sodium Carbonate
SIA	Social Impact Assessment
SIAMP	Social Impact Assessment Management Plan
STI	Sexually Transmitted Infection
SWAT	Strengths, Weaknesses, Opportunities and Threats
TB	Tuberculosis
TDS	Total Dissolved Solids
TOR	Terms of Reference
UNFCCC	Framework Convention on Climate Change
USBR	United States Bureau of Reclamation
VEC	Valued Environmental Components
WAPDA	Water and Power Development Authority
WC	Watercourse
WEAP	Water Management Evaluation Approach
WUA	Water Users' Association

Conversions

British Units	Metric Units	Metric Units	British Units
1 ft	0.305 m	1 m	3.28 ft
1 mile	1.609 km	1 km	0.621 miles
1 cusec (ft^3/s)	0.283 cumec (m^3/s)	1 cumec (m^3/s)	35.315 cusec (ft^3/s)
1 ac	0.405 Ha	1 ha	2.47 ac

1 Introduction

The Balochistan Integrated Water Resources Management and Development Project (the Project) is a proposed project, by the Government of Balochistan (GoB), for improved water resources planning, management and monitoring by the government, and increased adoption of water-efficient practices and technologies by water users, in targeted communities in the Nari, and Porali river basins of Balochistan covering 80,840 km^2.

The Project has three major components with five sub-components following an integrated water resources management approach including: (i) new irrigation infrastructure and improved irrigation management, (ii) improved agriculture management and promotion of drought tolerant cropping varieties and other productivity measures including pest management to improve soil and water conservation; (iii) better decision making by farmers based on analysis of soil, improved water availability, and weather advisories; (iv) new and improved water supply systems, (v) enhanced flood protection and (vi) improved watershed and rangeland management to improve soil moisture retention, reduce erosion and improve groundwater recharge. These activities not only have a positive impact on environmental sustainability but also build resilience to climate change. A comprehensive Environmental Assessment (EA) has been carried out for the Project and is presented in this report.

1.1 Background

Agriculture is the mainstay of Balochistan economy. About 60% of the GDP and 67% of 13.2 million Balochistan population live in rural areas and mainly depend on agriculture and related activities for their livelihood. The lack of water, severely constrains agricultural development, and only 1.5 million of Balochistan's 35 million ha are under cultivation. Climatic conditions range from dry to hyper-arid, and annual rainfall varies from 80 mm in the west to 250 mm in the east. Soils are mostly thin and calcareous, low in organic matter and prone to erosion. Balochistan farmers can be split between *Khushkaba* - those who grow rain-fed crops and also run small livestock flocks, and *Sailaba* - those who have access to irrigation water and grow irrigated crops.

The main rain-fed crops are wheat, sorghum, rapeseed, mustard and fodder. The main irrigated crops are wheat, rice, apples, apricots, peaches, grapes, pomegranates, dates and vegetables. Only 37% of Balochistan's cultivated land is under perennial irrigation; most of the farmers in the province rely on erratic partial irrigation. An estimated 47% of the population live below the official poverty line (33% nationally). Annual per capita GDP is US$757 (US$1,297 nationally), literacy rate is 50% (58% nationally) and less than 15% of people have access to safe water supply. In Pakistan, agriculture accounts for 20.88% of GDP and 43.5% of employment in the fiscal year of 2014-15. Agriculture GDP consists of 32.8% major crops, 11.1% minor crops, 53.2% livestock, 2.9% fisheries and forestry. Through its production, agriculture contributes 60% to the country's export earnings and 45% of the nation's labor force. Pakistan is among the top 20 global producers in over 48 different agricultural commodities including rice, sugarcane, wheat and cotton.

Irrigation is critical for agriculture in Balochistan. There are 18 river basins in Balochistan. Surface water from Indus basin irrigation system (IBIS) mainly contributes irrigation scheme in Balochistan. In addition, flood flows, perennial base flows in rivers, subsurface flow through river gravels, springs and groundwater also support small scale irrigation schemes. The estimated total perennial irrigated area during the fiscal year 2013-14 was 1.08 million ha of which 40% is irrigated by the Pat Feeder, Desert and Khirthar canals from the Gudu and Sukkur barrages on the Indus River. Private canals irrigate 0.13 million ha and tubewells and dug wells irrigate 0.42 million ha and 0.05 million ha, respectively. Karezes, springs and minor irrigation sources irrigate 0.05 million ha (Pakistan Bureau of Statistics, 2015).

Spate irrigation (traditionally known as Sailaba farming) remains common as is rainwater harvesting (Khushkaba). Area under Sailaba and Khushkaba irrigation is about 0.87 million ha (Agricultural Statistics of Pakistan, 2011). Therefore, the total irrigated areas become about 1.95 million ha. Sailaba and Khushkaba farming are dependent on occasional rainfall and floods. There are significant opportunities exists for spate irrigation if additional floodwaters are effectively diverted; prospects exist at Nari, Porali, Kaha, Hingol, Zoab and Rakhshan River basins. Spate Irrigation has dual purposes, it can support agriculture production and also recharges groundwater and helps mitigate flood damages. There is huge potential for rainwater harvesting across Balochistan to the benefit of poor remote settlements.

Need for improvement in Water Resources Management. The poor coverage and reliability of hydro-meteorological data is preventing effective planning and management of water resources. Much of Balochistan has no groundwater monitoring network, despite the critical status of the groundwater resources, and the surface water data monitoring network is inadequate. The institutions lack expertise in hydro-meteorological monitoring, field sites are remote, field staffs are under supervised and data transmission infrastructure are inadequate.

Annual average rainfall in Balochistan is less than 200 mm, with as few as 7 rain days per year in the desert areas and a maximum of 28 rain days in the mountain areas. Annual average surface water generated in Balochistan is around 10.8 billion m^3 of which around 21% is utilized. Around 8 and 13% of the surface water are utilized in the Porali and Nari river basins, respectively. This low utilization of surface water is due to the lack of limited storage and diversion infrastructure especially for the episodic flood flows. Under the Water Apportionment Accord of 1991, Balochistan has a water allocation of around 5.7 billion m^3 of floodwaters and a further allocation of 4.8 billion m^3 from perennial canals of the Indus Basin Irrigation System.

Due to the inadequate and poorly maintained canal infrastructure, only 36% of this combined allocation is utilized. Major portion of the water is lost along the inefficient conveyance and on-farm application. Unreliability of surface water and the dilapidated water infrastructures, groundwater became a critical water resources in Balochistan. Intense rainfall events, deforestation, and virtually no mechanism to naturally recharging groundwater table and episodic and over-exploitation of groundwater is leading to rapid decline of groundwater tables. Investing in new water infrastructure and rehabilitation of existing facilities are urgently needed to address critical state of agriculture, food security, and economic development in the province.

Severe drought condition with a 4-5 year frequency is dominant in Balochistan. Intense dry periods take heavy toll on the livelihood patterns of the local population as irrigation and potable water resources run dry. Water availability is drastically reduced during extended droughts.

Loss of life and destruction of settlements and irrigation infrastructure during the 2010 floods and 2007 and 2011 cyclones led to significant reduction in agricultural production. The lack of adequate water storage facilities, flood retention areas as well as flood protection dykes exacerbated the damages experienced during those years – and will cause damages again in the future. To minimize flood risk, construction of storage facilities and flood protection works are very urgent.

To improve the long-term sustainability of the environment and livelihoods of local communities, changes in current landuse practices and associated resource use are required. Currently, watersheds in the province are in a very poor and derelict state. Major investments are required to rehabilitate the watersheds in close collaboration with local communities and the Departments of Agriculture, Irrigation, and Forestry. This will make major improvements on rangeland and ground water recharge. Environmental protection activities through community involvement is needed to conserve protected areas especially Juniper forests and Mangrove forests, and protecting riverine flora along major rivers and streams.

Inefficient irrigation practices, such as, flooding orchard fields, by reducing water use efficiency to below 30% and unlined water conveyance channels from the source to the farms, causing seepage losses of up to 45 to 50% in the system are some of the bottlenecks of the water productivity.

Effective water management in Balochistan is highly dependent on governance, institutional capacity, institutional set up, and political will and commitment by the public sector. Irrigation service delivery is currently managed independently among the agriculture and irrigation sectors without proper collaboration. At the community level, little interaction or information exchange among communities and the Government of Balochistan (GOB) are present, on available options to them to increase water productivity in a long-term.

River flows are highly dependent on the global climate change, including changes in glacial melt, temperature, and precipitation patterns. This phenomenon tends to increase the frequency of floods and droughts. Analyses conducted by various projects concluded that all rainfall/snow-fed rivers will have significant reduction in long-term discharge. Glacier-fed rivers will increase their discharges by 10-15 percent through 2050 but thereafter also significantly reduce their discharges due to the disappearance of glaciers in the Hindu Kush-Himalayas.

Climate change and the issues highlighted above on inadequate water management, followed by the population growth, urbanization, mining, and industrialization in the future will exacerbate scarcity of water in Balochistan. With a 3% population growth, Balochistan's population will grow by 50% and the urban population will double by 2025. In addition, the mining sector, which is the driving force of future economic growth in Balochistan, will require water, further aggravating the resource scarcity. In this context, the GOB adopted the IWRM approach in 2005 for formulating a policy including sixteen policy thrust areas, which are essential for improving and sustaining the management of surface and groundwater resources in the province.

1.2 The Proposed Project

A detailed feasibility study of the Integrated Water Resources Management and Development Project, including Environmental and Social Impact Assessments, has been prepared during 2013-2014 by Pakistani consulting firms. Financial assistance for the study was provided by the World Bank under the Balochistan Small Scale Irrigation Project (BSSIP). Balochistan Irrigation Department (BID) is the executing agency of the Project. In addition, BID also recruited a group of Independent Consultants, who submitted an EIA in November 2015 for the World Bank review and approval.

Location: The project is located in the Nari and Porali River Basins (Figure 1.1). The Nari River Basin (NRB) is sub-divided into six sub-basins: Loralai (5,505 km^2), Khost (4,974 km^2), Beji (10.859 km^2), Chakar-Lehri (23,095 km^2), Mashkaf-Bolan (9,531 km^2) and Mula (15,259 km^2). The total area of NRB is 69,224 km^2 and it is the largest river basin in the province. The PRB covers 11,616 km^2 of land spreaded over three districts of Balochistan: Khuzdar District (6,167 km^2 or 53.1%), Lasbela District (4,813 km^2 or 41.4%) and Awaran District (637 km^2, 5.5%).

Project Components: The proposed project has three major components:

- *Component A: Institutions, Capacity and Information.* Sub-Components: A1 Institutional Strengthening and Restructuring, A2 Hydro-met Data Collection and Management.
- *Component B: Sector Sub-projects.* Sub-components: B1 Infrastructure Sub-projects; B2 Watershed and Rangeland Management; and B3 On-farm Water Management and Agricultural Productivity.
- *Component C: Project Management and Technical Assistance.* Component C has four sub-components. The first three will support overall project implementation and management activities by the Project Management Unit (PMU), and the fourth supports

(i) Monitoring and Evaluation consultants, (ii) Project Supervision and Implementation Assistance (PSIA) consultants, and (iii) completion of various management plans and studies, preparation of feasibility studies for other basins and implementation of Environmental Management Plan, Social Management Plan, Resettlement Policy Framework, Grievance Redress Mechanism and Gender Action Plan.

The physical works proposed under the Project are as follows:

- The perennial irrigation schemes under the project mainly include construction of off take structures from main river, channel lining, construction of outlets, construction of water distribution structures and cross drainage works.
- The Spate irrigation component comprises of a) construction of weir-controlled floodwater diversion systems including the headwork; b) main canal, distributaries and watercourses for distribution of water to the command area; and c) development of command area and Spate farming in the system.
- The flood protection works comprise construction of (i) earthen bunds with rip rap, (ii) earthen spurs with stone pitching, and (iii) gabion structures. Collectively, across the two river basins, these flood protection works will protect 14,400 ha from erosion, protect 3,220 homes of poor families, and benefit 4,500 farming families through minimizing damage to agricultural land.
- The water supply scheme of the project envisages development of 16 village water supply schemes. The works mostly consist of construction of intake structure and overall rehabilitation and remodeling of some existing schemes. Many of these water supply schemes use the common intakes of the irrigation head works or structures proposed under Irrigation Water Supply component. The schemes will supply potable water to about 29,000 people.

Implementation of the project: The project will be implemented over a period of six years at a total estimated cost of US$253.72 million including financing from the International Development Agency (US$205.56M), the International Fund for Agricultural Development (US$38.06M) and the Government of Balochistan (US$10.11M).

1.3 The Environmental Assessment

Studies and basic data: This EA is based on field studies and data collected between 2013 and 2014 by the consultant team charged with the feasibility study and design of the project and their report on Environmental Impact Assessments (EIA) and Social Impact Assessments (SIA) of both Nari and Porali River Basins under the Balochistan Small Scale Irrigation Project. A team of independent consultants was retained by BID to validate design consultants reports and prepare independent EA report as per guidelines of World Bank. In addition, World Bank recruited two advisors to provide technical support in finalizing the contents of the Independent EIA. The role and scope of work of the independent consultants is described further in section 1.5 below.

Contents of the present document: This EA document contains a project description as presented in Chapter 2, followed by a description of the Balochistan and Pakistani legal and administrative framework and the applicable World Bank policies, and gap analysis between local legislation and World Bank policies in Chapter 3, followed by a discussion of project alternatives in Chapter 4. A description of the physical, biological and socio-economic baseline is presented in Chapter 5. Potential adverse effects of the project including climate change impacts and risks are described in Chapter 6 and potential cumulative impacts and concerns associated with selected valued environmental components are presented in Chapter 7. Possible mitigation measures to offset, reduce or compensate potential negative impacts of the project are included in the Environmental Management Plan (EMP) that is summarized in Chapter 8. Finally, Chapter

9 provides an overview of all stakeholder consultations and activities for disclosure and access to the information.

1.4 Study Area

The project area consists of two river basins Nari and Porali. The total geographic area consists of 80,840 km^2 spreaded over in 21 districts. The Nari Basin lies between latitudes 29^0 40’ and 31^0 00’ N and longitudes 67^0 10’ and 69^0 45’E; and the Porali Basin lies between latitude 24^0 53' to 26^0 42'N and longitude 65^0 15' to 67^0 27'E.

1.5 Composition of Study Team

Independent Advisors: The World Bank retained two independent advisors – Dr. Masud Karim/Lead Environmental Specialist and Ms. Ishanlosen Odiaua/Environment Specialist to review previous studies and independent ESIA, assess the environmental and social impacts of the project, and to support local counterparts in the preparation of this main EA report and an Executive Summary. During the EA process, the independent advisors regularly interacted with the independent consultants and PMU, reviewed all previous reports and comments of Regional Safeguard Advisors (RSA) on the independent ESIA and conducted their independent analysis and impact assessment.

Independent consultants: The Project Management Unit of Balochistan Irrigation Department retained a team of independent consultants – Mr. A.F. Babar Sani, Ms. Mehrunisa Malik, and Ghulam Muhammad – to review previous EIAs and SIAs prepared by the feasibility and design consultants and develop an independent ESIA in compliance with both national regulations and the World Bank policy guidelines.

Environmental and social study team (Feasibility and Design Consultant): The study was conducted by a team of specialists in environment, social and gender. The team members of Nari River Basin ESIA study included Dr. Shahid Ahmad/Team Leader, Mr. Arshad Dasti/Environmental Expert, Mr. Naimatullah Khan/Senior Social Sciences Expert, Miss Maliha Samiullah/Gender Expert, Miss Mehnaz Hafeez/GIS Expert, Mr. Saadullah Tareen/Social Organizer, Mr. Ahmad Shah/Social Organizer, Mr. Saadullah Yousafzai/Social Organizer, Mr. Sar Anjam/ Social Organizer, Ms. Saima Umer/Social Organizer and Porali River Basin EIA and SIA included Mr. Ibad ur Rehman/Team Leader, Mr. Kashif Masud/Environmental Engineer, Mr. Rafi ul Haq/Ecologist.

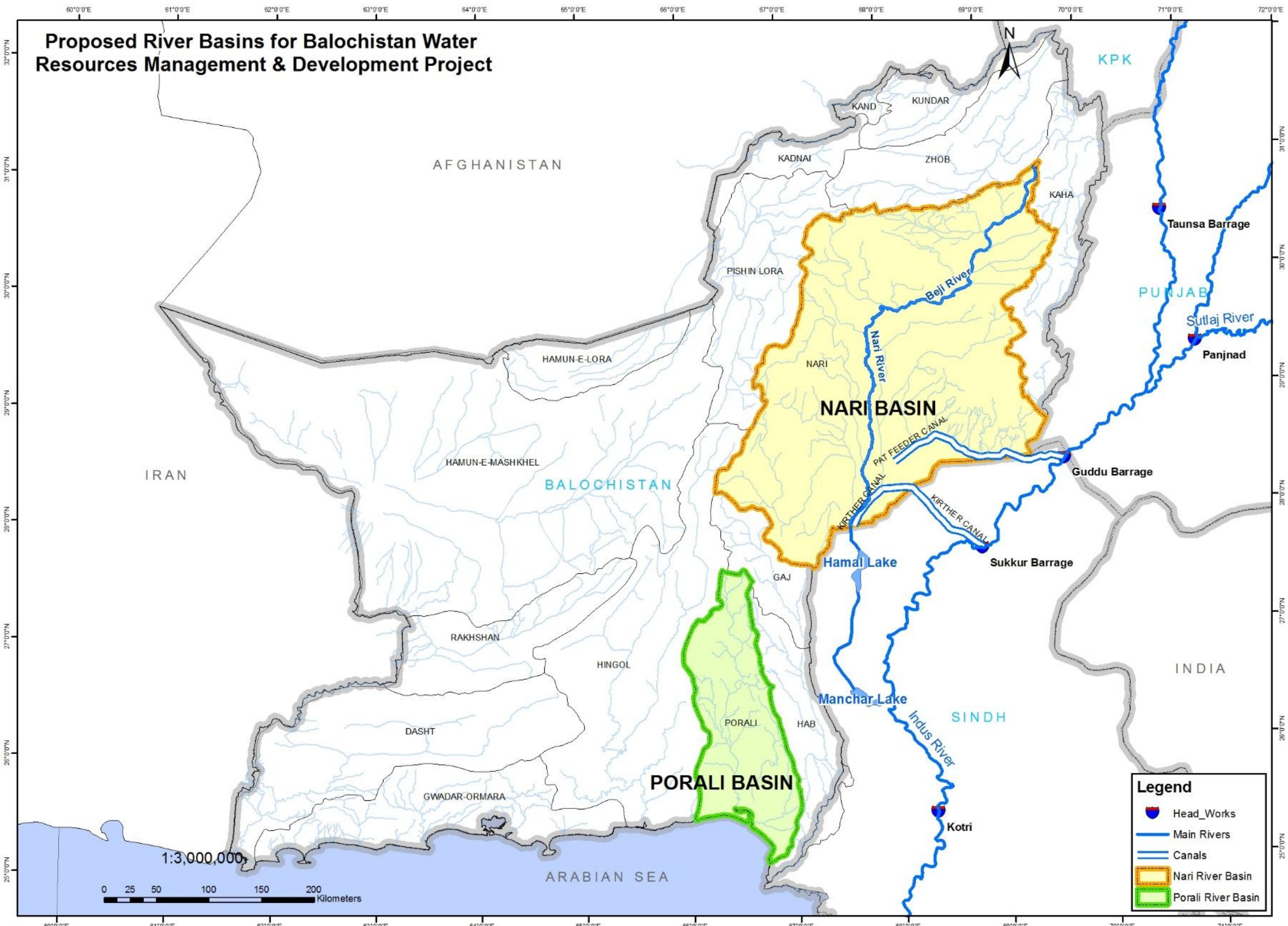

Figure 1-1: River Basins under the Project.

2 Project Description

2.1 Background

The current situation of water sector in Balochistan includes: wasteful use with extremely low productivity of water in agriculture; investments largely concentrated for a smaller segment of the farming community ; depriving the larger segment of the community and resulted in inequitable distribution of scarce financial resources in the form of subsidy to electric tubewells; lower returns on investments; and causing serious inter-generational issues for having access to scarce resources of groundwater. The potential opportunities for managing and sustaining scarce water resources covering all sources of water (surface and groundwater) and all sub-sectors of water use (domestic, agriculture, mining and nature) to ensure welfare of the society, as a whole.

Perennial Irrigation Schemes (PIS): The majority of the Perennial Irrigation Schemes within the project are three ogee weirs along with the off takes and irrigation channels, as well as off take schemes. The project will focus on the improvement and increment of the existing command area. Distribution of land and water shares on the schemes will remain same as existing, thereby providing a highly conducive environment for community participation activities. Typical civil works on PIS comprise main weir body, off take structure, conveyance channel, river training and auxiliary structures including siphons, washing pads, and animal drinking points. Associated community managed watershed improvement, rangeland rehabilitation and On-farm Water Management (OFWM) interventions will be undertaken as an integral part of PIS development. The option of high efficiency irrigation scheme (HEIS) will also be considered on PIS.

Flood Irrigation Schemes (FIS): Flood Irrigation is the most common irrigation practice found in the River Basins. Large land areas are cultivated under flood water every season. Flood diversion or Spate Irrigation System is defined as “diversion of floodwater through natural, earthen or weir regulated structures and channelized into a water conveyance network for delivery to the command area as per agreed water rights and allocation rules”. This diversion not only provides water for irrigation but also reduces the flood intensity for the downstream areas. Spate Irrigation is a traditionally used system for diverting hill torrents into cultivable command areas for growing seasonal crops. It usually entails the construction of an earthen diversion weir across the torrent with large channels on one or both sides of the river to convey flood water across large distances. In line with the traditional system, a properly designed system provides greater control over the flood flows and includes a concrete weir, sediment exclusion skimming weir and sluice, flow regulator and limiter on off taking flood canals, and sediment settling basin. The site of the weir is usually selected at a point where the gradient of the flood torrent is not so steep that its momentum becomes uncontrollable.

Potable Water Sources: The ground water potential for water supply in some districts is good and in some it is getting difficult due to the lowering of water table. In remote areas, women fetch water from long distances, the selection of sites for hand pumps, water tanks etc. and in most of the remote area, water is extracted from wells through the use of ropes attached to pulleys, pulled out either manually or by camels or donkeys. Donkeys and camels are generally used to draw water from the dug wells due to low water level. Also the people are using water from the rivers and rain water storage. The project envisages development of 16 village water supply schemes. The works mostly comprise construction of intake structure and overall rehabilitation and remodeling of some existing schemes. Many of these water supply schemes use the common intakes of the irrigation head works or structures proposed under Irrigation Water Supply component.

Watershed and Rangeland Management: Rangeland ecosystems have vital role in Balochistan due to many direct services to the society like food, forage, medicines, fuel, building materials, industrial products, and indirect services of maintaining the composition of the environment, mitigating climate and moderating weather, fertilizing and stabilizing soils, disposing of wastes, cycling nutrients, storing and purifying water. Rangelands degradation in Balochistan is a major issue and affecting not only the direct users of pastoral communities but many others benefiting from the environmental services. Some of the indicators of rangelands degradation include reduction in vegetation cover, above ground plant productivity, soil erosion, elimination of soil seed bank, and shift in species composition. Rangeland degradation is site specific due to spatial, temporal variation of vegetation and utilization practices. Rangeland productivity in Balochistan is substantially affected due to non-existence of grazing management practices, low and erratic rainfall distribution, and over exploitation of natural resources. Major range management issues in Balochistan include: open range areas, no clear land ownership, weak community participation, recurrence of drought, and lack of integrated range management approaches. Rangeland management activities under the project will focus on biomass production and controlled grazing will be introduced by leaving and stocking rates limited for sustainable rangeland use.

2.2 Project Objective

The main project objective is to develop and manage integrated water resources management (IWRM) schemes in the Nari and Porali river basins in Balochistan to ensure the sustainability of the natural resources within the framework of overall Integrated River Basin Management (IRBM). The IWRM schemes aim to provide sustainable and diversified livelihoods, through integrating watershed management with all land use systems, including irrigated agriculture in command areas, spate irrigation in downstream areas, and Khushkaba farming.

The development objectives of the project include improving water resources planning, management and monitoring by government agencies and increased adoption of water-efficient practices and technologies by water users in targeted communities in the regions.

2.3 Project Description by Components

The project has three major components, (a) Component A: Institutions, Capacity and Information, (b) Component B: Sector Sub-projects, and (c) Component C: Project Management & Technical Assistance. The potential design options for physical activities include Spate and Perennial Irrigation Schemes, Watershed and Rangeland Management activities and Command Area Development, development of Potable Water Schemes for the rural population and flood protection works.

The Spate irrigation component comprises the following:

- Construction of weir-controlled floodwater diversion systems including the headwork;
- Main canal, distributaries and watercourses for distribution of water to the command area; and
- Development of command area and Spate farming in the system.

The Perennial Irrigation Schemes are based on sources of surface and groundwater (springs and Karezes) and comprise the following:

- Construction of off take structures from main river, channel lining;
- Construction of outlets; and
- Water distribution structures and cross drainage works.

2.3.1 Component A: Institutions, Capacity and Information

Component A lays the foundation for a gradual transition to IWRM in Balochistan and has two sub-components: (i) A1 Institutional Strengthening and Restructuring, and (ii) A2 Hydro-meteorological Data Collection and Management. This component supports institutional restructuring and installation and operation of a hydro-meteorological system. It will determine appropriate institutional arrangements for the initial stages of IWRM in Balochistan and recommend a realistic trajectory for institutional change. Under the component, appropriate institutional arrangements for IWRM will be determined and implemented progressively over the life of the Project.

A hydro-meteorological observation network will be established in the two river basins including (i) telecommunication equipment, (ii) software for data transmission and analyses, (iii) storage conversion of the data into the needed information and (iv) training in network operation and maintenance (O&M). The component will also establish a data center in Quetta and data reception units in the two basins.

Professional development will enable a transition to IWRM, such as the establishment of new and more effective institutions capable of proper planning and management of water resources. Suitable institutional arrangements for IWRM will be determined and progressively implemented during the Project..

2.3.2 Component B: IWRM Sub-projects

This component supports the establishment of IWRM related investments within a framework of community mobilization and participation in the Nari and Porali basins. These investments include: construction and/or rehabilitation of irrigation and potable water supply facilities; flood protection infrastructure; watershed and rangeland management and on-farm water management and agricultural productivity activities. Below the sub-components are discussed in more detail.

Sub-component B-1: This sub-component will include irrigation, water supply and flood protection infrastructure. The objective of the schemes is to develop and implement cost-effective interventions of water resource management and development both in investment and O&M. This will enhance agricultural productivity and develop new livelihoods for the water users and vulnerable groups using an Integrated River Basin Management approach. In this sub-component, eight irrigation schemes will be implemented. Four schemes will be implemented in Nari and four in Porali. The schemes will be implemented across 127,949 hectares, benefiting farming families (around 48,100 households). The development work includes remodeling of the headwork and secondary canals, command area development in perennial irrigation, spate irrigation/sailaba, and rainwater harvesting/khushkaba irrigation areas, and construction of access farm tracks. In addition, the project will support construction and rehabilitation of 16 village water supply schemes, which will provide potable water supply to about 29,000 people (4,174 households).

In Balochistan, flooding has always been a major concern, especially in the project area. High-intensity rains in the upper steep catchments tend to generate high-energy flash flooding in the area. Since very little investment has been made in flood protection works to-date, there is an urgent need for flood protection works in five districts in Nari and two districts in the Porali Basin. Seven schemes are envisioned for the Nari Basin and five are envisioned for the Porali River Basin. The funding will be allocated as 60% for the Nari schemes and 40% for the Porali schemes. Across the two river basins, the flood protection works are expected to protect 14,600 ha of farmland, 4,100 homes of low-income families and 4,500 farming families through minimizing damage to agricultural land. In total, 10, 200 households will be benefited. The proposed works will also protect 31 km of village road network with 18 bridges and culverts and many irrigation infrastructures from 25% probability of floods (i.e., on average floods occur every four years).

The proposed construction works will comprise of (i) earthen bunds with rip-rap, (ii) earthen spurs with stone pitching, and (iii) gabion structures. Table 2-1 shows the details of the flood protection works in Nari and Porali River basins.

Table 2-1: Details of Flood Protection Works

S.I	Name of Scheme/ Details	District
Nari River Basin		
1	Flood protection of agricultural land and villages on both banks of Loralai River	Loralai
2	Flood protection structures on both sides of the Anambar River and allied active creeks Duki Area	Loralai
3	Flood protection/river training works Mithri, Haji Shahar, Erri, Ghazi & Touk	Bolan
4	Flood protection works village Doopasi along Bolan River	Bolan
5	Flood protection works village Talli, Ghulam Bolak	Sibi
6	Flood protection works village Tariq Abad and surrounding areas	Jhal Magsi
7	Flood protection of Baba Kot, Umrani village and surrounding areas	Naseerabad
Porali River Basin		
1	Construction of flood protection bunds along Porali River Bela	Lasbela
2	Construction of flood protection wall for Sathey Bent at Porali River Wadh	Khuzdar
3	Construction of flood protection wall for Bizenjo Bent at Porali River Wadh	Khuzdar
4	Construction of flood protection wall for Bent Mohammadzai at Wadh	Khuzdar
5	Construction of flood protection wall for Sello Bent at Porali River Wadh	Khuzdar

Sub-component B-2: This sub-component will support a participatory approach to (i) watershed management at irrigation scheme level and (ii) rangeland management focusing on biomass production.

Watershed management activities will be undertaken in both Project river basins. Activities will include, (i) soil and water conservation measures (i.e., contour ridges, mulching, strip farming, wind break plantations, drainage improvement network and etc.); (ii) block plantations for fuel-wood/small timber production for local subsistence and (iii) shelter-belt plantations in order to reduce sheet erosion and losses from evapo-transpiration. Trees will also be planted along canals and around ponds and community plantations will be established for habitat improvement. In NRB, plantations areas are planned for Yetabad (10,000 ha), Nari Gorge (6,070 ha), Sehan (810 ha) and Mushkaf (1,620 ha). In PRB plantation, target areas include Khuzdar District and the areas of the Nami-Lasbela, Gundacha/Narg, Hingri, Lasbela and Sheb-Medan. Priority will be given to ensuring benefits for families participating in soil and water conservation work. Watershed management activities at irrigation scheme level will also include the improvement of the natural drainage network, soil-water conservation measures and the rehabilitation of irrigable land endangered or degraded by erosion gullies.

Rangeland management activities will focus on biomass production and will be either "regulation" activities or planting activities. Regulation activities include (i) preventing grazing on degraded land, (ii) protecting areas with good natural regeneration potential, (iii) reseeding/sowing rangelands with palatable species, (iv) establishment of grazing management plans based on carrying capacities, and (v) construction of watering ponds for livestock. Planting activities include (i) planting of palatable shrubs and trees and (i) reseeding of grass as well as introduction of stall feeding based on fodder production. The total number of beneficiaries under the sub-component is expected to be around 280,000. Table 2.2 shows the activities to be carried for watershed and rangeland Improvement under this sub-component.

Table 2-2: Activities for Watershed and Rangeland Improvement

Watershed Management Interventions	Intervention Details
Catchment Area Activities	
Grazing Management	Demarcation of Community Rangeland Area.
	Grazing Management through Community Grazing Monitors (CGM).
Rangeland Improvement	Planting of fodder species through Water Harvesting Techniques.
	Annual re-seeding.
	Stock Water Pond.
Soil & water Conservation	Construction of loose and pack stone check structures.
	Construction of Gabion structures.
Khushkaba & Spate Area Activities	
	Fuel-wood Plantation on Water Harvesting Techniques.
	Shelter-belt plantation.
	Plantation along water channels and around water storage ponds.
	Village and Community plantation.
	Commercial value plants, etc.
Supporting Activities	Nursery Hut & Seed Store.
	Nursery Tunnel/ Shade.
	Water Resource Development for Nursery.
	Seed collection for range land & forestry activities.
	Plant production for range land and afforestation activities.
	Purchase of Plants.

2.3.2.1 Nari River Basin

In the Nari Basin, spate irrigation systems will be implemented in Yetabad, Sehan, Mushkaf and two minor spate systems (namely Arrand and Bori) in Nari Gorge. Nari Gorge will also have a perennial irrigation scheme. Figure 2-1 shows the locations of the irrigation schemes. The four Irrigation schemes that will be implemented in Nari basin are discussed in more detail below.

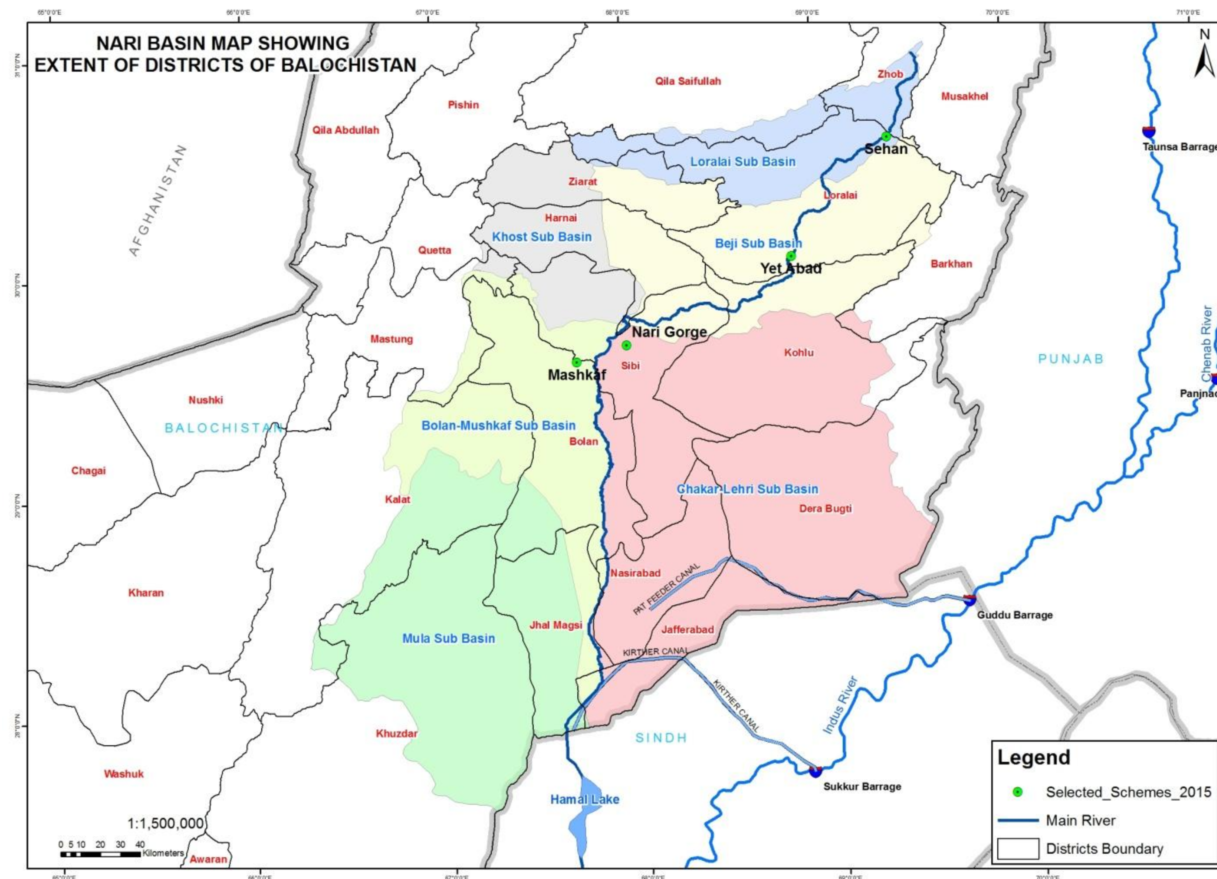

Figure 2-1: Irrigation Schemes in the Nari Basin

(a) Yetabad Flood Irrigation Scheme: This scheme will be implemented in Yetabad FIS, which is located between latitudes 30° 06' to 30° 31' N and longitudes 67° 47' to 68° 41' E in the Beji sub-basin of NRB along the boundary of Duki city. The total area of the sub-project will encompass 1,470 km^2. The area is connected to Quetta and D.G. Khan by roads.

About 836 ha of land have tube-well/dug-well irrigation, the total area under spate irrigation is about 1,903 ha and the area under Khushkaba farming is approximately 3,634 ha. An assessment of the availability of floodwater for the Spate irrigation system in Yetabad showed that water is available at 50% probability in the spate irrigation system and is 111.87 million m^3. With distribution of 80.25 million m^3 in the Kharif season and 31.62 million m^3 in the Rabi season. The water available for diversion for the Yetabad Flood Irrigation scheme is about 41.1 and 21.2 million m^3 during the Kharif and Rabi seasons, respectively. The total divertible water for Spate irrigation is around 62.28 million m^3.

The proposed spate irrigation system will provide benefits to more than 674 households having a total population of 7,093, with a command area of 16,194 ha in Yetabad. A designed cropping intensity of 150% will provide a cropped area of 24,292 ha per annum. The main components of the spate irrigation system will include:

- Construction of main weir, sluice, head regulator and guide bund;
- Construction of conveyance system comprising of 21,500 m of main canal and 51,640 m of distributaries;
- Construction of 10 flow regulators and 172 outlets;

- Construction of cross drainage box culverts; and
- Construction of a staff quarter and office/residential buildings.

Table 2-3 shows the details and specifications of the proposed spate system in Yetabad.

Table 2-3: Engineering Details of the Proposed Spate System of Yetabad

Component		Details
Weir		
Type		Broad Crested
Width of Weir, m		610
Length of Stilling Basin, m		22.78
Design Discharge (Q), cumec 100 year		7071
Free Board, m		1.22
Sluice		
Width, m		18.30
Length of Stilling Basin, m		22.38
No. of Gates		5, Size 3.18m X 2.63m
Discharge Capacity, cumec		424.6
Head Regulator		
Width, m		22.06
Length of Stilling Basin, m		23.16
No. of Gates		5, Size 3.93m X 2.18m
Discharge Capacity, cumec		42.48
River Training Works		
Type		Earthen
Top Width, m		7.00
Side Slope (H:V)		2:1
Length, m		927
Main Canal		
Design Discharge, cumec		42.48
Total Length, m		21,500
Bottom Width, m (Start Point – End Point)		22.06-3.88
Bed Slope, % (Start Point – End Point)		0.00016-0.00016
Side Slopes	Internal	2:1
	External	1:1
Top Width, m		3.00 to 4.00
Side Slops		1;1
No. of Cross Regulators		10
No. of Distributaries		10
Total Length, m (Distributaries)		51,640
No. of Fall Structures		34
Cross Drainage Box Culverts		33
Road Crossing Culverts		24

(b) Nari Gorge Integrated Scheme: This scheme comprises a perennial canal irrigation system, having six branch canals and sub-branches that cover Looni, Bukhra Ghulam Bolak, Khajjak, Kurrak, Dehpal and Marghazani. Also, there are two small-scale spate irrigation systems namely Arrand and Bori. The sub-project is located in the Chakar-Lehrisub-basin of the NRB, along the boundary of Sibi city. The area lies between latitudes 29° 28' to 29° 41' N and longitudes 67° 10' to 68° 20' E. The area is connected with Quetta, Jacobabad and Sakkar. The potential command area of the perennial irrigation is about 40,000 ha, out of which about 6,990 ha are cropped.

The availability of perennial water is approximately 3.4 m^3/s which is enough to provide irrigation to around 17,840 ha of command area using a cropping intensity of 133%. The average floodwater has been assessed for the two small-scale spate irrigation systems, which is around 1.8 million m^3. A design command area of 607 ha is taken so that in the wet year all floodwater can be utilized without affecting the canal irrigation system.

The major components of the sub-project include remodeling of the existing perennial irrigation system and development of two spate systems. The Perennial irrigation system is to be remodeled in order to increase the cropped area from 6,990 to 17,840 ha by reducing application losses in unleveled fields and water conveyance. Table 2-4 shows the details of the channel lining and associated works in Nari Gorge.

Table 2-4: Details of Perennial Conveyance Systems of Nari Gorge

Name of PIS channels	Design Discharge (Cumecs)	Total length	Distribution Structure	Super passage	Nuka	Road culverts	Flow/Time Division	Inverted Syphon	Tail structure
Looni Branch including Sub-Branches	0.024 - 0.189	8,114	1	-	130	20	-	3	-
Bukhra Ghulam Bolak Branch including Sub-Branches	0.047 - 0.094	3,125	-	-	6	5	-	-	-
Khajjak Branch including Sub-Branches	0.024 - 0.755	44,801	1	33	79	20	-	3	-
Kurrak Branch including Sub-Branches	1.667	8,190	1	-	2	6	-	2	1
Dehpal Branch including Sub-Branches	0.024 - 0.378	33,224	1	6	74	26	5	1	-
Marghazani Branch including Sub-Branches	0.083 - 0.566	39,870	1	6	16	5	-	1	-

The two small-scale Spate irrigation systems are designed to command 608 ha and control flood waters in wet years so that the perennial canal system is not affected. The systems are designed to provide benefits to over 539 households (total population of 5,387). With a designed cropping intensity of 133%, the perennial irrigation command will provide a cropped area of 23,726 ha and the Spate irrigation system with cropping intensity of 100% will provide a cropped area of 608 ha. Thus, the total cropped area will be 24,334 ha. Table 2-5 provides the details of spate irrigation component of the scheme.

Table 2-5: Structural Component of the Nari Gorge

Dispersal Structure/ Description	Branch (Left)	Main (Right)
Structure Details		
A. Arrand **A1. Bifurcation Structure 1**		
Type	Broad Crested	Broad Crested
Width of Weir, m	5.00	10.00
Length of Stilling Basin, m	16.27	16.27

Dispersal Structure/ Description	Branch (Left)	Main (Right)
Design Discharge (Q), cumec	30.30	30.87
Free Board, m	0. 60	0.60
A2. Bifurcation Structure 2		
Type	Broad Crested	Broad Crested
Width of Weir, m	5.00	5.00
Length of Stilling Basin, m	16.22	16.22
Design Discharge (Q), cumec	15.43	15.43
Free Board, m	0.60	0.60
B. Bori		
B1. Bifurcation Structure 1		
Type	Broad Crested	Broad Crested
Width of Weir, m	6.00	6.00
Length of Stilling Basin, m	16.22	16.22
Design Discharge (Q), cumec	18.75	18.75
Free Board, m	0.60	0.60
B2. Bifurcation Structure 2		
Type	Broad Crested	Broad Crested
Width of Weir, m	4.00	4.00
Length of Stilling Basin, m	16.22	16.22
Design Discharge (Q), cumec	9.37	9.37
Free Board, m	0.60	0.60
River Training Works		
A. Arrand		
A1. Bifurcation Structure 1		
Top Width, m	3.00	3.00
Side Slopes (H/V)	2:1	2:1
Length of Shank, m	80.00	80.00
Pitching thickness in Slope, m	0.75	0.75
Pitching thickness in Level, m	1.42	1.42
Length of Head, m	45.00	45.00
Pitching thickness in Slope, m	0.75	0.75
Pitching thickness in Level, m	1.42	1.42
A2. Bifurcation Structure 2		
Top Width, m	3.00	3.00
Top Level, m	156.50	156.50
Side Slopes (H/V)	2:1	2:1
Length of Shank, m	97.92	97.92
Pitching thickness in Slope, m	0.75	0.75
Pitching thickness in Level, m	1.42	1.42
Length of Head, m	34.00	34.00
Pitching thickness in Slope, m	0.75	0.75
Pitching thickness in Level, m	1.42	1.42
B. Bori		
B1. Bifurcation Structure 1		
Top Width, m	3.00	3.00
Side Slopes (H/V)	2:1	2:1
Length of Shank, m	96.82	96.82
Pitching thickness in Slope, m	0.75	0.75
Pitching thickness in Level, m	1.40	1.40
Length of Head, m	36.30	36.30
Pitching thickness in Slope, m	0.75	0.75
Pitching thickness in Level, m	1.40	1.40
B2. Bifurcation Structure 2		

Dispersal Structure/ Description	Branch (Left)	Main (Right)
Top Width, m	3.00	3.00
Side Slopes (H/V)	2:1	2:1
Length of Shank, m	96.82	96.82
Pitching thickness in Slope, m	0.75	0.75
Pitching thickness in Level, m	1.40	1.40
Length of Head, m	36.00	36.00
Pitching thickness in Slope, m	0.75	0.75
Pitching thickness in Level, m	1.40	1.40
Conveyance System	**Arrand**	**Bori**
Main Canal		
Design Discharge, cumec	15.43 - 30.86	18.47 - 37.94
Total Length, m	1,393.00	953.00
Bottom Width, m	10.00 - 15.00	8.00 – 11.00
Bed Slope, %	0.00015-0.00017	0.00015-0.00017
Side Slopes (H/V)	2:1	2:1

(c) Sehan Flood Irrigation Scheme: This scheme lies between latitudes 30° 25' and 30° 55' N and longitudes 69° 15' and 69° 36' E, in the Loralai sub-basin close to Mekhtar city in Loralai District. The area is connected with Quetta and D.G. Khan with roads and the total geographical area spanned is about 642 km^2.

The current cropping pattern in the area is mostly groundwater irrigation, with command of around 1,570 ha, out of which 1,187 ha are currently cropped. Sailaba, Khushkaba, and Perennial irrigated areas consist of around 8,158 ha, 4,724ha, and 30 ha out of which 5,046 ha, 1,713 ha and 26 ha are cultivated, respectively. About 90% the total cultivated area is under Sailaba and Khushkaba and the area under Spate irrigation is about 5,046 ha.

Floodwater is available at 50% probability in the Sehan scheme, at 30.43 million m^3 with distribution of 6.3 and 24.14 million m^3 in the Rabi and Kharif seasons, respectively. The water available for diversion is 3.6 and 9.82 million m^3 during the Rabi and Kharif seasons, respectively.

The Spate irrigation system will provide benefits to over 1,052 households (total population of 14,494). The Spate irrigation system will have a command area of 3,441 ha with designed cropping intensity of 141.2% and provide a cropped area of around 4,858 ha per annum. Table 2-6 provides the engineering details of the spate irrigation components.

The spate irrigation system of Sehan is comprised of the following sub-components:

- Construction of main weir, sluice, head regulator and guide bund;
- Construction of conveyance system comprising of main and distribution canals;
- Construction of flow regulators and outlets;
- Construction of cross drainage and road crossing box culverts; and
- Construction of staff quarter and office/residential buildings.

Table 2-6: Structural Component of Sehan FIS

Component	Details
Details of Weir Structure	
Weir	
Type	Broad Crested
Natural Surface Level (NSL), m	1,392.15
Weir Crest Level, m	1,395.00

Component		Details
Width of Weir, m		77
Length of Stilling Basin, m		23.35
Design Discharge (Q), cumec		72.40
Abutment Level, m		1399.43
Free Board, m		1.00
Sluice		
Crest Level, m		1394.40
Width, m		4.60
Length of Stilling Basin, m		23.95
No. of Gates		2
Discharge Capacity, cumec		4.50
Head Regulator		
Crest Level, m		1,394.60
Width, m		12.08
Length of Stilling Basin, m		23.95
No. of Gates		3
Discharge Capacity, cumec		550
River Training Works		
Type		Earthen
Top Width, m		7.00
Side Slope (H:V)		2:1
Length, m		950
Top Level, m		1,399.43
Conveyance System		
Cultivable Command Area (CCA), Ha		3,442
Main Canal		
Design Discharge, cumec		550
Total Length, m		12,000
Bottom Width, m		12.08-1.77
Bed Slope, %		0.00019-0.00028
Side Slopes	Internal	2:1
	External	1:1
Top Width, m		3.00 to 4.00
Side Slops		1;1
No. of Cross Regulators		13
No. of Distributaries		6
Total Length, m		14,200
No. of Fall Structures		25
Cross Drainage Structures (Numbers)		16
Road Crossing Culverts (Numbers)		10

(d) Mushkaf Flood Irrigation Scheme: This scheme is located in the Mushkaf Bolan sub-basin of NRB, along the boundary of Sibi city. The area lies between latitudes 29° 34' to 29° 37' N and longitudes 60° 42' to 60° 46' E. and is connected with Quetta and Sibi by roads. The total geographical area spanned is about 557 km^2. The area under spate irrigation is about 1,821 ha and under Khushkaba farming is approximately 6,070 ha.

The availability of floodwater has been based on the rate of average and wet years water availability for Bolan Mashkaf sub-basin and has been estimated at 0.0154 million m^3 and 0.0345 million m^3, respectively. The annual number of occurrences for rainfall varies between 1.17 and 2.34 cm and the average is 11.72. This means there would be 11.75 flood events in an average year from this rainfall range.

The proposed system for Mushkaf will provide benefits to over 2,333 households (with population of 16,333). A designed cropping intensity of 100% will provide an annual cropped area of 1,821 ha. The proposed spate irrigation system is comprised of the following sub components:

- Weir, sluice and head regulator;
- Upstream protection/ river training works;
- Conveyance system comprising of main canal, distributaries connected to the existing conveyance system; and
- Cross drainage works to safely convey flood flows across the main canal /distributaries.

Table 2-7, Table 2-8 and Table 2-9 provide detail specification of the scheme.

Table 2-7: Structural Components of the Mushkaf System

Component	Details
WEIR	
Type	Broad Crested
Weir Crest Level, m	151.80
Width of Weir, m	132
Length of Stilling Basin, m	27.23
Design Discharge (Q), cumec 100 year	1,190
Free Board, m	1.00
SLUICE	
Width, m	9.14
Length of Stilling Basin, m	29.40
No. of Gates	3
Discharge Capacity, cumec	28.32
HEAD REGULATOR	
Width, m	15.0
Length of Stilling Basin, m	10.06
No. of Gates	3
Discharge Capacity, cumec	22.65

Table 2-8: Detail of River Training Works Details

Description	Guide Bund (L/S)	Guide Bund (R/S)
Type	Earthen	Earthen
Top Width, m	7.00	7.00
Side Slope (H:V)	2:1	2:1
Length, m	1060	1120

Table 2-9: Details of Conveyance System

Irrigation System	Main Canal	Sub-Main Canal (1 and 2)	Distributaries (1 and 2)	Minor (1 to 4)	Outlet (1 to 17)
Cultivable Command Area (CCA), Ha	2,639				
Design Discharge, cumec	22.65	11.33	5.66	3.17 to 1.86	1.41 to 0.71
Total Length, m	89	606	1758	366	1401
Bottom Width, m	15.2	9.88	6.21	4.03 to 2.43	1.77 to 0.91
Bed Slope m /m	0.00018	0.0002	0.00022	0.00025	1.77 to 0.9

Side Slopes	Internal	2:1	2:1	2:1	2:1	2:1
	External	1:1	1:1	1:1	1:1	1:1
No. of Cross Regulators		10				
No. of Fall Structures		4				

2.3.2.2 Porali River Basin

The Porali basin includes the perennial irrigation schemes of District Khuzdar near the border of District Lasbela, where the Porali River passes through a narrow gorge and perennial river flows are diverted by local people with permanent arrangements for diversion to irrigate small tracts of land called Bents. Large perennial irrigation systems of Nimmi, Gandash and Sheb Medan have also been included for development. Figure 2-2 shows the irrigation schemes that will be implemented in the Porali Basin. The four schemes that will be implemented in Porali are discussed in more detail below.

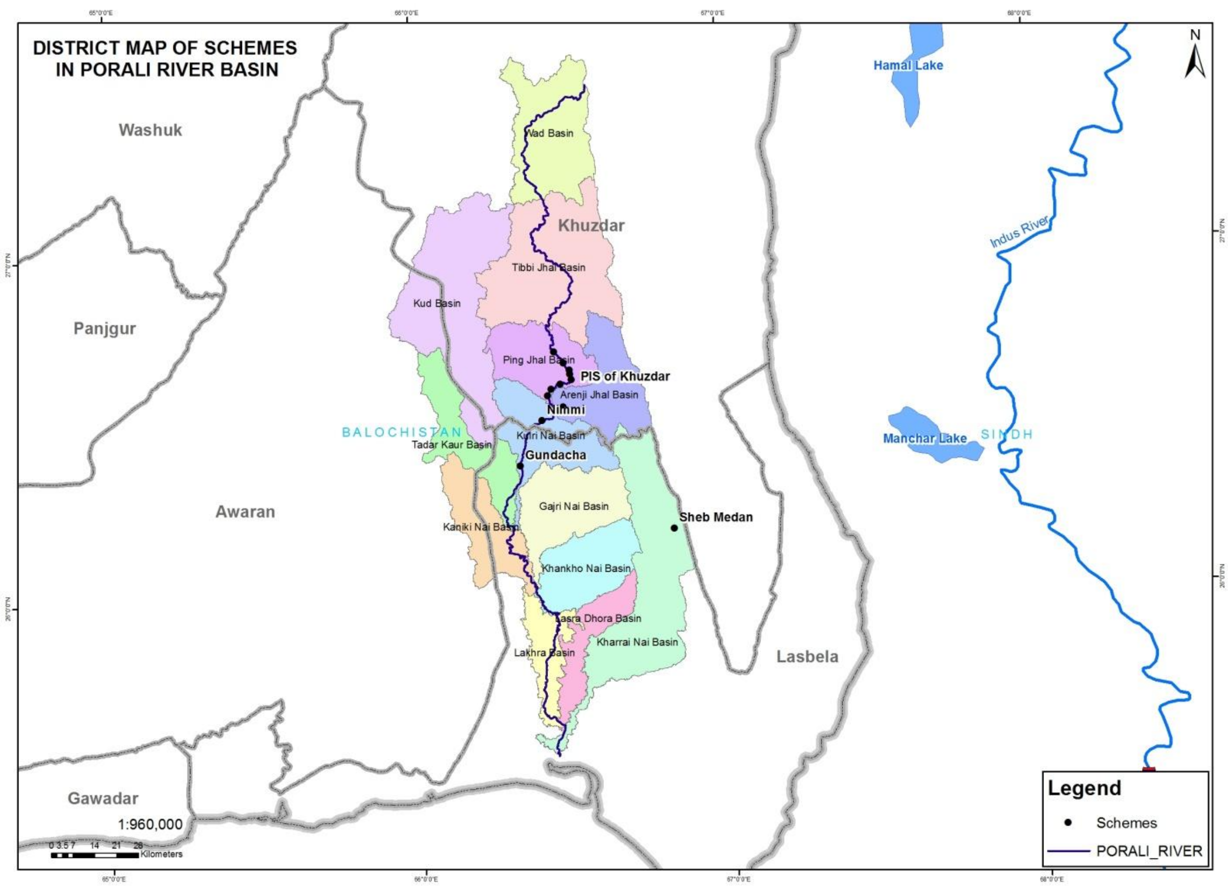

Figure 2-2: Irrigation Schemes in the Porali Basin

(a) Nimmi Perennial Irrigation Scheme: This scheme will be located at the main Porali River, at a distance of roughly 3.5 km from the Regional Cooperation for Development (RCD) Highway in the north-west direction, where the Porali River runs in a gorge with small patches of agricultural land on both sides. The co-ordinates of the proposed weir are 26°30'33.02" N and 66°22'43.45" E.

The overflow weir will be an un-gated concrete structure with its crest at EL 268.5 m and length of 280 m. The crest of the overflow weir will be a USBR standard sharp crested shape with a sloping upstream face and sloping face on the downstream. The sloping portion of the weir crest is to be joined on with the stilling basin floor (at EL 266.5 m) by means of a straight sloping portion having slope of 1V:1H and a circular curve. The floor level on the upstream of the weir is kept at EL 267.0 m, while the crest level of the weir is 268.5 m. The weir is designed for a flood discharge of roughly 3,500 cumec. Under sluices in the weir structure are provided to flush out sediment deposits from upstream of the head regulator and the discharge flood water.

The head regulator is designed as a gated sluice with a breast wall. It consists of two openings each of size 1 m wide x 0.5 m high (clear). Vertical lift type gates will be provided to regulate the flow. Sill of the regulator is provided at EL.267.5 m which is 0.50 m above the upstream floor level set at EL 267 m and 0.50 m above the crest of the under sluice to prevent sediment from entering the main canal.

The head regulator is designed for a maximum discharge of 1 cumec. The irrigation system has been designed for a command area of 1,457 ha. The length of the main canal is about 24,000 m, while the length of the branch canal is about 5,100 m. Table 2-10 shows the irrigation structures of Nimmi.

Table 2-10: Irrigation Structures of Nimmi

Structure	No
Aqueduct Large	11
Aqueduct Small	15
GlasicFalls Structure	15
Field Offtake Structures	30
Drainage Culvert Large	17
Drainage Culvert Small	49
Road Culvert Small	27
Road Culvert RCD Highway	5

(b) Gundacha Nurg-Hingri Irrigation System: The Nurg-Hingri area starts at about 5 km downstream of Gundacha Village. This area falls under the flood irrigated commands of the Porali River, no perennial flow reaches here. Currently, spate users rely on an existing diversion that facilitates partial flood flows to irrigate their lands. The total benefitted area is about 4,858 and 3,239 ha on Nurg and Hingri flood channels, respectively.

The objective of the scheme is to implement a reliable diversion system at Gundacha and to upgrade and improve the performance of the existing Nurg-Hingri diversion structure and conveyance channels for achieving full benefits from the Gundacha-Nurg/Hingri package of the development scheme. The conveyance system for Gundacha command area comprises concrete canals and associated structures such as falls, cross regulators, road culverts, drainage crossings and outlet structures. At Nurg-Hingri, weir off-takes equipped with breast walls resting on piers along with necessary energy dissipation devices will be constructed. An under sluice is also planned between the main weir and off-takes. The necessary lengths of guide banks shall also be provided to safely lead the flow into the downstream unlined channels.

The Gundacha diversion weir is designed for (i) raising the water level to ensure continuous irrigation water supply to the command area, and (ii) to prevent incoming sediment bed-load from entering the main canal. The head works and associated structures consist of the following components:

- Overflow Weir
- Under sluice

- Head Regulator
- Guide Bunds and Retaining Walls

Table 2-11 shows the details of the Gundacha weir and its components.

Table 2-11: Salient Features of the Gundacha Irrigation Scheme

Component	Details
A. Main Weir	
Type of Weir	Un-gated Broad Crested Weir with USBR Stilling Basin Arrangement
Weir Crest Level	172.5 m
Width of Waterway	410 m
B. Under Sluice	
Type	Open rectangular channel
Sluice Crest Level	171 m
Width Waterway	8 m
C. Head Regulator	
Type	2 cell box culvert
Crest Level	171.5m
Width Waterway	1.5 m (clear span)

The existing Nurg-Hingri diversion weir is located on the Porali River (about 5 km downstream of Gundacha). It is in moderate working condition and since its construction in 1987, has experienced several flood peaks. The main weir stretches across the Porali River bed and has two diversion weir crests at its left end. The diversion weir on the extreme left serves the Hingri channel while the next one feeds the Nurg channel. Table 2-12 shows the lengths and elevations of the weir crests.

Table 2-12: Features of Existing Nurg-Hingri Weir

Sl	Description	Length (m)	Elevation (m)
1	Main Weir	295	136.6
2	Nurg Weir	66	136.6
3	Hingri Weir	44	136.0

The existing overflow weir is an un-gated concrete structure with its crest at El. 136.6 m and length of roughly 295 m. The overall existing condition of the structure is poor, due to absence of maintenance and upkeep during past years. This is evident from the damaged conditions of water bodies and eroded away portions of guide banks. The existing un-controlled weir off-takes have resulted in entrance of excessive flood peaks into downstream earthen channels. This has caused two-fold damage, (i) erosive damage to channel sections and guide banks and (ii) flood damage to the command area. Part of the sub-project proposes to upgrade these facilities. Four components have been identified where improvements should be made:

- The existing un-controlled diversion weir crest of Nurg and Hingri channels needs be equipped with a breast-wall to limit the entering flood peaks within a reasonable value.

- One or more under-sluice(s) should be provided to keep the low river channel tending towards the off takes.

- The washed out portion of divide bund (embankment) should be re-constructed and strengthened to withstand future floods.

- Spot repairs to minor damages in main weir and appurtenances should be undertaken to prevent further loss.

Details of the Breast Wall, Under Sluice, Main Weir and Guide Bund are presented below:

Breast Wall: A suspended concrete wall on the top of the crest, spanning between the piers is proposed to the piers. This will create a rectangular opening above the crest level to pass the flow as a weir up to water levels remains below the bottom of this wall. As the water level rises, the opening transforms to an orifice, there by controlling the flow. The lengths of the span will be approximately 66 m and 44 m for Nurg and Hingri respectively. The height of opening below the breast wall is to be 1.5 m, the height of breast wall above the opening is 2.5 m.

Under sluice: For upgrading the existing weir structure, a under sluice will be provided to flush out sediment deposit from upstream and discharge flood water. The under sluice portion will be located on the left flank of the weir. It is an open weir with stop logs. The axis of the under sluice weir will be in line with that of the main weir except at the crest elevation. The under sluice portion will have six openings, each 2.5 m wide (clear) with 0.6 m thick piers. Stop logs (2.5 m wide x 0.30 m high) will operate in between the piers.

Main Weir: The existing weir bodies for off-takes of Nurg and Hingri channels are already significantly damaged and the introduction of piers for constructing the breast wall will require the dismantling of a considerable portion of the existing weir bodies. Thus, it has been proposed to completely demolish, remove and to construct entirely new weirs at a slightly downstream location. On the upstream end of the new weirs, a skimming platform, 0.5 m high is proposed to prevent bed load entering at off-takes. The low platform on the upstream of the skimming weir leads to the under sluice.

Hydraulic design computations for the proposed off-take weirs have been performed against a design return period of 25 years, shown in Table 2-13.

Table 2-13: Hydraulic Design Computations

Type of Weir	Weir with Breast Wall
Energy Dissipation Device	USBR Stilling Basin Arrangement
Weir Crest Level	136 m
Design Flood (25 Year Return Period)	2317 cumec
Weir Height from River Bed	2 m

Guide Bunds: The Guide bunds will be built along the flow direction in places where damages have occurred, to the left of the Hingri Channel. These will be built with locally available sand and gravel with an existing top width. Guide banks shall be compacted to 95% AASHTO density and shall be protected by stone pitching on filter material where required.

Table 2-14 below shows the features of the Nurg-Hingri irrigation scheme.

Table 2-14: Salient Features of Nurg-Hingri Irrigation Scheme

Component	Details
A. Main Weir	
Type of Weir	Un-gated Broad Crested Weir with USBR stilling Basin
Weir Crest Level	136 m
Width of Waterway	295 m
(i) Nurg Weir	
Length	66 m
Crest Elevation	136.3 m
(ii) Hingri Weir	

Length	44 m
Crest Elevation	136 m
B. Under Sluice	
Type	Open rectangular channel with stop logs
Sluice Crest Level	135.1 m
Waterway Width	2.5 m
Height of Waterway	1.5 m

(c) Sheb & Medan Perennial and Flood Irrigation Scheme: This scheme is located on the Kanraj River of PRB at co-ordinates N 26.196310^0 and E 66.825520^0. Currently, there is no proper irrigation system in Sheb, however local farmers temporarily divert the perennial flow to their lands by locally available techniques.

The cultivable land in the area of Sheb and Medan is about 971 ha, but due to the absence of proper irrigation systems, only 162 ha of land is under cultivation. The proposed weir along with conveyance system will not only divert the required water for Sheb and Medan, but will also divert the excess water downstream. This scheme will ensure perennial supplies for irrigation of 971 ha of agriculture land. Table 2-15 describes the technical details of the components:

Table 2-15: Technical details of Sheb and Madan:

Component / Parameter	Details
Type of Weir	Broad crested
Material	RCC
Length of Weir	250 meter
Height of Weir	2.5 meter
Crest width of Weir	1 meter
No. of Channels	1
Irrigation Channel	
Length	10 km
Capacity	0.56 cumec
Cross section of the Channel	Trapezoidal
Height of Channel	0.5 meters
Bed Width of Channel	1.5 meters
Slope of side wall of the Channel	1: 1.5

(d) Small Scale Perennial Irrigation Schemes of District Khuzdar: In the proposed scheme area, the Porali River runs through a small gorge that is covered with mountains. Small patches of land (called bents) within the river course on both sides are cultivated by the farmers. There are no proper intake structures for these patches of land (bents), thus this scheme proposes to provide proper off-take structures at nine (9) different bents. These off-takes will be designed according to the need of potential available land for agriculture. Off-take structures of all the 9 bents are proposed to be RCC structures, while the conveyance channels of all are proposed to be Pre-stressed Concrete Cement.

Also a Badri Kareze from Wadh area is also selected for development. Under this scheme, the channel from the Kareze to the command area will be lined to improve the conveyance efficiency, thus increasing the command area from 24 to 89 ha. Table 2-16 shows the features of the irrigation schemes of Khuzdar District.

Table 2-16: Salient Features of Irrigation Schemes of Khuzdar District

Sl.	Name of Scheme	Scope of Works	Existing Command Area (ha)	Proposed Command Area (ha)

Sl.	Name of Scheme	Scope of Works	Existing Command Area (ha)	Proposed Command Area (ha)
1	Badri Kareze	Lined Trapezoidal Channel – 2.5km	24	89
2	Naik M. Bent	Lined Trapezoidal Channel – 6 km & Off take	28	61
3	Khazeni Bent	Lined Trapezoidal Channel – 2 km & Off take	30	101
4	Hassan Mengal Bent	Lined Trapezoidal Channel –5 km & Off take	49	162
5	Saloon Bent	Lined Trapezoidal Channel –5 km & Off take	81	149
6	Bazenjo Bent	Lined Trapezoidal Channel – 2 km & Off take	49	162
7	Hinnami Bent	Lined Trapezoidal Channel – 3 km & Off take	36	121
8	Peori Bent	Lined Trapezoidal Channel – 2 km & Off take	24	81
9	Pepri Bent	Lined Trapezoidal Channel – 1.5 km & Off take	26	49
10	Sathy Bent	Lined Trapezoidal Channel – 25 km & Off take	30	61
		Total	**377**	**1,036**

2.3.2.3 Water Supply Scheme

Along with the irrigation schemes discussed above, 16 village water supply schemes will also be implemented. The Urban and Rural Water Supply sectors have not kept pace with population increases and development, thus a significant proportion of the population does not have access to clean and safe water for domestic needs and sanitation facilities.

The works will mostly comprise of construction of intake structures and overall rehabilitation and remodeling of some existing schemes. Many of the water supply schemes will use the common intakes of the irrigation head works or structures proposed under Irrigation Water Supply component. The schemes are envisioned to supply potable water to approximately 29,000 people. Table 2-17 shows the features of the 16 water supply schemes.

Table 2-17: Water Supply Schemes

S.I	Name of Scheme/ Village	Population	Source	Scope of Work
1	Naik M Bent, Khuzdar	75	Perennial Flow	• Intake Structure • Transmission Main – 11500 Rft • Storage Tanks - 1 No.
2	Khazeni Bent, Khuzdar	100	Perennial Flow	• Intake Structure • Transmission Main – 8500 Rft • Storage Tanks - 1 No.
3	Hassan Mengal Bent, Khuzdar	75	Perennial Flow	• Intake Structure • Transmission Main – 9500 Rft • Storage Tanks - 1 No.
4	Saloon Bent, Khuzdar	100	Perennial Flow	• Intake Structure • Transmission Main – 8500 Rft • Storage Tanks - 1 No.
5	Hinami Bent, Khuzdar	75	Perennial Flow	• Intake Structure • Transmission Main – 12500 Rft

S.I	Name of Scheme/ Village	Population	Source	Scope of Work
				• Storage Tanks - 2 No.
6	Peori Bent, Khuzdar	50	Perennial Flow	• Intake Structure • Transmission Main – 13000 Rft • Storage Tanks - 1 No.
7	Pepri Bent, Khuzdar	70	Perennial Flow	• Intake Structure • Transmission Main – 4500 Rft • Storage Tanks - 1 No.
8	Sathy Bent, Khuzdar	75	Perennial Flow	• Intake Structure • Transmission Main – 8500 Rft • Storage Tanks - 1 No.
9	Sheb & Medan, Kanraj, Lasbela	100	Perennial Flow	• Intake Structure • Transmission Main – 13000 Rft • Storage Tanks - 2 No.
10	Nimmi, Lasbela	100	Perennial Flow	• Intake Structure • Transmission Main – 8000 Rft • Storage Tanks - 3 No.
11	Gundacha, Nurg Hingri, Lasbela	1,200	Perennial Flow	• Intake Structure • Transmission Main – 24000 Rft • Storage Tanks - 2 No.
12	Manzaki a- Killi Jahangir Khan b-Manki c-Bashnatmanzaki (Yetabad FIS) Loralai	1,200	Tube Well	• Tube-wells – 3 Nos. • Distribution System • Pump Houses • Pumping Machinery • Electric Connection
13	Mekhtar, District Loralai (Sehan FIS)	6,000	Tube Well	• Tube-wells – 3 Nos. • Distribution System • Pump Houses • Pumping Machinery • Electric Connection • Solar Pumping System
14	Villages of Mushkaf FIS (a) Killi Azam Khoso Mushkaf, (b) Killi Dashtani Haji Umer, (c) Killi Chamkarni Chakir Khan	2,500	Tube Well	• Tube-wells – 3 Nos. • Distribution System • Pump Houses • Pumping Machinery • Electric Connection
15	Villages of Yetabad FIS (a) Killi Wadera diva Khan, (b) Killi Mahrullah Pazz	1,500	Perennial Flow	• Intake Structure • Transmission Main – 14000 Rft • Storage Tanks - 2 No.
16	Villages of Nari Gorge	16,000	Perennial Flow	• Intake Structure • Transmission Main – 53000 Rft

S.I	Name of Scheme/ Village	Population	Source	Scope of Work
	PIS Gullu Shaher (Qadeem & Jadeed),Chandia, Mall Gishkori, Mall Gohramzai, Mall Gorgej, Mall Hara, Gorkan, Kore Zameen, Dehpa lKalan, Bakhra Shakar Khan, Kach Walari, Tehri Brahmani in Sibi area			• Storage Tanks - 23 No.

Sub-component B-3: This sub-component will support on-farm water management and agricultural productivity and mobilize the community and promote grass roots level organizations and facilitate participatory skills development. The formation of Farmer Organizations (FOs) will be supported and encouraged to participate in project decision-making. Activities will establish farmer organizations, water user associations, agricultural development groups, and forest user groups and help raise awareness. Beneficiary farmers will contribute in-kind with their labor, for cost sharing of the development work.

This sub-component will also support and improve (i) command area development, such as lining of watercourses for improved water delivery at tertiary/on-farm level; and (ii) On-farm and field irrigation efficiency and farm productivity. Activities will include matching grants to service providers and farmers for provision of high efficiency irrigation system, land leveling and other farm machinery; training of farmers in improved water management technologies; training in improved crop management, including Integrated Pest Management (IPM) and crop diversification; exposure visits; training for women in agriculture and livestock subsectors; on the job and off-site training of project/department staff. It is expected that around 42,700 farming households across 76,000 ha (will participate in and benefit from irrigation development

2.3.3 Component C: Project Management & Technical Assistance

This component will support overall project management, monitoring and evaluation and studies. Activities will include: financing of expenditures associated with overall project implementation costs including incremental costs associated with PMU and the PIUs; Project Supervision and Implementation Assistance (PSIA) consultants; Monitoring and Evaluation (M&E) consultants; and implementation of Management Plans and Strategic Studies including Environmental Management Plan, Social Management Plan, Gender Action Plan, and strategic studies. Study tours will also be included with piloting of new technologies and others that may be identified during project implementation, as well as feasibility studies for other potential river basins.

2.4 Project Timing and Financing

Total duration of project implementation will be 6 years. The total project cost is estimated at US$253.74 million and component wise breakdown of the costs and financing is given in Table 2-18.

Table 2-18: Project Costs and Financing

Component	Component Name	Cost (USD millions)
A	Institutions, Capacity and Information	20.87
B	Sector Sub-projects	207.75
C	Project Management and Technical Assistance	25.11
	Total Project Costs	**253.74**

3 Policy, Legal and Administrative Context

National Policy, international treaty obligations and World Bank guidelines relevant to environmental and social issues associated with the Project are described in the sections below.

3.1 Applicable National Environmental Policies and legislation

3.1.1 National Conservation Strategy

The National Conservation Strategy (NCS, 1993-98) provided a broad framework for addressing national environmental concerns through three main objectives: conservation of natural resources, promotion of sustainable development and improved efficiency in the management and use of available resources. Coming at an opportune time, it was a "call for action" to central and provincial governments, businesses, nongovernmental organizations (NGOs), local communities, and Pakistanis. The NCS recommended fourteen priority action areas ranging from soil management to the preservation of cultural heritage.

3.1.2 National Environmental Policy

The National Environmental Policy (2005) is the overarching framework for addressing environmental issues in Pakistan. It provides directions for addressing the underlying causes of environmental degradation, cross sectoral issues and meeting international obligations. It builds on the goals and objectives of the NCS and other related national policies

3.1.3 Pakistan Environmental Protection Act, 1997

The Pakistan Environmental Protection Act (1997) is the basic legislative tool empowering the government to frame regulation for protection of environment. It established a Provincial Sustainable Development Fund and allows for protection and conservation of renewable resources, establishment of Environmental Tribunals and appointment of Environmental Magistrates, and for conduct of Initial Environmental Examinations and Environmental Impact Assessments. According to Section12 (1) of the Act, no development program involving construction activities or any change to the physical environment can proceed without an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA), with both requiring approved by federal and provincial Environmental Protection Agencies (EPAs). Section 12(6) of the Act states the provision is only applicable only to prescribed categories of projects, which are defined in the Pakistan Environmental Protection Agency Review of IEE and EIA Regulations (2000). Under these regulations projects are classified according to the expected degree of environmental impact. Project types listed in Schedule-I are potentially less damaging and only require IEE; those types listed in Schedule-II are potentially more damaging and requires an EIA. The proposed Balochistan Integrated Water Resources Management Development (BIWRMD) Project falls under Schedule-II (Section D) of the Regulations, hence an EIA has been conducted.

3.1.4 Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations

The Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations (2000) define the categories of projects for which an IEE and EIA are required. The Regulations classify projects on the basis of expected degree of adverse environmental impacts. Schedule I lists projects that require IEE while Schedule II presents the list of projects that require an EIA. The proposed BIWRMP Project falls under Schedule II (Section D) of the Regulations.

3.1.5 National Environmental Quality Standards

Under the provisions of Pakistan Environmental Protection Agency (PEPA), the National Environmental Quality Standards (NEQS) specify the following standards:

- Maximum allowable concentration of pollutants (including pesticides, herbicides, fungicides and insecticides) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment and sea.
- Maximum allowable concentration of pollutants in gaseous emission from industrial sources.
- Maximum allowable emissions from motor vehicles.
- Drinking water standards.
- Ambient air quality standards.
- Noise standards

3.1.6 Guidelines for sensitive and critical areas, 1997

These guidelines provide identify protected areas in Pakistan and provides detailed guidance on the approach to adopt. The protected areas include wildlife reserves and forests, and cultural heritage sites. It presents the requirements for the consideration of sensitive and critical areas during environmental assessment, as well as a list of nationally protected natural and cultural heritage.

3.2 Other applicable national policies and legislations

3.2.1 The Land Acquisition Act, 1894

The Land Acquisition Act, 1894 (LAA) regulates land acquisition for public purpose. However, each province has its own interpretation of the LAA. The LAA and its accompanying regulations require that, following an impact assessment and valuation effort, land and crops are compensated in cash at market rate to titled landowners and registered land tenants/users, respectively. The legal requirement is that such land valuation should be based on the latest 3-5 years average registered land sale rates. Because of widespread under-valuation by the Revenue Department, a 15% Compulsory Acquisition Surcharge is now often applied to current market rates. Each province has its own interpretation of the LAA, and some provinces have issued provincial legislations.

Only legal owners and tenants registered with the Land Revenue Department or possessing formal lease agreements, are eligible for compensation. Users of Rights of Way (RoW) are not considered "affected" by project activities and thus not entitled to any mitigating measure, compensation, or livelihood support. There is no legal obligation to provide: (i) titles to landless users and unregistered tenants, (ii) rehabilitation for encroachers or informal settlers either in the form of house-for-house or land-for-land replacement, or in form of cash. There are, however, precedents where legally ineligible affected parties (APs) have been compensated or rehabilitated.

The LAA also does not mandate specific rehabilitation and/or assistance for the poor, vulnerable groups, or severely APs, nor does it automatically provide for income/livelihood losses or resettlement expenses rehabilitation. However, provincial interpretations are made to suit operational requirements, local needs and socio-economic circumstances. *Ad-hoc* arrangements, agreements and understandings for resettlement are often made in difficult situations.

Exceptions to the rules can be explained by the fact that the LAA is broadly interpreted at the provincial level depending on operational requirements, local needs, and socio-economic circumstances. Recourse is often taken through ad-hoc arrangements, agreements and understandings for resettlement in difficult situations. This is also influenced by the fact that the Ministry of Environment is considering an amendment to the LAA to widen the scope of eligibility for compensation and tighten up loopholes (i.e. regarding definitions of malpractice, cut-off dates, political influence on routing, etc.).

Land ownership in the intervention areas of the proposed BIWRMD Project, the project areas are of the following main types: (i) self-owned property or (ii) Government property or (iii) Shamilat communal land. Relevant communities are all supportive of the proposed and if any land is required, appropriate compensation will be made. The costs of resettlement will be included at the scheme level.

3.2.2 Forest Act, 1927

The Forest Act (1927) authorizes Provincial Forest Departments to establish and protect forest reserves. For forest reserves, it prohibits the (i) lighting of fires, (ii) removal of forest produce and (iii) any damage to the forest. The Khost sub-basin area is the most sensitive forest reserve in the Project and is home to the second largest juniper (*Juniperus excelsa*) forest in the world.

The Project activities will respect the provisions of the Act and no activities will be carried out in any protected forests.

3.2.3 Antiquity Act, 1975

The Antiquities Act of 1975 ensures the protection of Pakistan’s cultural from destruction, theft, negligence, trade and illegal export. The Act prohibits new construction within 200 feet of protected sites. It further stipulates that if archaeological discoveries are made during construction, these should be protected and reported to the Department of Antiquities. It also empowers the Government of Pakistan to prohibit any excavations in any area that may contain objects of archaeological significance.

3.2.4 Mines, Oilfields And Mineral Development Act, 1948

This Act provides procedures for quarrying and mine construction material. Beji sub-basin schemes areas are located under coal mines. In the proposed project this Act will be applicable.

3.3 Applicable provincial environmental policies and legislations

3.3.1 Balochistan Environmental Protection Act, 2012

Balochistan Environmental Protection Act of 2012 provides the overarching provincial framework for the protection of the environment in Balochistan. It builds on the provisions of PEPA and localizes them to the provincial context.

For projects such as the BWIRM, it provides a framework for managing water resources (Section 20), through consideration for the protection of aquatic ecosystems and biodiversity and achieving minimal pollution levels for water resources. It requires that project proponents prepare water resource management plans taking into account the following points:

- Provisions for integrated watershed management;
- Regulation of sustainable abstraction of groundwater;
- Regulation of the use of ground or surface water for agricultural, industrial, mining and urban purposes;

- Measures to protect human health and ecosystems;
- Any other provision necessary for the sustainable use and management of water resources.
- An land owner or individual who uses the land on which any activity or process is performed or undertaken which causes or is likely to cause significant pollution of a water resource must take measures to prevent any such pollution.

3.3.2 EIA Approval Procedure

The Federal EPA has jurisdiction over all EIA/IEE and may delegate its power to the provinces. As per law, the relevant body that is to review the EIA is the Government Agency (GA). The GA in turn is defined as the division, department, attached department, bureau, section, commission, board office or the unit of the federal or provincial government; a development or local authority or a company controlled or established by government; Provincial Environmental Agency or any other body. Prior to devolution of the environment to provinces, Provincial EPAs were entrusted to review EIAs for projects in provinces and projects shared by more than one province or in federal areas were reviewed by the federal EPA. The Balochistan Act has further devolved the power at district/regional level and allows for district agencies along with a provincial EPA (Para 8 of the Act). The Balochistan EPA is vested with the authority of reviewing IEE/EIAs, in line with the institutional administrative structure.

3.3.3 Balochistan Wildlife Protection, Preservation, Conservation and Management Act, 2014

This legislation is guided primarily by the principle of ensuring the protection, preservation, promotion, conservation, management and sustainable development of wild animals in recognition of their position as key components of biological diversity with social, cultural, economic and ecological significance for the present and future generations. In recognizing various levels of protected wildlife areas, it domesticates the provisions of the international conventions and treaties to which Pakistan is member. It further encourages the active participation of local communities in the protection of wildlife resources in the Province. Community participation is further encouraged through economic incentives and benefit sharing. The Act embraces the principle of co-management of protected areas and the promotion of livelihood activities in protected areas.

The proposed project activities will be conducted in compliance with the requirement of this Act.

3.3.4 Canal and Drainage Ordinance, 1980 (amended in 2000 and 2006)

The Balochistan Canal and Drainage Ordinance, entitles the Provincial government to use and control, for public purposes, water of all rivers and streams flowing in natural channels, of lakes, sub-soil and other natural collection of still water. The Ordinance empowers the government to define, in identified areas, a cropping pattern for the purpose of controlling waterlogging and soil salinity. The government may also impose a ban on cultivation of certain crops in lands situated outside the canal command area and can, in the event of any violation, impose penalties in terms of punishment and fine. The government may also compel land tenants, occupiers or owners to grow particular crop in order to comply with the designed parameters for concerned canal systems or any good reason to control and save water.

The latest amendment (2006) – guided by ADB technical assistance – is relevant to the BIWRMD Project, as is the Irrigation Manual Order (2006) that guides O&M of the irrigation system and water management.

3.3.5 Irrigation Manual Order, 2006

The Irrigation Manual Order of 2006 provides guidelines to the engineers and staff of the Irrigation Department implementation, operation and maintenance of the irrigation, drainage and other related infrastructure in the Province. It provides detailed guidance and instructions on personnel assignments, expenditure and accounting, housing for department activities, land sales and acquisition, and miscellaneous other issues which could come under the purview of the implementing agency. It prescribes the necessary measures to take in the event of land acquisition for public purposes. Excluded from acquisition are lands associated with places of religious worship, shrines, tombs, graveyards or any immovable property attached to any such institution and the boundaries of which are continuous with the site of the same. The prescriptions connect with the requirements of the Land acquisition Act and provide guidance for staff of the Department of Irrigation regarding the necessary steps under the requirements of the Land Acquisition Act.

3.3.6 Balochistan Irrigation and Drainage Authority Act, 1997

The Balochistan Irrigation and Drainage Authority (BIDA) Act of 1997 transformed the Irrigation wing of the Irrigation Department into an autonomous Authority for development and management of irrigation, drainage and flood control infrastructure. BIDA exercises powers under the Balochistan Canal and Drainage Ordinance and the Balochistan Groundwater Rights Administration Ordinance to formulate and implement policy guidelines regarding water management and use. It is responsible for developing a sustainable irrigation and drainage network through equitable distribution of irrigation water to improve the efficiency of water utilization while minimizing drainage surplus.

The proposed BIWRMD Project will need to be cognizant of BIDA (1997) regulations, especially for organizing and registering farmer organizations. The regulations for registration of farmer organizations were approved and issued in 2000. A registrar appointed by BIDA is responsible for registering and maintain the operations of registered farmer organizations.

3.3.7 Balochistan Water and Sanitation Authority Act, 1989

This Act provides for the establishment of the Water and Sanitation Authority. The Authority is responsible for providing an adequate supply of potable water and for eliminating water-borne diseases through the provision of effective sewerage and sanitation systems. The Act defines the composition of the Authority and its powers and functions. The Authority is empowered to issue licences, set charges and recover revenues for the services provided, authorize the discharge of industrial waste into sewerage or sanitation systems, and protect water resources and water supply systems from sources of contamination or pollution.

3.3.8 Community Irrigation Farmers’ Organization Regulation, 2000

Despite the prevalence of minor irrigation schemes in Balochistan, there was no appropriate legislation for registration of Farmers’ Organizations (FOs) except the Water Users Association Ordinance of 1981 that provided a framework for improving watercourses in canal command areas. The Community Irrigation Farmers’ Organization Regulations provides a legal status for entities that may be established on community irrigation schemes, outside the Indus basin irrigation system, and which are responsible for operation and monitoring of community irrigation schemes. The Regulations were approved and issued by BIDA in April 2000. A BIDA-appointed registrar is responsible for registering and maintaining the operations of the Registered FOs. The Registrar issues model bye-laws and relevant guidelines to foster efficient functioning and prudent management in CIFOs and Associations and approve the bye-laws of CIFOs or Associations. He can issue the certificate of registration only when he is satisfied to the authenticity or correctness of any element in the demand for registration otherwise he may issue a notice of refusal of registration to the applicants concerned, stating the detailed grounds for such refusal.

3.3.9 Water Users' Association Ordinance, 1981

The Balochistan Water Users' Association (WUA) Ordinance provides for the formation, operation and promotion of WUAs in the province. The Ordinance makes it obligatory for farmers to organize themselves into WUAs for collective action related to watercourse rehabilitation and its systematic maintenance. The main shortcoming of this Ordinance is that it is applicable only to WUAs in canal-irrigated systems and not small-scale irrigation schemes operated by farmer- or community-based organizations.

3.3.10 Balochistan Agricultural Produce Markets Act, 1991

The Balochistan Agricultural Produce Markets Act, 1991 provides better regulations of purchase and sale of agricultural produce and establishment of markets for agricultural produce in the Province. The Government may, by notification, declare an area to be a notified market area and shall exercise control over the purchase and sale of such agricultural produce. By the same measure of notification, the Government shall establish a market committee for every notified market area. The market committee concerned is responsible for issuing licences to dealers. Powers and duties of the market committees and their composition are set out in the Act. A market committee may levy fees on the agricultural produce bought or sold by or through a dealer in the notified market area. The Act further provides for the establishment of Market Committee Funds. The Government may direct that all or any of the disputes, arising in a notified market area, shall be referred to a Board of Arbitrators constituted under this Act. The Act contains also penalty provisions and provisions of miscellaneous nature.

3.3.11 Groundwater Rights Administration Ordinance, 1978

The Groundwater Administration Ordinance (1978, amended 2000) regulates groundwater use and administers the rights of various persons at the provincial and district levels. A Provincial Water Board was constituted for administering groundwater rights and to establish policies for conservation and development of groundwater. The Ordinance established the procedures and framework within the district level administration to issue permits for the development of new *Kareze*, dug wells and tubewells by the District Water Committee. This committee also has the right to stop groundwater extraction by unauthorized persons. The Ordinance provides a legal and institutional framework for resource management by the local administration together with tribal leaders, allowing flexibility in determining rules for groundwater use as a common property. However the Provincial Water Board has supreme power to call for record of any case relating to water rights to satisfy itself as to the regulatory, propriety and legality of the proceedings and can set aside and quash the proceedings, if it considers that any material irregularity has occurred. The main shortcoming of Ordinance has been the lack of involvement of local communities and poor overall enforcement by District Water Committees. The proposed BIWRMD Project will need to take account of the Groundwater Administration Ordinance (1978, amended 2000).

3.3.12 Balochistan Culture Heritage Preservation Act, 2010

This Act empowers the Provincial Government to protect cultural heritage in the Province. It empowers the government to compulsorily acquire any heritage that could be lost to various threats. It states punitive action for the wilful destruction of protected cultural heritage.

3.4 Balochistan Integrated Water Resources Management (IWRM) Policy

3.4.1 The IWRM Approach

The IWRM concepts and principles are globally well accepted. However, IWRM implementation remains a challenge in many countries including Pakistan. In the province of Balochistan the situation is complex and challenging, given the lack of adequate capacity for integrated water management and the entrenched prioritization of irrigation infrastructure construction above all other water sectors. Establishment of effective IWRM will require significant capacity building of public-sector institutions.

The Balochistan IWRM Policy was prepared in 2004 under the ADB-funded Balochistan Resource Management Program, and approved by the provincial cabinet in 2006. The key policy foci are:

- Water availability and potential for development
- Water resources assessment and monitoring
- Managing water demand
- IWRM for agriculture and other sub-sectors
- Environmental water management
- Cost recovery of irrigation infrastructure and high-efficiency irrigation systems
- Cost effectiveness of water conservation interventions
- Promoting inter-provincial cooperation and fostering participation
- Institutional restructuring and strengthening

The Policy endorses a river basin approach and emphasizes the need for an integrated approach across all water sources and all water-using sub-sectors of the economy. It stresses the need for demand management and reduction of water losses. It advocates for small multi-purpose dams to store floodwater for both spate irrigation (Sailaba) and supplemental irrigation supply during the dry periods, and for enhanced groundwater recharge.

Poverty is higher in Balochistan than other provinces of Pakistan. The general aridity, frequent droughts and fragile environment require resource management to be linked to poverty-reduction and environmental protection. The IWRM Policy and reforms thus consider poverty-reduction and environmental management in order to improve productivity and sustainability of water without affecting the resource base.

IWRM requires basin-level planning to guide water resources management and development. This should consider watershed dimensions (as well as downstream irrigation) from both livelihood and ecological perspectives.

3.5 Environmental Regulatory Authorities

The Pakistan Environmental Protection Council (PEPC) is the apex environmental authority in Pakistan. Its membership is made up of representatives of trade and industry, non-governmental organisations, educational institutions, journalists and concerned ministries. The Prime Minister, or his nominee, is head of the Council.

3.5.1 Pakistan Environmental Protection Agency

The Pakistan Environmental Protection Agency (Pak-EPA) was established under the provisions of the 1997 Act. It is an autonomous department of the Ministry Pakistan Federal Ministry of Environment is responsible for planning, coordinating, promoting, protecting and oversight of national environmental and forestry programmes.

It is an enforcing agency that reviews Environmental Impact Assessments and Initial Environmental Examinations (IEE). It issues certificates for establishment of environment labs in the Islamabad Capital Territory. Pak-EPA is mandated to prepare, establish and revise the National Environmental Quality Standards (NEQS) with approval of Pakistan Environmental Protection Council (PEPC). It is involved in the promotion of research and the development of science and technology which may contribute to the prevention of pollution, protection of the environment, and sustainable development. It identifies the needs for, and initiates, legislation in various sectors of the environment; provide information and guidance to the public on environmental matters. The Agency is charged with specifying safeguards for the prevention of accidents and disasters which may cause pollution. It is charged with fostering an inclusive approach to environmental management by encouraging the formation and operations of nongovernmental, community and village organizations to prevent and control pollution and promote sustainable development. Pak-EPA may undertake inquiries or investigation into environmental issues, either of its own accord or upon complaint from any person or organization.

3.5.2 Balochistan Environmental Protection Agency

Balochistan Environmental Protection Agency (BEPA) is a department headed by the Secretary of Environment and Sports. It is the sole environmental regulatory body for Balochistan Province, responsible for implementing National and provincial laws, improving the protection of environmental and natural resources of the Province, while developing policies for improvement and sustainable use of natural resources.

3.6 Obligations under International Treaties

Pakistan is signatory of several Multilateral Environmental Agreements (MEAs), including:

- Basel Convention
- Convention on “Biological Diversity, Convention on Wetlands” (Ramsar)
- Convention on “International Trade in Endangered Species” (CITES)
- UN Framework Convention on Climate Change (UNFCCC)
- Kyoto Protocol
- Montreal Protocol
- UN Convention to Combat Desertification
- Convention for the Prevention of Pollution from Ships (MARPOL)
- UN Convention on the Law of Seas (LOS)
- Stockholm Convention on Persistent Organic Pollutants (POPs)
- Cartina Protocol.

These MEAs impose requirements and restrictions of varying degrees upon the member countries, to meet objectives of these agreements. However, the implementation mechanism for most of these MEAs is weak in Pakistan and institutional setup mostly non-existent.

The MEA most applicable for the Project is the Stockholm Convention on Persistent Organic Pollutants (POPs), under which certain pesticides such as dichlorodiphenyltrichloroethane (commonly known as DDT) cannot be used.

3.7 Applicable World Bank Operational Policies

Table 3-1 briefly presents the World Bank environmental and social policies that are applicable to the project and the reasons why they are applicable.

Table 3-1: World Bank Operational safeguards policies

Safeguard Policy	Triggered?	Explanation
Environmental Assessment OP/BP 4.01	Yes	Overdrawn river basins; multiple ecological zones to be affected, with possibility of some irreversible change in the functioning of the eco-zones require detailed environmental assessment. Implementation of subprojects will also have construction-related environmental impacts such as air quality deterioration, water and soil contamination, land use and land form changes, and impacts on biological resources. This policy is therefore triggered to carry out detailed environmental assessment and

Safeguard Policy	Triggered?	Explanation
		prepare environmental monitoring and mitigation plan.
Natural Habitats OP/BP 4.04	Yes	There are approximately six protected areas in the selected river basins, along with many other sensitive regions which are not classified. The project activities may have negative impacts on habitats and associated biological resources.
Forests OP/BP 4.36	No	Juniper forests in Ziarat and Mangrove forests at the coast of Lasbela may be affected due to project interventions (land conversion and decreased freshwater supply); rangelands are also classified as forest area by the Balochistan Forest Department. The project does not involve any activity that will exploit the forests in the two basins.
Pest Management OP 4.09	Yes	Major interventions planned to enhance agricultural productivity with a possibility of introduction of newer crop varieties which together may affect local pest population with a possibility of increased use of pesticides and other agro-chemicals.
Physical Cultural Resources OP/BP 4.11	Yes	Chance find remains a possibility
Indigenous Peoples OP/BP 4.10	No	No indigenous people as defined in the OP reside in the Province.
Involuntary Resettlement OP/BP 4.12	Yes	There is a likelihood of some land acquisition.
Safety of Dams OP/BP 4.37	No	No dams are planned to be constructed within this project
Projects on International Waterways OP/BP 7.50	No	The Porali basin drains to the Arabian Sea. The Nari basin while in the Indus basin, terminates before reaching the Indus River. Thus OP7.50 is not triggered.
Projects in Disputed Areas OP/BP 7.60	No	No disputed territories exist in the Province.

3.7.1 Environmental Assessment (OP 4.01)

The World Bank requires environmental assessment (EA) of projects proposed for Bank's financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making through appropriate analysis of actions and of their likely environmental impacts. The BIWRMD Project consists of activities which can potentially have significant environmental and social consequences including: (i) Changes in land use; (ii) Damage to natural vegetation; (iii) Deterioration of air quality; (iv) Water contamination and consumption; (v) Damage to top soil due to land reclamation, levelling and soil erosion; (vi) Cutting of trees in the reservoir or in the alignment and construction of water conveyance network; (vii) Safety hazards and (viii) Resettlement.

The proposed BIWRMP Project is classified as Category A which means project has potentially significant adverse environmental impacts that are sensitive and diverse. These impacts may affect areas bordering scheme sites. The EIA has been carried out in accordance with the relevant Operational Policy (OP), to identify the extent and consequences of these impacts, and to develop an Environmental Management and Mitigation Plan.

3.7.2 Natural Habitat (OP 4.04)

OP 4.04 supports the protection, maintenance and rehabilitation of natural habitats and their functions. The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. The Bank does not support projects that, in the Bank's opinion, involve the significant conversion or degradation of critical natural habitats. The degradation of a critical natural habitat is defined as the modification of a natural habitat in a manner that substantially reduces the habitat's ability to maintain viable populations of its native species. This policy is triggered specifically on account of the presence of Miani Hor, a Ramsar site mangrove habitat located downstream in the Porali River basin, which is directly dependent on downstream run-offs, and which is a critical natural habitat.

3.7.3 Pest Management (OP 4.09)

Through this OP, the WB supports a strategy that promotes the use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides. As the project aims to improve and enhance irrigation water availability, agricultural activity will increase, with possible use of chemical fertilizers and pesticides. The balanced use of chemical fertilizers, use of organic composts and balanced and reduced use of pesticides along with IPM will be part of the integrated sub-project. Pest and pesticide management issues relevant to the project will be addressed in the EA.

3.7.4 Cultural Property (OP 4.11)

This policy seeks to assist in the preservation of cultural property. The Bank normally declines to finance projects that will significantly damage non-replicable cultural property, and will assist only those projects that are sited or designed so as to prevent such damage.

The Bank will assist in the protection and enhancement of cultural properties encountered in the Bank-financed projects, rather than leaving that protection to chance. The Policy outlines possible mitigation measures that could be taken to address cultural heritage in projects. These include: relocating the project order that sites and structures can be preserved, studied, in-situ restoration of cultural heritage, relocation, preservation and study of cultural heritage. It also recommends strengthening of institutions entrusted with safeguarding a nation's cultural patrimony. Such activities should be directly included in the scope of the project, rather than being postponed for some possible future action, and the costs are to be internalized in computing overall project costs.

Deviations from this policy may be justified only where expected project benefits are great, and the loss of or damage to cultural property is judged by competent authorities to be unavoidable, minor, or otherwise acceptable. Specific details of the justification should be discussed in project documents.

This policy pertains to any project in which the Bank is involved, irrespective of whether the Bank is itself financing the part of the project that may affect cultural property.

The BIWRMD Project covers river basins characterized by remote rural areas and it is possible that sites of cultural, archaeological, historical, or religious significance might be encountered. However, in case of discovery of any such sites or artefacts during the project feasibility, design and implementation, the site will not be selected if significant cultural sites are going to be affected or alternate options for the design of the sub-projects will be developed. However, in every situation, the provisions of this Policy will be applied. Additionally, the provincial and federal archaeological departments will be notified immediately, and their advice sought before finalization of the sub-projects feasibility and design of such sub-projects.

3.7.5 Involuntary Resettlement (OP 4.12)

This Policy seeks to avoid involuntary resettlement where feasible, or to minimize, exploring all viable alternative project designs. Where resettlement avoidance is not feasible, resettlement should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable displaced persons to share in project benefits. Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs. Projects should assist displaced persons to improve or, at least, restore livelihoods to pre-displacement levels or to levels prevailing prior to the beginning of project implementation or whichever is higher. This policy is triggered for the Project as there will be some form of land acquisition or tree cutting, belonging to individuals, and these will need to be compensated. Full details of the application of this policy in the BIWRMDP are presented in the stand-alone Social Impact Assessment and Mitigation Plan (SIAMP) Report.

3.7.6 World Bank Group Environmental, Health and Safety Guidelines

The World Bank Group's Environmental, Health and Safety Guidelines (EHSG) are technical reference documents with general and industry-specific examples of Good International Industry Practice. When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards.

The EHS Guidelines contain the performance levels and measures that are normally acceptable to the World Bank Group institutions (World Bank, IFC and MIGA), and that are generally considered to be achievable in new facilities at reasonable costs by existing technology. The application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets with an appropriate timetable for achieving them. For World Bank Group-financed projects, the environmental assessment process may recommend alternative (higher or lower) levels or measures, which, if acceptable to the Group, become project- or site-specific requirements.

When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects will be required to achieve whichever is more stringent. If less stringent levels or measures than those provided in the EHS Guidelines are appropriate in view of specific project circumstances, a full and detailed justification must be provided for any proposed alternatives through the environmental and social risks and impacts identification and assessment process.

3.8 Gap Analysis between applicable National and World Bank safeguards policies

Table 3-2 presents a gap analysis between national legislations and the World Bank safeguard policies and how to address the gap under this project.

Table 3-2: Gap analysis between National Legislation and the World Bank Safeguard Policy

Requirement	Applicable World Bank Policy	Relevant Pakistan legislation/policy framework	Gaps to be addressed by BWIRMP
Environmental Assessment	OP 4.01	• National Conservation Strategy (93-98) • National Environmental Policy (2005) • Environmental Protection Act (1997) and its accompanying regulations • Balochistan Environmental	• Project should address cumulative impacts of catchment degradation, HIV/AIDS, degradation of biodiversity, and livelihood impacts in project area of influence • Free, prior and informed consultation with stakeholders to solicit feedback and ensure their participation as early as possible and throughout the project implementation. • Communication and disclosure in local language with understandable content during public consultation. • Ensure community engagement free of external manipulation, interference, or

Requirement	Applicable World Bank Policy	Relevant Pakistan legislation/policy framework	Gaps to be addressed by BWIRMP
		Protection Act, 2012	coercion, and intimidation, and conducted on the basis of timely, relevant, understandable and accessible information. • Establish a grievance mechanism to receive and facilitate resolution of the affected communities' concerns and grievances about the borrower's environmental performance.
Forestry	OP 4.36	• Forest Act, 1927 • Guidelines for sensitive and critical areas, 1997	• Ensure that no project activity degrades existing forest areas
Natural Habitat	OP 4.04	• Environmental Protection Act (1997) • Guidelines for sensitive and critical areas, 1997 • Balochistan Wildlife Protection, Preservation, Conservation and Management Act, 2014	• Ensure that no project activity degrades protected areas • Develop management plans for protected areas if there are none • Build upon existing co-management programmes to ensure the sustainable management of protected areas in the project area of influence • Ensure that the optimal environmental flows are ensured for the protection of downstream biodiversity
Pest Management	OP4.01 OP 4.09	• Environmental Protection Act (1997) • National Environmental Quality Standards	• EMP will address the treatment of irrigation waste water, containing chemicals from pesticides and herbicides, to ensure the protection of downstream habitats
Cultural Property	OP 4.11	• Antiquity Act, 1975 • Environmental Protection Act (1997) • Guidelines for sensitive and critical areas, 1997 • Balochistan Culture Heritage Preservation Act, 2010	• Prepare chance finds procedure to ensure that any likely heritage discoveries are reported to the appropriate authorities and adequate protective measures are taken
Sectoral Guidelines	Environmental Health and Safety Guidelines	• Hazardous Occupation Rules, 1963 (No. 1-6 (L-II/64) • Hazardous Substances Rules, 2003.	• Apply good international practice for the protection of project workers and community members.

4 Analysis of Alternatives

During feasibility study and detailed design stages of the project, various alternatives are considered based on the previous experiences in the province and other parts of the country. These alternatives were primarily derived based on alternatives to the project and different alternatives achieving the same objective of the project, with an intention to avoid any adverse environmental and social impacts associated with the drought and flood water management. This Chapter presents the analysis of various alternatives considered and their evaluation highlighting environmental and social aspects. A no-project alternative is also compared with the potential benefits of the project.

4.1 No Project alternative

Current status of water resources management. The ‘No Project’ alternative is not an appropriate approach as considerable amount of floodwater will continue to be wasted and causing destruction on mass level in terms of infrastructure, soil erosion and livelihoods of poor community. Floods and droughts are common phenomena in the proposed projects region, however, it is observed that the droughts are invariably more common and persistent than floods in Balochistan. It is important to realize that the flood damages are more intense affecting the provincial GDP adversely. For example, direct and indirect damages during 2011 flood for Agriculture and Livestock sectors of Balochistan were estimated at US$ 104 million as assessed jointly by the World Bank and the Asian Development Bank. At the same time, the reconstruction cost of these damages was estimated at US$ 306 million.

The approach for management of droughts and floods is to develop a project to conserve floodwater by diverting or storing for groundwater recharge, efficient water use, and hydropower generation schemes to uplift the ultra-poor community. There is limited economic activity in the project area due to non-availability of sustained perennial water resources in the Nari and Porali river basins.

Agriculture and livestock activities are therefore dependent mainly on flood and Khushkaba farming. The Khushkaba and Sailaba / flood farmers are the poorest-of-the-poor, whereas irrigated farmers are relatively rich. There are also no industrial activities in the project area, which may contribute in the socio-economic progress of the local communities of Nari or Porali, River Basin areas on sustainable basis.

The employment of females is almost negligible compared with the males. Major employment is in the social services, agriculture, construction, transport and storage, etc. but not adequate enough to sustain the regular economic activities. Landless, women, children, and grazers are the main vulnerable groups. The low income is largely due to low productivity of agriculture and livestock as services and inputs are not available to the farmers. Productivity can be doubled through the provision of irrigation, water supplies and services coupled with partnerships with the private sector and access to the markets and market information.

Therefore, integrated water resources management projects are needed at the basin level to improve the socio economic, health and hygiene conditions of the population of the basin. So Alternative with ‘No Project’ approach is not viable hence project components with sub-project/schemes should be developed to minimize the effects of floods and droughts and maximize the benefits of 706,000 people in the Project area.

Consequences of not carrying out integrated water resources management. Effective planning and management of water resources in the province is hindered by the poor coverage and reliability of hydro-meteorological monitoring data. The project will bring benefits by installing 190 hydro-meteorological stations in both river basins. About 48,100 farm households engaged in irrigated agriculture, mostly small-holding farmers (up to 5 ha) and medium-holding farmers

(5-20 ha) will be deprived of from the benefits of irrigation sub-projects and improved on-farm water management. About 3,700 households will be deprived of the benefits of improved potable water supply, about 10,200 households will not benefit from improved flood protection, about 33,000 households will not acquire benefits from better watershed and rangeland management and environmental protection, and 20,000 households will be denied from the benefits of On Farm Water Management and Agriculture productivity. Without the implementation of the project in total, 86,000 households (about 705,000 people) will be neglected from the direct benefit of the Project, including enhance opportunities to 352,789 women to participate in profitable agriculture, by tailoring interventions to their specific needs and by promoting gender equity in rural communities. This will severely affect the economy of the province and the country at large. The alternative of doing business as usual was considered to be not viable.

4.2 Alternative of the Project

4.2.1 Traditional Irrigation Project

The first alternative, traditional irrigation project, was considered at the project level, to have an immediate impact. This option is considered attractive given the security challenges in the project area, which may complicate implementation. However, availability of water has become a serious concern in Balochistan for economic development, which cannot be effectively addressed through a traditional irrigation project, focusing solely on better use of available water in one sector. In addition, the increasing frequency of floods and droughts coupled with climate change impact and population increase and rising water demand outside of agriculture sector, are emerging as the biggest water resource challenges for Balochistan. Balochistan is characterized by a low population density, scattered communities with long distances between settlements, and a lack of basic infrastructure. Thus isolated irrigation investments without effectively addressing agricultural productivity, watershed and rangeland management, groundwater management, drinking water supply will not greatly eradicate major poverty in remote areas of the province.

The critical challenge facing current irrigation system cannot be addressed by a traditional irrigation project, and likely further embed the culture of building new isolated inefficient water resources and irrigation infrastructure without adequate knowledge of the current or future availability of water. It will not help to develop the capacity for strategic long-term water planning and demand management in the face of growing scarcity. A comprehensive and integrated approach covering all aspects stated above are needed to address the acute water security in Balochistan. It is essential for the Province, to develop knowledge and information base to make informed decisions in the face of growing water resource challenges. All water using sectors in Balochistan require an IWRM approach to create a platform for an efficient and sustainable resource utilization. Poverty will be addressed in a broader and more comprehensive manner by commencing implementation of the IWRM policy adopted by the Government of Balochistan.

4.2.2 Capacity Building Project

The second alternative was considered a sole capacity building project focusing on efficient collection and improved hydro-meteorological data. Hydro-met systems are in disrepair and are not in active use. Technical knowledge in monitoring is very limited. Collection and handling of hydro-meteorological data and the technical knowledge to use them in water resources planning and management is critical due to the growing water security challenges. In Balochistan, capacity is low and there is a dire need to demonstrate impact in IWRM, commencing with active engagement in hydro-met and water resources modelling to guide future management and investment.

International experience shows that the best way to build capacity in hydro-meteorology is to involve responsible agency in the process of system design, installation and operation, coupled with water resources development projects that require the new capacity and information to acquire first hand experiences. However, a pure capacity building project without an application in real-life will not be sustainable.

4.2.3 Integrated Water Resources Management and Development (IWRMD)

A multi-faceted and multi-sectoral Integrated Water Resources Management and Development Project is considered for the improved water resources management in multiple major river basins of the province. Experiences from previous projects in Balochistan indicate the growing capacity in the province for infrastructure project implementation and the growing demand for a more integrated approach to water management across government departments, stakeholders and beneficiaries. Stand-alone and isolated projects have been unable to deliver major impact and reform water resource management in the province. The proposed approach combines scaled-up irrigation investment, modest investment in other water sectors, with initial efforts to build the information and capacity foundation for IWRM over the longer term. This integrated and comprehensive approach is the best option for delivering substantial and lasting impact, and project preparation has confirmed the motivation and capacity of the government for this approach. The proposed project will lay the foundations for future IWRM in via participatory approach to designing and establishing hydro-met and water information systems and initial information use in water resources planning. By coupling this work with the multi-sectoral components on water resources development and management, a practical not theoretical approach to IWRM will be pursued.

4.3 Different Alternatives Achieving the same Objective as the Project

The purpose of the Project is to provide equal access of water to all segments of the rural communities to seek better livelihoods including gender and vulnerable groups. Development works under irrigation and water supply subprojects include remodeling headwork structures and secondary canals, and command area development. Command areas will be provided with access tracks to the nearest gravel roads for transportation of farm produce. Works under flood protection subprojects will include construction of (i) earthen bunds with rip rap, (ii) earthen spurs with stone pitching, and (iii) gabion river training structures. An activity alternative would be to consider different uses for the same financial investment that could provide flood protection, groundwater recharge, potable and irrigation water to the supply area, improve the quality of life and generate an equivalent number of jobs and income to the area.

4.3.1 Diversion Weir vs. Storage Dams

Storage dams could be constructed for irrigation and cropland productivity. However, due to the huge elevation difference (especially in NRB) larger storage area will be needed, which will affect settlements by inundating their residents and cropland close to the dam site. In addition, the disperse nature of population in the river basins will make it difficult to maximize the positive benefits of the storage dams. The economic analysis of various projects reveals[1] that large dams increase productivity in downstream but they have a negative effect on cropland within the vicinity.

A diversion weir is an impervious barrier constructed across a river to raise the water level on the upstream side. The water is raised up to the required height and then flows over the weir. In a weir the water overflows the weir, but in a dam the water overflows through a special place called a spillway. Diversion weirs have traditionally been used to create mill ponds. They are also used to prevent flooding, measure discharge, and help render a river navigable. In addition,

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[1] Is Small Better? A Comparison of the Effect of Large and Small Dams on Cropland Productivity in South Africa, Policy Research Working Paper 6567, The World Bank, 2013.

weirs can improve in water infiltration by improving vegetation cover in the selected catchment, water supply to close by settlements, and provide more volume and quality with improved winter flows. Improvement of infiltration will also mitigate against big floods that are prevalent in the project area.

The technical feasibility study has looked into options of building and rehabilitating storage dams (Kharrari, Bambri, and Kud in Porali Basin) for supplying irrigation and potable water as many households as possible within economic reach of the dams, maximizing the development of irrigated agriculture, flood protection scheme, watershed and rangeland management, environmental protection, employment creation and above all socio-economic development of the area. However, these options are not considered in the project due to the potential social disputes of perceived negative impact in water sharing in downstream. Storage dam options were rejected after the preliminary study. Rather than the storage dam, diversion structures have been proposed because they will cost much less, and will result in more geographically spreaded benefits. It will also avoid the socio-political conflicts of building dams in upstream to convince downstream population. The potential negative impacts are displacement of population due to storage reservoirs, impact on aquatic species by physical barrier, sedimentation in the reservoir and hence maintenance requirements, reduced downstream flow in dry season, and overflow in wet season potentially destroying cultivated land in downstream command area. Specific reasons of rejection in investment on these storage dams are:

- Bambri Dam was damaged during 2010 Flood, the capacity of the spillway did not cater the discharge and the water overtopped the dam wall. The breaching of the dam results in the enormous destruction of command area and settlements at downstream. The partition wall and RCD Highway was also damaged. Considering potential environmental and social impacts and high rehabilitation cost this subproject was not included in the project.
- Kharrari dam was planned to construct a wall of crest length 762.2 m (2,500 ft), of which 457.3 m (1,500 ft) was constructed but the construction was stopped in the year 1994 because of the lack of funds. The portion of the spillway is also constructed. The project was funded by the federal government. The proposed location of the dam by TCI is 800 meter upstream of the existing location that was proposed by Irrigation department. Based on the hydrological assessment, current location is found not suitable and hence an upstream location is recommended, hence, entirely new investment is required, which will be very expensive.
- Kud is the major tributary contributing in the Porali River, as per hydrological calculations. During flood situation Kud contributes almost 25% of water to the Porali River resulting in the severe damages in Lasbela district. Preliminary survey has been conducted to locate the best suitable location of the dam considering all topographic, hydrologic and social conditions. There is an archeological site at the downstream of the proposed location of dam posing potential risk of inundation during dam failure.

4.3.2 Groundwater Recharge, Project vs. No-Project

Groundwater recharge process is categorized as a gravity driven infiltration measure of the precipitation through surfaces (original ground) and river beds, whereas, the artificial recharge(s) measures are mainly through the recharge devices in the form of infiltration well and ponds. Gravitated recharge is quantitatively less expected because of low rainfall intensity with precipitation in the range of around 65 to 263 mm in the average year, 25 to 153 mm in dry year, and 155 to 481 mm in the wet year in the NRB. On the other hand, rainfall in Porali River Basin at three probability levels (25%, 50%, and 75%) are 239.40 mm, 93.35 mm, and 93.98 mm, respectively. The rainfall in the wet year contributes for the groundwater recharge, whereas it hardly contributes in the dry year. River runoff does not generally contributes as sub-surface groundwater recharge due to its short duration (torrential), in addition severe surface erosion caused by floods devastates the groundwater conservation conditions in the drainage areas.

On the other hand, diversion weirs with pond as artificial recharge facilities, have been proposed to accelerate recharge of groundwater aquifer. These ponds serve several important functions in that they transmit, filter, and store water. Water from the diversion weir and from rainfall will enter into the sub basins through pond areas and will undergo natural filtration as it will transmit into deeper aquifers. The groundwater sub basins have significant potential and vast storage capacity, which will allow to store excess water in normal and wet years. This stored water will serve as the province's best protection against droughts or other outages. Table presents a comparison of groundwater recharge with and without project alternatives. Table 4-1 indicates that diversion structures with pond will enhance/rehabilitate groundwater recharge.

Table 4-1: Comparison of groundwater recharge alternatives with and without project

Items	Description	Without Project	Diversion Structures/ Pond
Hydrological condition	Flash floods and/or river runoff in short duration immediately after rainfall.	Without any obstruction, flash flood runoff recharge quantity is limited due to very short duration of run off.	Flood is stored in the pond in diversion weir. Good quantity of river runoff is infiltrated into the ground when pond capacity is sufficient. Further recharge is accomplished by discharge of stored water through conveyance system of canal, distributaries, and by spreading water in the downstream river bed.
		Poor	Good
	River flow contains fine materials, silt and clay, recharge capacity of foundation may be gradually reduced due to clogging.	Silt contents with flash flood spreaded over the command area and accumulated on the surface layer.	Sediment is accumulated in the pond. Fine materials shall be periodically removed, and filter material shall be replaced by machinery. However, sediment free water is discharged into conveyance systems and downstream riverbed through weir overflow. The recharge through alluvial downstream riverbed and pit is accelerated.
		Good	Good
Construction	Design and construction of structures.	No design work required	Most of the works are levelling works. There is no difficulty on design and construction.
		Good	Good
Regional characteristics	Recharge volume depends on river run off. Project implementation is determined by availability of the structure.	Most of the rivers dry up during dry season. Storage facility such as pond/reservoir is necessary to increase recharge volume.	River flood runoff is stored in the pondage of the weir and discharged through overflow weir in the downstream riverbed. Adequate capacity for sediment volume shall be allocated in the pond capacity.
		Fair	Good

Items	Description	Without Project	Diversion Structures/ Pond
Project justification	Net value by a unit of water is estimated considering capital cost and O & M cost. Project benefit is dependent on availability of recharge volume.	Storage capacity is required to increase recharge volume. In case, water is directly diverted from the river, periodic O & M cost for rehabilitation and sediment removal of existing structures shall be estimated. Construction cost is relatively small	Most of river runoff is available for recharge. Water utilization ratio is rather higher compared with other alternatives. Capital cost is high besides less O & M cost is required.
		Fair	Good

4.3.3 Water Development and Conveyance Practices

4.3.3.1 Existing Methods

(a) Kareze System

Karezes are underground gently sloping horizontal tunnels with vertical shafts/wells for ventilation and periodic cleaning (Figure 4.2). The horizontal tunnels are laid on natural gradient for conveying water from the mother well located at the foot of mountain to the daylight point in valley floors from where it is distributed in open channels for different uses including domestic and agriculture. Irrigation through Karezes is a traditional and age-old practice of meeting crop water requirements tapping and conveyance and is quite useful, convenient, and easy to operate due to the fact that water flows under gravity without energy consumption for transmitting from the source to the command area.

The residents of an area mark the site where the precipitation drained into an underground formation followed by the appearance of water a few kilometers downstream of the command area. The man who organizes villagers to begin and complete the arduous task of building a Kareze and maintaining it over time holds the office of Sarishtra, the manager of a Kareze. The Sarishtra holds the land immediately adjacent to the daylight point from which the water is discharged.

The shareholders in Kareze water first dug a well down to the groundwater table in the recharging alluvial fan. This well is called the mother well. More wells at a distance of 50 to 100 meters apart are then dug in the expected direction of groundwater flow. A Kareze once established, can be used for years.

The vertical shafts (ventilation wells) in the Kareze are sources of falling debris and often collapse during rains causing blocking of the flow in the horizontal tunnels. The blocked Karezes require periodic cleaning once a year to keep them flowing, operating, and functional. Cleaning is a highly skilled job, labor is expensive and thus the users have to bear recurrent costs almost every year.

An average Kareze can irrigate 10-20 hectares of agricultural lands. Karezes, which can yield up to 0.2 cumec, can serve a maximum of 200 shareholders. A few decades ago, the agricultural economy of the province was totally dependent upon the supply of Kareze water. Due to the advent of electricity in the province resulting in excessive drilling of large number of tubewells and consequent depletion of water table many Karezes have dried up. Owing to this the area irrigated by Karezes in Balochistan has been declining steadily and has reportedly decreased from 14.2% in 1980 to 5% in 2013. The system has very low operational cost, it is not only fulfils daily need of usage of water but also irrigates orchards and supply water for cultivation.

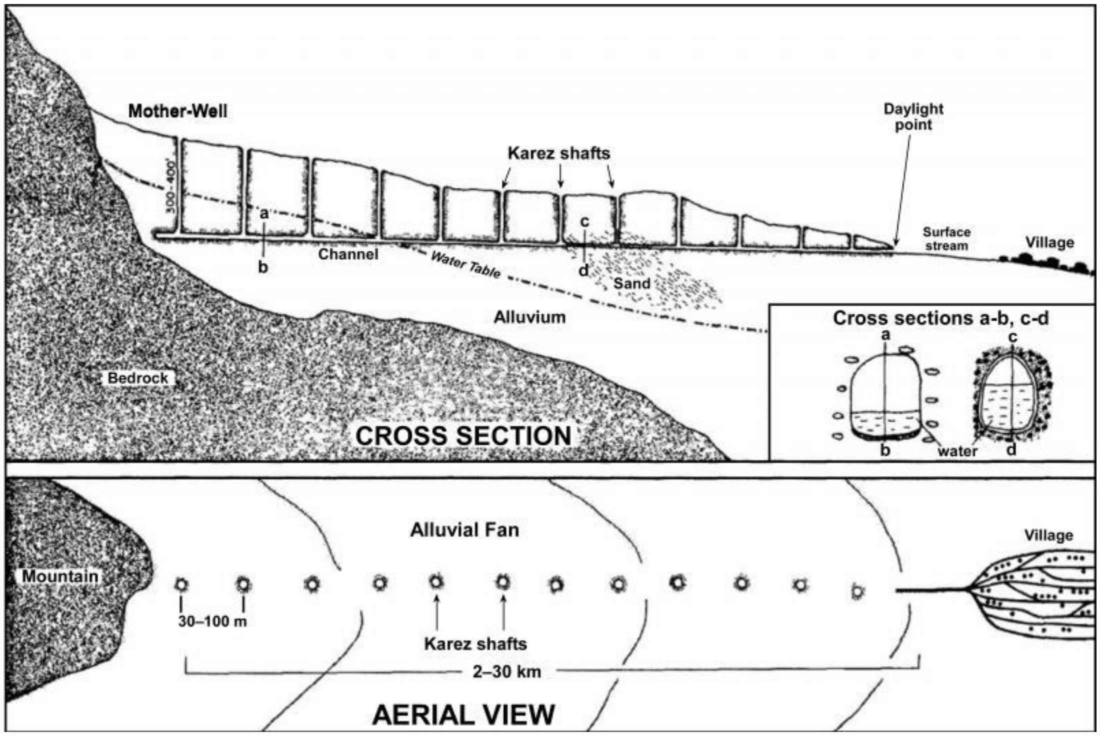


Figure 4-1: Schematic of Kareze System

Figure 4-2: Dug/open well

(b) Dug/Open Wells

Dug/open wells (Figure 4.3) are also means to enable utilization of groundwater. Water is taken out of the wells by different mechanisms like diesel-operated or electric pumps and Persian wheels energized with animal power. Simple rope and pulley arrangement are also used for the abstraction. The water is then either taken manually or is discharged into small canals/ water courses for conveyance to cropland. According to the agriculture census, the number of these wells in Balochistan is estimated to be about 3,000. As open/dug wells are usually installed in shallow perched water aquifers, they tend to dry up during periods of droughts or excessive intervals between rainfalls. The role played by such wells in irrigated agriculture is minor and not of much significance. However, for water supply and domestic use dug wells have been extensively used. These wells are also used extensively for orchard growing in some valleys of Loralai district, where water table is shallow and low delta crops are grown.

(c) Tubewells

Tubewells are increasingly used for abstracting groundwater to meet both domestic and agricultural requirements. In Balochistan, the number of installed deep tubewells has been growing significantly where electricity is available. Currently, it is estimated that over 44,000 tubewells, including a small number of public sector tubewells, are operating to meet the crop water requirements in the province. There is no doubt that the development of tubewells has contributed largely to the economic uplift of the province, as this resource is found by farmers to be more dependable in increasing their agricultural production particularly in horticulture. The positive impact of development of tubewells has been phenomenal, from zero to over 100 percent in the cropping intensities. Assured supplies of water at critical times of crop growth with full farmer control with tubewells have been responsible for converting low value crops to high value orchards and cash crops, which have brought about an economic boom in the farming community in Balochistan.

The flat rate of electricity for pumping water has served as an incentive to the farmers to pump 24 hrs of day irrespective of the actual need of the water for crop growth thus promoting over-irrigation and inefficient use of water. The water table has been dropping significantly in areas where the abstraction has exceeded recharge. Moreover farmers tend to install more powerful pumps most of which are submersible pumps. The practice of disregard to the value of water pumped by tubewells and the serious consequences is causing serious environmental disasters.

(d) Spate (Inundation)

Spate or inundation method (Figure 4-3) of developing water for irrigation and meeting crop water requirements is a surface water development traditional system, whereby floodwater generated through rains/storms is dispersed in dry ephemeral streams and conveyed to irrigable fields by building dams/diversion structures across streams. These structures raise the water level in the stream and allow the inundation of surrounding lands. It is a pre-planting method of irrigation, where the flood season precedes the crop production period. To establish a spate irrigation system, surface water runoff helps adjacent low-lying fields with deep soils store sufficient moisture for the crops during periods with no precipitation. Such systems support livelihoods of the poorest segments of the rural population. The system is being used extensively in the Kachhi plain areas (Sibi District), and to a lesser extent in Loralai, Awaran, Pishin, Qila Saifullah, Mastung, Lasbela, and Khuzdar districts.

In Balochistan, the major floods occur in the monsoon months between June and September, which is the time of heavy rainfall in upper catchments; and crop growth under spate irrigation systems takes place between October and February depending on the water stored in the soil. The annual average cropping intensity under this system is less than 20%. The use of inundation method in Balochistan is primitive with no scientific designs of the system. Reliance is made only on rules of thumb and the structures to divert water to fields are temporary in nature. Most often the silt brought in by the inundation canals get deposited in the beds and fields making it necessary to raise the dams every year to allow water flow. Spate systems suffer from operational problems, due to the structures were strongly inspired and designed by perennial systems but were not able to cope with the heavy sedimentation process or violent peak floods. A good designed spate system can irrigate big areas compared to other indigenous system, floods can be controlled, groundwater source are relatively rich due to long periods of recharge in areas irrigated by spate irrigations.

Figure 4-3: Spate irrigation system

(e) Khushkaba System

In the Khushkaba or dry land agriculture farming system, the fields receive moisture directly from rainfall or from localized runoff. Some area near the foothills with natural gradient is earmarked for collection of runoff, which is guided in to prepared areas surrounded by small dykes or bunds so that the water gets the opportunity to seep down and saturate the soil. Crop cultivation is then immediately practiced. The retained moisture is considered sufficient to support crop growth till the next rainfall. The Khushkaba system is prone to high risk of crop failures. The cropping intensity is very low (less than 20%). The system is most common in all areas where no other sources of irrigation water are available. A drawback of this system is the lack of uniformity in water distribution across the cropping area. If the width of the cropping area is reduced to improve uniformity, the system comes to resemble the runoff strip system. Under this project, technical and demonstration support along with service provision from the private sector for developing water harvesting systems will be improved and strengthened.

(f) Sailaba System

In the Sailaba system, rainwater runoff generated from adjacent lands is harnessed and brought to cultivable area for storing moisture in the soil for later crop growth. In this system hill torrent flows are diverted through construction of large size structures across hill torrents. Small guide bunds constructed on hill slopes to divert rainwater from other fallow areas to cropped fields, where it is collected to saturate the agricultural land by slow seepage. Relatively large fields, each over 3 hectares, are irrigated in this system and deep-rooted crops are usually recommended. Under the Sailaba system of irrigation in the valley bottom, large bunds are made by farmers to serve as field demarcation boundaries and to trap runoff water. In this system, 0.5 to 3 m high bunds (earth embankments), depending on the topography of the land, are constructed on the main seasonal riverbeds to divert floodwater and lead it to the bunded fields. The bunds are traditionally built by animal labor (camel and bullocks) but now it is common to see increasing use of bulldozers and tractors.

In the higher summer rainfall areas, where Sailaba cultivation is practiced the cropping intensity is much higher whereas in the Khushkaba areas the cropping intensity does not exceed 50% in most of the year. Sailaba systems are also high risk systems for crop production, as environmental stresses such as cold and drought in winter and the combined effects of drought and heat and a short growing season during spring affects production efficiency significantly.

(g) Basin or Flood Irrigation

Under this system of irrigation, water is applied to the farm divided in basins. In Pakistan basin irrigation is the most widely used practice for irrigating field crops. The application efficiency of such systems is generally very low due to deep percolation losses, field undulations, un-compatible intake discharges, and run-off losses. The method is most extensively used in Balochistan for field crops and for orchards. Little attention is given to levelling the fields and adopting scientific farm layout designs to help improve the efficiency of water use. Due to the generally low cost assigned to water (even in tubewells pumping water from great depth) the irrigation efficiency is very low less than 20% in orchards where a single young tree with hardly 20% of canopy area is planted in a basin as large as 100 square feet. In field crops the efficiency is higher but is still not over 50%. Large amount of irrigation water is being wasted by farmers due to inefficient use of irrigation water. There is a tendency of farmers to irrigate crops with more water with the belief that more water results in higher productivity. It has been estimated that about 50% of irrigation water is being lost through these practices and also from transmission losses.

4.3.3.2 Modern Methods

(a) On-Farm Water Management

On-Farm Water Management is a better managed irrigation water by the farmers and increase agricultural productivity, supported by improved irrigation infrastructure, and service delivery. OFWM intends to improve the efficiency, reliability, and equity of irrigation water distribution, support agricultural productivity enhancement to complement the benefits of improved water management, and enhance long-term financial sustainability of the irrigation system, by fostering self- sustaining farmer organizations, at the watercourse, and distributary canal levels - a key element of the decentralized and financially sustainable institution.

(b) Other Efficient Irrigation Systems

In Balochistan various agencies are introducing efficient systems for irrigating high yield crops like orchards. The technologies mostly include trickle irrigation followed by bubbler on apple orchards and grape vines. The sponsoring agencies are Asian development Bank (ADB) in collaboration with the provincial Agriculture Department and Pakistan Council of Research in Water resources (PCRWR), while the World Conservation Union (IUCN) laid demonstration projects in the province on cost sharing basis with the communities in Qilla Saifullah. Unfortunately these systems have not been able to gain much popularity with the local farming communities for reasons that include high initial capital cost, lack of education and extension, lack of participatory approach, lack of proper maintenance after installation, and the general fear of the conservative farmer that the yield would not be comparable with the once irrigated with flood water. An underlying reason for non-popularization of the systems is the huge subsidy on agricultural tubewells given by the government, which acts as an incentive to over irrigate and inefficient use of water.

Trickle irrigation systems installed during 1982 to 2002 in Balochistan was conducted through field surveys. Out of 106 sites 72% sites were nonoperational. 28% systems were found operational completely or partially, 11% systems survived for a maximum period of 5 to 9 years out of which 6 systems were found working satisfactorily even after passing a period of 9 years. The success of 6 systems installed under the Food and Agriculture Organization (FAO)/UNDP financed Deciduous Fruit Project has been sustained mainly due to imported quality equipment and materials, possessing spare components and accessories for replacements, skilled manpower and installation at the government farms and fields of progressive farmers, mostly in Quetta, Kalat, Pishin and Mastung areas. The dominant fruit species like apple, grapes and mix orchards were found cultivated under the working trickle systems covering an area of 47 ha, 65 ha, and 64 ha, respectively. The trickle systems on old grown up orchards showed poor performance, due to non-adaptation to limited irrigation supplies, as number of emitters were not increased with the age and canopy cover of trees, therefore system were unable to meet the water requirements of the plants, as a result the trees had stunted growth and in some cases dried up. The farmers were not trained to operate and maintain the systems in a proper way and were eventually compelled to switch over again to the flood irrigation systems.

Another system that has high potential in Balochistan is the “Bed and Furrow method of Farming”, which is an improved form of basin irrigation. Improving and developing crops specific field layouts can reduce the losses. In the bed and furrow method, water is applied only in furrows. Experiments have proved that cotton grown on bed and furrow system had the maximum water use efficiency and yield against other methods of irrigation. An operational problem with bed and furrow is that with the passage of time, the furrows become cemented due to silt deposition. Water then moves laterally and vertical seepage of the water reduces considerably. However with minor maintenance the problem are overcome. Since water is applied in furrows, the effect of water borne and water transmitted diseases on the crop health are minimal. The weeds, which are transported through canal water, are trapped in the furrows from which these can be removed or controlled easily. Moreover, the same field may be used for inter-cropping, e.g., sugarcane in furrows and wheat on beds etc. After construction, the furrow system required periodic maintenance; during irrigation it is necessary to check if water reaches the downstream end of all furrows. Pondage of water will reduce the efficiency of crop production. Overtopping of ridges is not allowed and the field channels and drains should be kept free from weeds.

4.3.3.3 Proposed Irrigation Methods under the Project

The Project will invest in both new and rehabilitation of existing schemes under irrigation, flood protection, and water supply system, with the purview of an integrated water resources management including watershed and rangeland management, environmental protection, and capacity building. Therefore, it will aim to improve water resource management through promotion of integrated river basin management to equitably distribute water for economic development, environmental sustainability and improved livelihoods. Integrated river basin management informed by stakeholder participation and scenario assessments for alternative climate change futures will guide equitable water distribution for sustainable growth. Improved water use efficiency in agriculture (the highest and most inefficient use sector) is the key outcome of the Project. Water savings have extremely been important given expected reductions in availability under future climate change in the water-scarce province of Balochistan.

(a) Improved Spate Irrigation

The integrated sub-projects/schemes under the Project largely include the weir-controlled Spate irrigation. Spate irrigation (or Sailaba) diverts water from ephemeral rivers beds during "spate" or flood periods. Spate irrigation under the project can be characterized in three main categories:

- Spate irrigation systems based on floodwater generated from hill-torrents and diverted through natural, earthen or weir regulated structures;
- Spate irrigation systems with headworks for diversion of floodwater into a canal network and tanks for storage and regulation; and
- Spate irrigation systems combining both no perennial and perennial flows.

Floodwaters, typically lasting a few hours or days, is channeled through primary, secondary and sometimes tertiary flood channels using weir controlled headwork. Command areas range from a few hectares to over 25,000 ha. Remodeling of the headwork and secondary canals, construction of access farm tracks to the nearest gravel roads for transportation of farm produce, command area development using rough and laser leveling and combined with furrow-bed irrigation for an efficient irrigation practice. The project will develop 22,056 ha of command area in Nari River Basin under spate irrigation through community participatory procurement with water users contributing 15-35% to construction costs in-kind (Table 4-2).

Table 4-2: Command areas for irrigation subprojects in Nari and Porali River Basins

Sub-projects	Command Area under various Irrigation Schemes (ha)			
	Perennial	Spate	Khushkaba	Total
Nari Gorge	17,833	607	10,522	28,962
Yetabad	0	16,188	6,073	22,261
Sehan	0	3,440	1,619	5,059
Mushkaf	0	1,821	1,619	3,440
Nari RB Sub-total	*17,833*	*22,056*	*19,833*	*59,722*
Khuzdar District	947	0	0	947
Nimmi	1,457	0	0	1,457
Gundacha	12,199	0	0	12,199
Sheb-Medan	2,539	0	0	2,539
Porali RB sub-total	*17,142*	*0*	*0*	*17,142*
Total Command Area	**34,975**	**22,056**	**19,833**	**76,864**

Spate irrigation systems are among the most fascinating and complex resource management systems. Uncertainty in the number and sequence of floods and the quantity of sediments are the primary factors affecting the spate irrigation. Spate irrigation systems are generally situated in remote areas where there is deep-seated poverty and support systems are weak. The following measures are taken to improve spate irrigation systems:

- Improve local diversion structures, ensuring that improvements do not interfere with established water distribution rules or expose the command area to risk of damaging high floods or heavy sedimentation. Design has considered a wide range of options, the use of gabion works, stone abutments and/or soil bunds using earth-moving equipment.
- First is the use of improved field-to-field structures (inlets and overflow structures), allowing more regulated inflows and outflows during the hectic spate period. Farmers will be trained to ensure that animal traction power is adequate for ploughing and mulching, to conserve soil moisture after irrigation. Schemes are considered concentrating flows

into a relatively compact command area. Compact command areas increase the chance of a second and third irrigation, taking crops out of the ‘stress zone’.

- Improve field preparations, seed treatment and use of improved seed, early planting and targeted use of agrochemicals.
- Introduce new crops – vegetables, onion, pulses, and oilseed besides traditional crops like, Sorghum, Sesame, Mung bean, and Cotton. Introduce post-harvest technologies such as seed cleaning and improved storage.
- Promote local agroforestry, particularly indigenous trees. This serves to stabilize surrounding areas and provides fuel, timber, medicines, and bee forage.
- Improve drinking water facilities in spate areas. These are often unprotected open ponds, but they can be improved by a range of technical and institutional improvements.
- Improve land and water tenure, issuing individual titles where they do not exist and codifying or reviewing water rights so as to minimize conflicts and accommodate new realities – such as intense use of groundwater and the need for recharging.

The proposed spate irrigation method has positive impacts on environment, in-terms of efficient use of water, groundwater recharge, erosion control, as a result less sedimentation in downstream, improve water productivity and soil moisture management, and provision of improved drinking water.

(b) On-Farm and Perennial Irrigation

About 34,975 ha of command area is considered for perennial irrigation under the project. The on-farm and perennial irrigation practices can be improved tremendously if layout of farms is improved and based on scientific and engineering principles. This will help in saving precious amounts of water and increase water use efficiency. Government of Sindh has been implementing an OFWM Project and BID can take initiative to implement similar approaches under Sub-component B5 of this project. Under Sub-Component B5, farmers shall be trained and provided strategic matching grant support to improve on-farm water use efficiency and productivity. Improved water management and crop management including integrated pest management and crop diversification will be considered in the farmers training program. Matching grants will be provided for investment support. Additionally, exposure visits for farmers, private sector and project staff will be arranged and training provided for women in agriculture and livestock subsectors, and for project staff. In addition to woman-specific training, women will be encouraged to participate in other training programs with a 20 percent participation target. The environmental and social benefits of an OFWM approaches are the following:

- Improved operation and maintenance and water distribution in distributary canals managed by farmers organization (FOs), i.e., improved reliability and equity of irrigation water distribution;
- Reduced wastage of irrigation water allowing more water to be discharged in to the downstream, which eventually help maintaining the environmental flow of the downstream river stretches;
- Improved water conveyance efficiency in improved watercourses (WCs);
- Increased cropping intensity;
- Increased crop yields; and
- Reduced use of pesticides.

4.3.4 Water for Agriculture

There are two different water sources for irrigation in Balochistan and they are surface water and ground water. According to an estimate about 52% of the project areas is irrigated through surface sources of dams, Indus Basin Irrigation System (IBIS), flood dispersal diversion weirs, and other flood interventions whereas the remaining 48% is irrigated through groundwater sources of Kareze, springs, dug wells, and tube wells.

The surface and groundwater usages are discussed in the following sub-sections.

4.3.4.1 Surface Water for Agriculture

Indus Basin Irrigation System through existing canals distribute about 3.765 billion m^3 of water which serves the irrigation requirements of about 0.56 million ha in addition to fulfilling the drinking water requirements of the population. The Irrigation Department has constructed a large number of irrigation infrastructure schemes including delay action dams, flood diversion structures, flood protection bunds and other related schemes for conservation and utilization of surface/flood flows. These schemes are instrumental in conserving about 90.5 million m^3 of flood/surface flows in Nari Basin and 148.28 million m^3 in Porali Basin.

4.3.4.2 Groundwater for Agriculture

In Nari Basin a small part of the Project area utilizes surface water for irrigating crops but a major portion relies on groundwater for agriculture. A total of about 0.131 million ha are irrigated through four main sources of groundwater (Kareze, springs, dug wells and tubewells). Total groundwater abstraction has been estimated as 814 million m^3. There are four main types of abstractions; electric motor driven tubewells, diesel operated pumps on medium deep wells, bucket or small motors fitted dug wells, and perennial irrigation schemes. On the other hand, groundwater utilization in Porali Basin is relatively smaller.

The project promotes the conjunctive use of water resources, maximize utilization of surface water when available, encourage indigenous method of groundwater use, and supplement irrigation with limited groundwater especially during the dry season. Groundwater recharge schemes are taken utilizing surface water resources, plantation program, and building storage facilities. There are tremendous environmental and social benefits of the conjunctive use of water resources. This will augment infrequent Khushkaba/Sailaba flood diversion events with a reliable water sources (groundwater or perennial) for the promotion of better crops, making better use of total water resources.

4.4 Conclusion

Selected and preferred option of various components of the project are finalized based on the Engineering Design, community consultation, environmental and social studies. The selected options are technically feasible, cost effective, environmentally friendly, and socially benign.

5 Description of Environment

Balochistan comprises about 44% of the total land area of Pakistan. Out of the total geographical area of 34.72 million ha, only 17.16 million ha are reported. The reported area is classified as rangelands, agricultural lands, forests, barren and unproductive mountain slopes. There are 4.35 million ha under cultivation and reported forests and rest is used for grazing (productive and non-productive rangelands and barren lands). Mountains dominate the province, and valley floors and piedmont plains make up only 15% of the landscape. It is these two landforms on which most human settlements, farms, and roads are developed.

The proposed works of the Balochistan Integrated Water Resources Management and Development Project will be carried out in the Nari and Porali River Basins, which feature diverse physical and biological characteristics. These River Basins provide wide variety of biodiversity. Variations in physical features and climatic conditions have produced diverse landscapes, ecosystems and habitats that are important to the national and global heritage.

The flora and fauna as well as their habitat are directly or indirectly threatened by human activities which lead to their degradation, displacement and, in most severe cases, even extinction.

5.1 Physical Environment

5.1.1 Geophysical Layout

5.1.1.1 Nari River Basin (NRB) geophysical layout

Nari River Basin is a groundwater deficit basin having considerable intensive agriculture, fairly large population and comprising of major cities of the province. The river debouches into Kachhi plains along with many other hill torrents (Figure 5-1). The water accumulated in the Kachhi plains during floods could damage the Pat Feeder canal of the Indus and its command in the Sindh and Balochistan provinces. The Ruds River in the north joins the Loralai tributary to become the Beji River; the confluence of the Beji and the Khost forms the Nari River that outfalls to Hamal Lake in Sindh province and from thence to Manchar Lake, with high flood connections to the Indus River. The basin covers around 20 percent of Balochistan, making it the largest river basin in the province and hydrologically the most endowed river basin. About 61% of the river flow occurs during the months of July and August. This water sometimes causes severe flood-like situations in the downstream areas of the river basin, causing severe loss of lives, property and livestock (ICID, 2005).

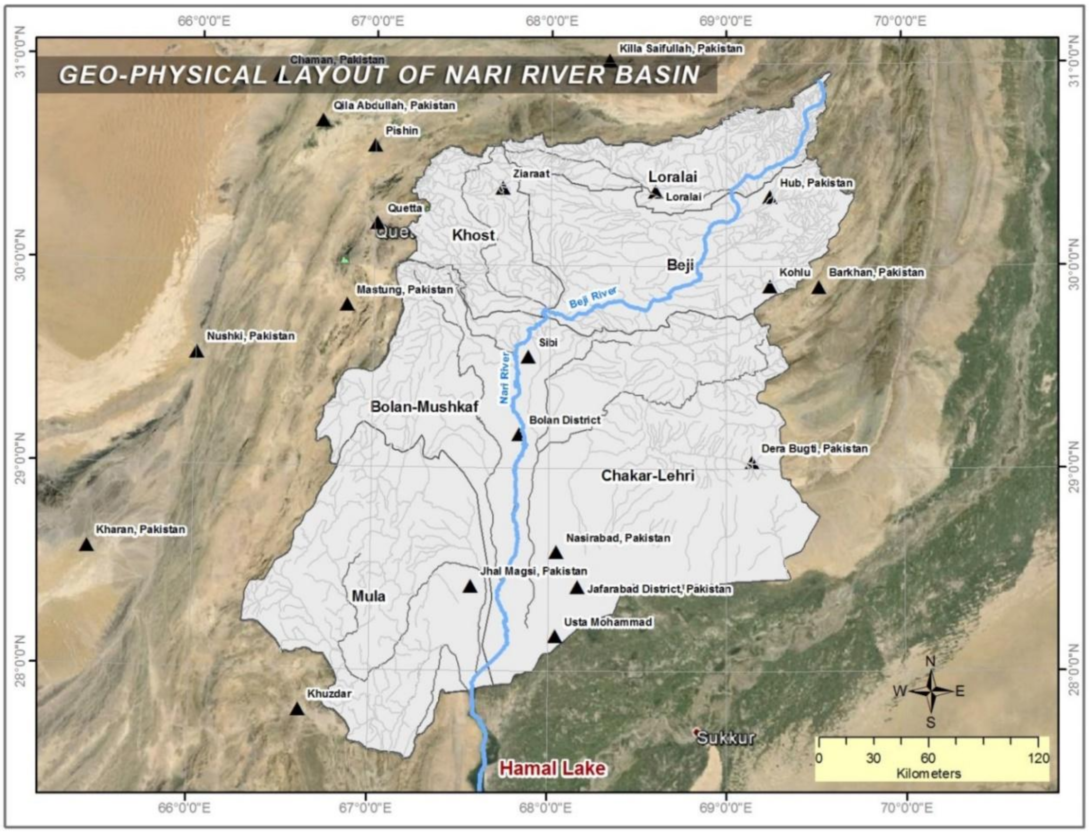


Figure 5-1: Nari River Basins with 6 Sub Basins and Streams Flow Connectivity

5.1.1.2 PRB Geo-physical layout

The Porali River is one of the four rivers of Balochistan draining into the Arabian Sea. Other rivers in the Province either drain into the Indus River or spread onto the Sibi plains (Figure 5-2). The 328km long river originates from the Wadh mountain range in the district of Khuzdar and runs through the plains of Lasbela District. At the southern end, it passes through Miani Hor wet land before entering into Arabian Sea at Sonmiani Bay. At about 90km distance from Karachi City, Miani Hor wetland is a swampy lagoon lying on the coast covering an area of 7,471 hectares and was designated as a Ramsar Wetland site in May 2001 under Ramsar Convention.

The Porali River Basin (PRB) lies within parts of Lasbela, Khuzdar and Awaran Districts of Balochistan. Neighbouring regions are Khuzdar to the north, Arabian Sea to the south, Hub to the East, and Punjgor to the West. Wadh, Bela, Uthal are the major cities which lie within the catchment boundary of Porali River. The total project area of Porali river basin is about 11,616 km^2, of which 6,167 km^2 is within the Khuzdar district, 4,813 km^2 is within the Lasbela district and 637 km^2 within the Awaran district. Overall surface flows follow the north-south path with some local changes.

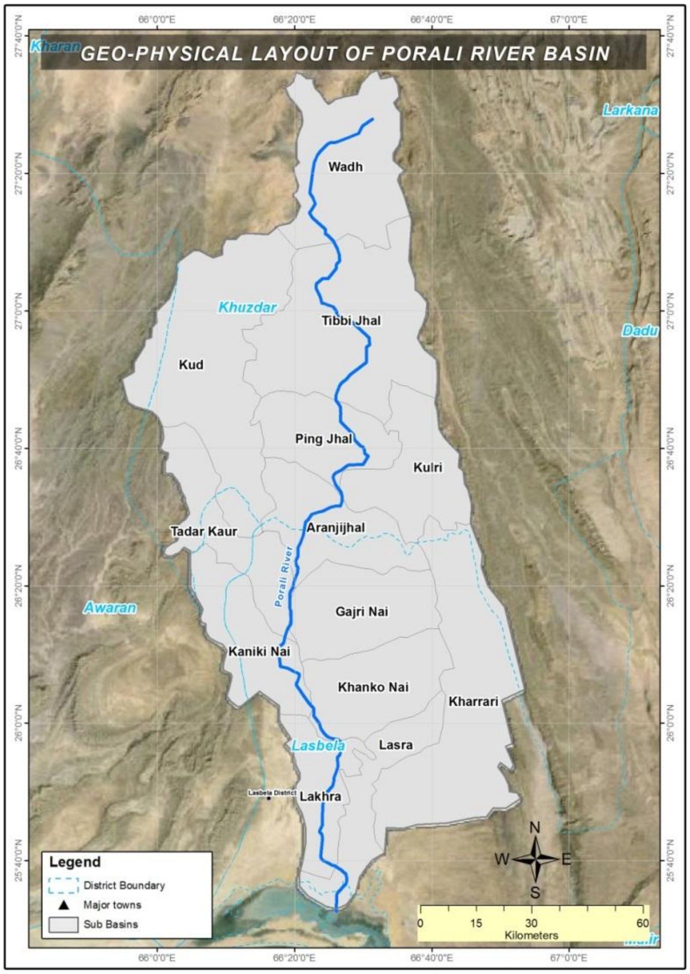


Figure 5-2 : Geo-physical Layout of Porali River Basin

5.1.2 Geology and Landform

5.1.2.1 NRB Geology and Landform

The NRB stratigraphy is quite complex and entails lateral variations in contemporaneous sedimentation. In terms of depositional basins, the province is divided into five geological zones: (i) Zhob-Zhob zone; (ii) Chagai eruptive zone; (iii) Axial belt of Khuzdar, Quetta and Zoab; (iv) Khirther zone of Lower Indus; and (v) Sulaiman range zone of Lower Indus. The geology (Figure 5-3) is characterized by zones of convergence and slip faulting having main geo-dynamic divisions of: volcanic-plutonic arc of Chagai; the Chaman-Ornach Nal oblique strike slip-zone; the Mekran sub-duction margin; the internal zone of convergence of Quetta-Loralai-Barkhan; the zones of ophiolites and ophioliticmalanges; and the continental shelf zone.

The alluvial deposits in the central and lower parts of the valleys consist of layers of clay, gravel, silt, sand or an admixture of these materials. The unconsolidated deposits occur in the form of beds, layers, lenses or irregular bodies. The piedmont areas have coarser materials and are poorly assorted. Thickness of alluvium varies from valley to valley depending on size of the valley, its geology and historical evolution and may be as high as 150 m in some places. Sedimentary rocks dominate the province ranging in age from Triassic to recent Pleistocene. Parts of the province have older volcanic rocks inter-bedded with the sedimentary rocks and largely composed of well-jointed and fractured limestone, sandstones, and conglomerates. The landforms include mountain ranges; alluvial fans; piedmont plains; valley bottoms; sand plains, and tidal plains. The geological formations and their outcropped areas are shown in Table 5-1.

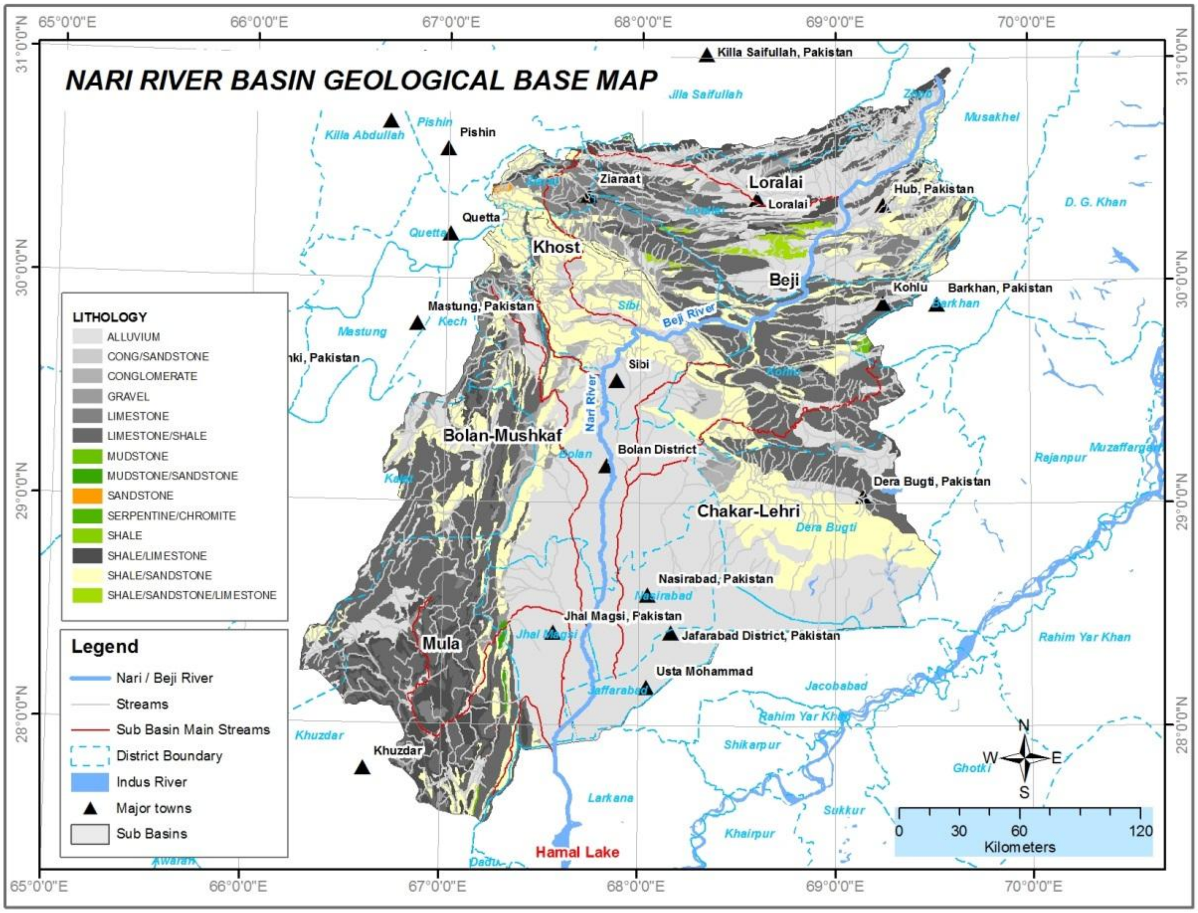


Figure 5-3: Geological formations Layout of Nari River Basin

Table 5-1: Geological formations and outcropped areas in the NRB

Geology/ Lithology	**Area (km^2)**
Alluvium	28,200
Conglomerate/Sandstone	253
Conglomerate	1,140
Gravel	1,792
Limestone	2,580
Limestone/Shale	18,071
Mudstone	41
Mudstone/Sandstone	63
Sandstone	38
Serpentine/Chromite	3
Shale	11
Shale/Limestone	3,867
Shale/Sandstone	12,790
Shale/Sandstone/Limestone	375
Total	**69,225**

Groundwater recharge zones are located in the limestone formations, which form major potential aquifers and sources of large capacity springs along valley margins. In valley floors they can be found at great depths. The quality of water of these springs is good and as such they serve as perennial sources of water for domestic and agricultural uses.

5.1.2.2 PRB Geology and landform

The geology of the PRB is represented by different geological formations as shown in Figure 5-4. The rocks consist mainly of sand stones, shale and conglomerates of various ages. Aeolian deposits can be seen in the south east and river deposits in the North West. From its entrance into Lasbela district, the Porali River runs over a stony course and has low banks as far as Mangia, where it passes through clay soil. In the south, an alluvial plain extends to the bay of Sonmiani and the hilly regions situated east and west of this plain. At the edge of the plain, around the margins of the adjoining hilly regions and near the coast, lie raised sea-beaches, situated some 15 to 25 meters above sea level. The east of the alluvial plain exhibits the greatest variety of rocks forming the Anticlinal Ranges, which are separated by valleys. The whole of the eastern part of the Porali River Basin is mountainous.

Wadh-Khuzdar region is relatively high relief consists of high hills, and this feature continues up to Bela region parallel to RCD high way, where the high hill along the Porali River terminates. The Porali River then widens and due to heavy flood during monsoon rainfall erosion occurs along the river bank. The Porali River flowing downstream of Bela region then turns to relatively low relief up to the Arabian Sea. The eastern part of the PRB, especially in Kharrari Nai sub-basin, exhibits the greatest variety of rocks forming the Anticlinal Ranges, which are separated by valleys.

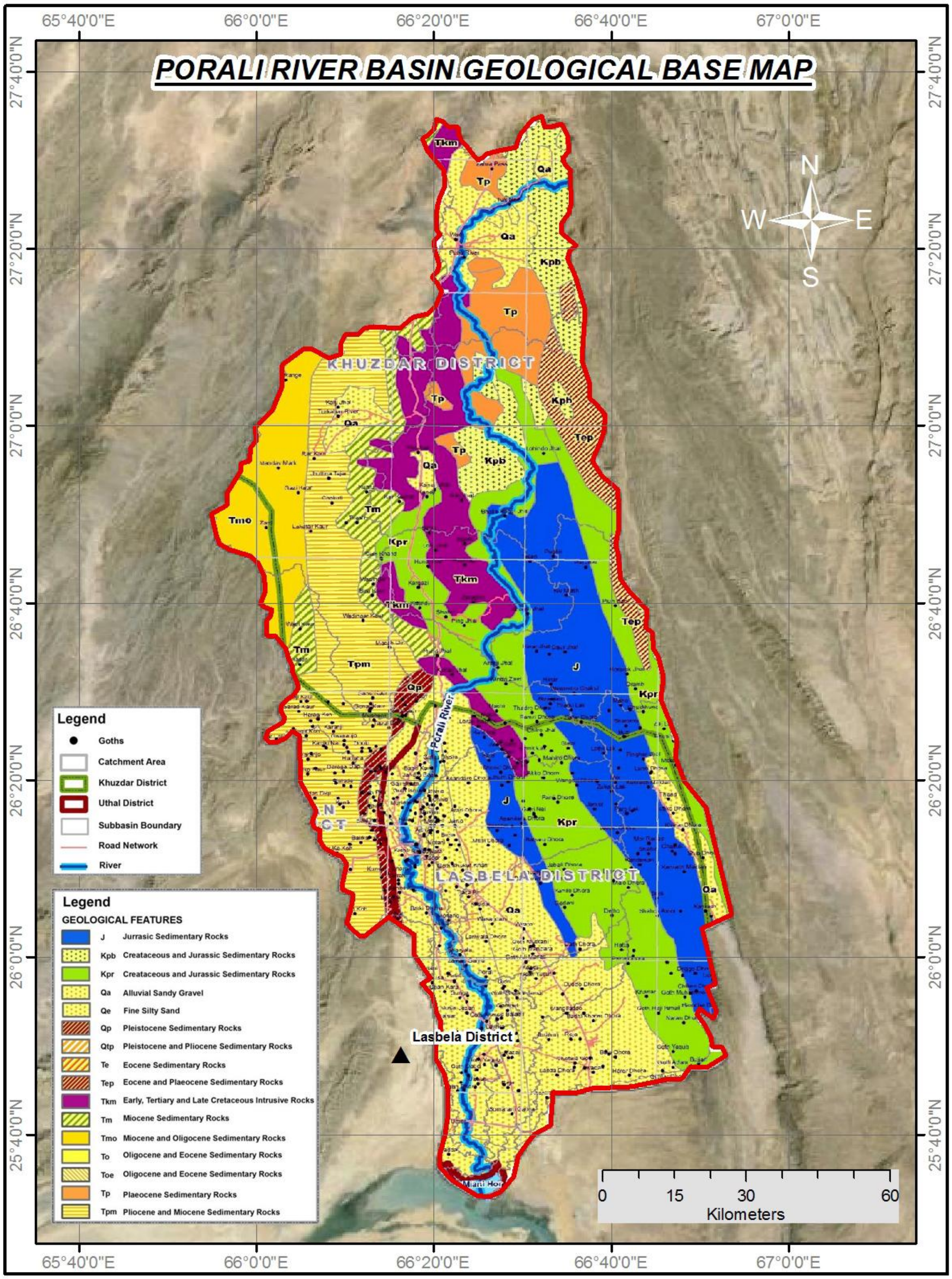


Figure 5-4: Geological formations Layout of Porali River Basin

5.2 Climate

Climatic variability, water management and economic development are intricately linked. Vulnerability to natural disasters affecting water supply hampers economic performance and undermines poverty reduction goals and achievement of the Millennium Development Goals

(MDGs) (UNESCO 2012). Variation in temperature and rainfall may affect water availability, increase the frequency and intensity of floods and droughts, and disrupt ecosystems that maintain water quality (IPCC 2007a, b). IPCC has projected that productivity of rain fed agriculture could decrease by 50% by 2020. The understanding of the climate and variability of climatic parameters for an area is foremost important to precede for the hydrological outgrowth and watershed management strategies. The climatic parameters include temperature, precipitation, relative humidity, sunshine hours, wind speed etc. Amongst the aforementioned parameters, temperature and precipitation play vital role in analyzing the trend and variability of climate for proceeding with management practices.

5.2.1 Precipitation

5.2.1.1 NRB precipitation

Mean annual rainfall in the NRB ranges between 150 to 350 mm. The northern parts of the NRB receive rainfall from both the western and monsoonal disturbances and these areas are classified as hydrologically endowed sub-basins. The rainfall varies from 50 to 200 mm in the Rabi season to between 75 and 200 mm in the Kharif season. There is an ample potential for the development of integrated water management schemes in the sub-basins having higher mean seasonal precipitation. The snowfall in the NRB is not measured therefore the precipitation is normally under-estimated.

5.2.1.2 PRB precipitation

Climatic data for the PRB was obtained from three weather stations at Uthal, Bela and Wadh, within the watershed boundary (Wadh in the North, Bela in the Southwest and Uthal in the South), whereas Khuzdar lies in the Northeast, right above the watershed (GoB, 2014).

The given temporal data for every station vary diligently in time period with distinct start time and missing data. However, all the provided data are used in order to achieve more accurate results. Data at Uthal station is available for 51 years (1961 to 2012). Bela station provides the most data, over 99 years (1912 to 2011). Data at Wadh station is available for 74 years, from 1935 to 2009. Monthly and annual precipitation is calculated from the provided daily precipitation data and various statistical tests & analysis are performed on each of the data set.

Figure 5-5 presents rainfall data of Bela where moving average shows a higher magnitude of precipitation, up to 550 mm, in the early years. From 1915 to 2001, the annual rainfall recorded at Bela did not exceed 300mm. Thereafter, the rainfall pattern shows marked variations with low and high trends.

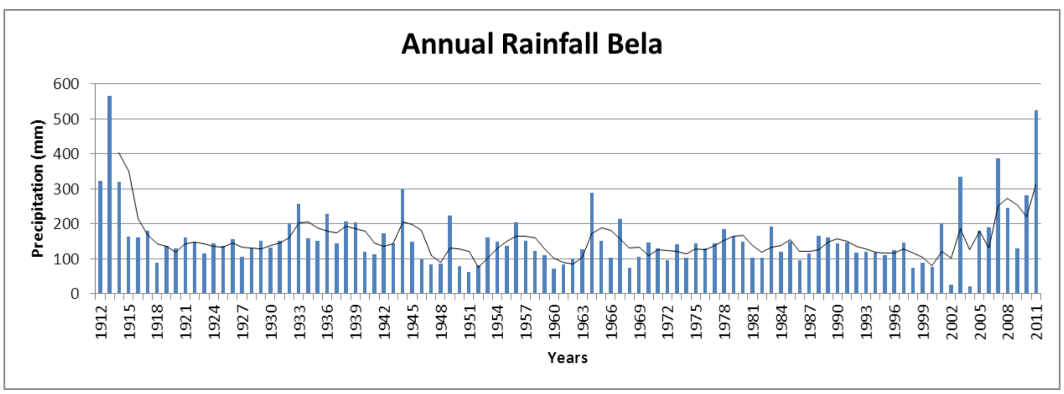


Figure 5-5: Moving average for annual precipitation at Bela

A similar scenario, depicting a decreasing trend, is observed at the Uthal station, Figure 5-6 illustrates moving average of three-year period. In early years difference in intensities of two successive rainfall events is high, whereas, recent years show consistent intensity but of lesser magnitude. Moreover, moving average depicts that a decade from 1968 till 1990 received steady magnitude of rainfall having an average of 110 mm, which in next fifteen years decreased to an average of 85 mm. These results illustrate that, from 2001 onwards, an interesting repetition of the pattern where intensity fluctuates on annual basis. This could be analyzed further on future data to depict if the trend is sinusoidal (GoB, 2014).

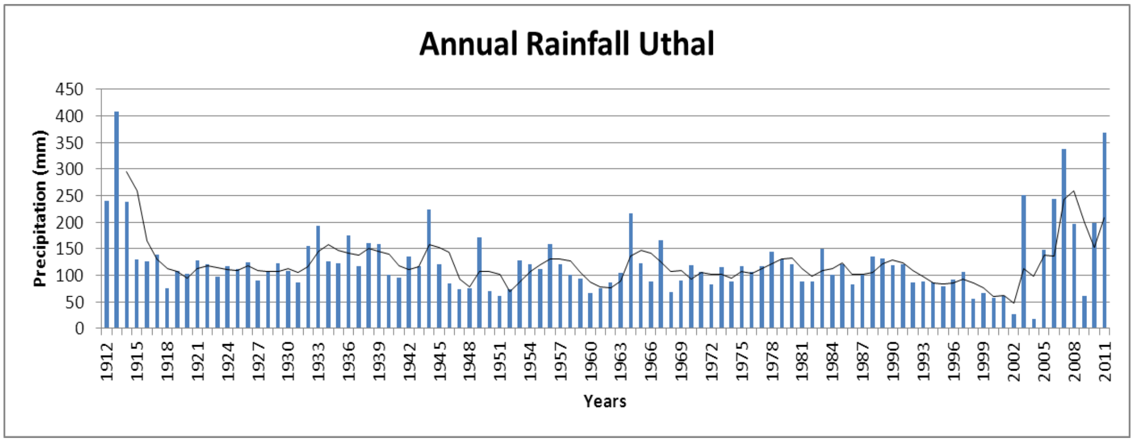


Figure 5-6: Moving average for annual precipitation at Uthal

The pattern recorded at Bela and Uthal are also evident at Wadh. Figure 5-7 shows the three-year moving average trend of precipitation at Wadh. It can be observed the magnitude of rainfall is higher than Uthal and Bela having an average value of 167 mm.

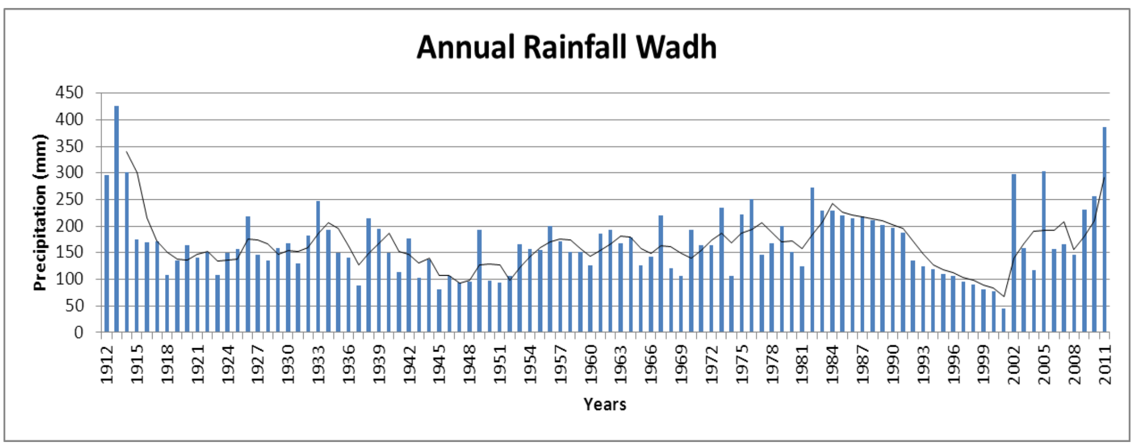


Figure 5-7: **Moving average for annual precipitation at Wadh**

Field surveys also highlighted the fact that the surface water from north flows towards south, leaving little amount of water to be utilized in north and subsequently flooding in South. This matter can be technically resolved as analysis shows increase in amount of water at Wadh. Rainfall can be stored there for efficient irrigation use and can be controlled to avoid flooding downstream.

5.2.2 Temperature

5.2.2.1 NRB temperature

The growing degree days represent the temperature available over and above the base temperature for *Rabi* (crops sown in winter) and *Kharif* (sown during the monsoon) crops and provide an indicator for the growing season length of different crops. Mean monthly temperature data are used to compute the growing degree days along with the base temperature selected for the Rabi and Kharif season reference crops. Chilling hours are computed based on the hours having temperature below 4˚C. This is a primary parameter in the selection of deciduous fruits in the NRB. As data of hourly temperatures are not available therefore chilling hours are estimated based on the minimum temperature data.

5.2.2.2 PRB temperature

Porali River watershed lies in the southern part of the province of Balochistan with hot, dry tropical climate. Summer temperatures rise up to 38˚C, and vary from 3˚C to 17˚C during winter months. Available records from the three weather stations indicate an increase in maximum monthly temperatures. Linear Regression for this parameter elucidates that there is not much significant change in temperature since the increase/decrease is very low. Range of change is not more than 0.3˚C -2˚C which is very insignificant. Annual maximum temperature for all stations shows very slight increase that depicts warmer days at Porali watershed. Linear regression shows that the difference is of 1.3˚C, 1˚C, and 0.5˚C for Bela, Uthal and Wadh, respectively.

5.3 Hydrology and Water resources

Floods and droughts are common phenomena in Balochistan. Droughts are more common and persistent than floods, but the flood damages are intense, affecting the provincial GDP adversely. The suggested approach for the management of droughts and floods is:

- **Floodwater** is a resource and it has to be managed to mitigate the impacts of drought. Management of floods would start from the watershed where improvements in landscape would result in enhanced recharging of groundwater and to provide additional livelihood sources to the watershed users. The excess floodwater can also be stored in a cascade of storage dams to carry and transfer water of a wet year to a relatively dry year.
- **Groundwater** is the only reliable source of water to mitigate the impacts of droughts on the rural economy, therefore recharge to groundwater and generating new shallow aquifers are essential elements of the suggested approach.
- **Diverting floodwater for spate irrigation and creating wetlands** wherever possible to initiate new and additional concepts of livelihood like aquatic food resources (fisheries and aquatic plants) and at the same time generating new shallow aquifers around the periphery of the wetlands demand innovative interventions.
- **Efficient use of water** to address impacts of drought on groundwater by adopting high-value and high-efficiency irrigated agriculture through the introduction of water productive cropping patterns ensuring higher profitability at the farm level.

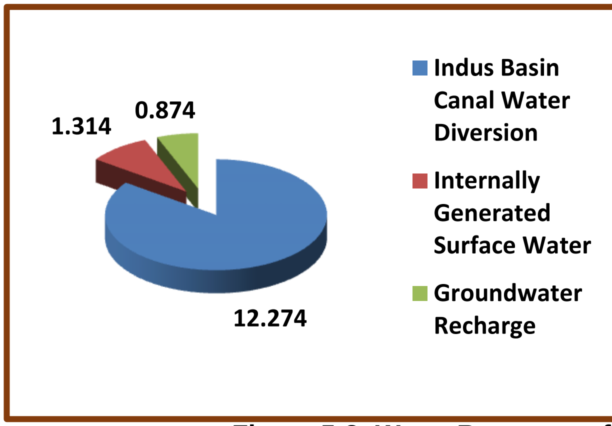
5.3.1 Surface Water

5.3.1.1 NRB Surface Water

The Indus Basin canal irrigation contributes 85% (12.274 billion m^3) of the available water resources in the NRB. The second largest resource is the internally generated surface water from the nine tributaries draining in to the Nari River, which make up 1.314 billion m^3 or 9% of the total resource. The groundwater recharge in the NRB is around 0.874 billion m^3 or 6% of the total resource. The above information is shown in Figure 5-8.

The Indus Basin canal irrigation system of Balochistan is not the target area of the NRB-WRMD Project. Therefore, the internally generated surface water and groundwater are the two resources to be addressed in the NRB-WRMD project. Of the total water available outside the

Indus basin, surface water constitutes around 60% and the groundwater contributes rest of the 40% in the NRB.



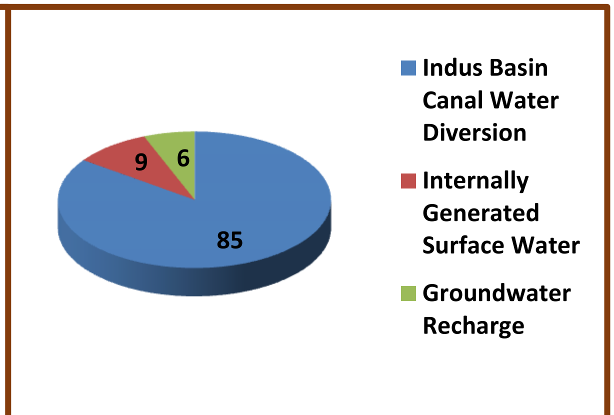


Figure 5-8: Water Resource of NRB (billion m^3) and as % of total

The current surface water use in the NRB is 222 million m^3 out of average surface water available of 1315 million m^3. Only 17% of available surface water is being utilized in an average year and rest 83% is available for future development. The current groundwater use in the NRB is 555 million m^3; representing 64% of the available groundwater and rest 36% is available in the four sub-basins, which can be utilized in future. Groundwater provides reliable source of water to mitigate the impacts of droughts when surface water is reduced by six-folds. The probability analysis of internally generated surface water in the NRB indicates that in wet years (one-out-of-five), the water availability increased to more than 3.058 billion m^3. It reduces to 0.307 billion m^3 in the dry years (one-out-of-five). The most important is the one-out-of-two year when water availability is more than 1.315 billion m^3. Surface water available in the wet years must be stored in reservoirs to reduce future pressure on groundwater in sub-basins where it is extensively used resulting in lowering of water table and mining of groundwater. This will reduce the risks of flood damages to irrigation infrastructure and other economic losses to the economy.

The available surface water/runoff was assessed on the basis of calibrated Strengths, Weaknesses, Opportunities and Threats (SWAT)/ Spreadsheet SCS model based on which runoff has been synthesized using daily rainfall data. Similarly the Indus share from Indus River is based on the allocation made under Pakistan Water Apportionment Accord 1991 (GoB, 2013).

The sub-basin wide availability of surface water resources was assessed at three probability levels representing dry, average and wet years (Figure 5-9 and Table 5-2). The surface water availability at the NRB level at three probability levels of 80, 50 and 20% is 307, 1315 and 3058 million m^3 per annum, respectively. This shows a wide variability in the availability of surface water and demands that excess water can be stored to reduce the impacts of floods and droughts on the NRB economy.

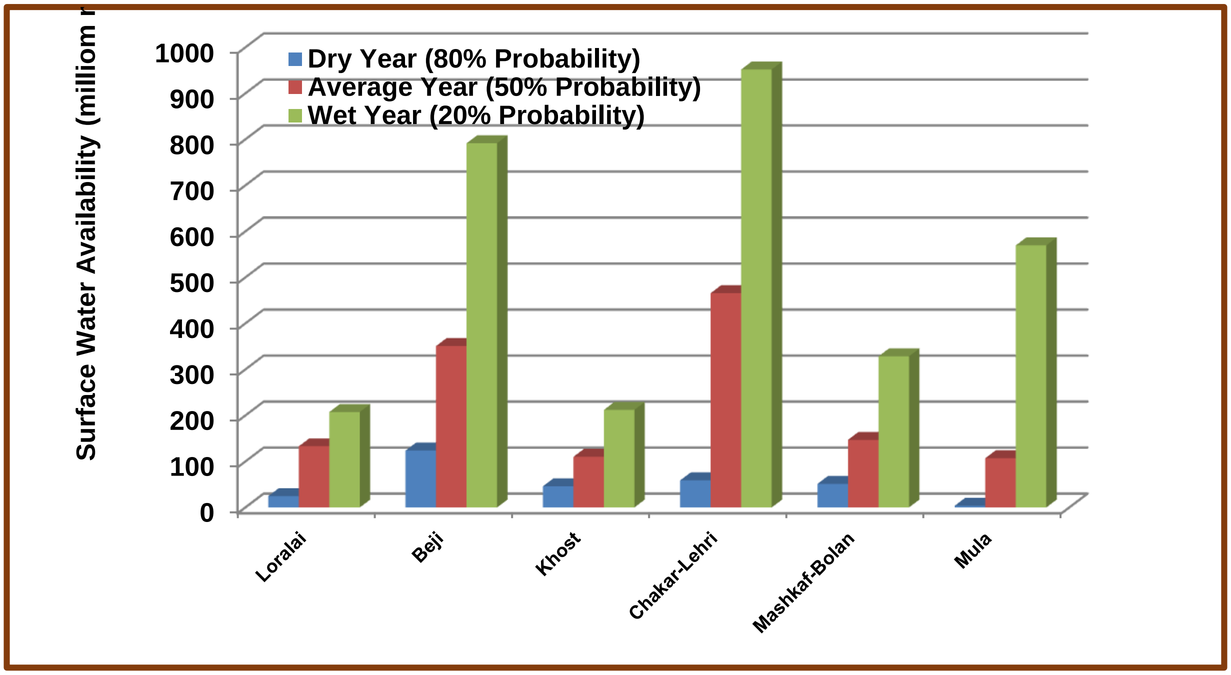


Figure 5-9: Probability of surface water availability in the sub-basins of the NRB (GoB, 2014b)

Table 5-2: Surface water assessment for the selected NRB sub-basins

Sub-basins	Precipitation (mm)			Water Availability (million m3)		
	Dry	Average	Wet	Dry Year	Average Year	Wet Year
Loralai	116.38	225.04	345.64	26.56	142.72	222.71
Beji	152.65	263.27	481.08	120.86	342.71	773.14
Khost	103.38	177.93	251.16	46	110.07	212.07
Chakar-Lehri	54.61	116.08	202.18	58.91	465.82	951.8
Mashkaf-Bolan	67.26	146.81	221.39	51.28	146.97	328.37
Mula	24.94	65.41	154.64	3.84	107.04	569.58
Total				**307.45**	**1315.33**	**3057.67**

Source: GoB, 2013 Using data collected by the Water Resources Planning, Development and Monitoring Directorate of Department of Irrigation, Government of Balochistan.

5.3.1.2 PRB Surface Water

Perennial flow is found in upper part of Porali River up to Gundacha whereas the flow in the lower reaches is found in and after rainfall events. The project feasibility report (GoB, 2014) presents a detailed assessment of Surface Water availability in PRB using field data, GIS based hydrological models and water balance models.

There are only two flow gauging stations in the Porali River Basin, *Sinchi Bent* and *Mai Gudrani*, where Sinchi Bent measures flow of Porali River and Mai Gundrani records flows for Kud River. Both gauging stations cover a certain drainage area of the watershed. Therefore, the watershed is divided into two segments/catchments according to the coverage area of flow gauging stations.

The flow gauging station for Porali River lies in the South of Khuzdar at Sinchi Bent. This station drains an area of 4,182km^2. The second flow gauge station is for Kud River which lies at the south of Bela at Mai Gudrani. It drains out an area of 2,005 km^2. A summarized list of annual flow is presented in

Table 5-3. However, available data is very limited and the modelling is based on weather data from different sources in the sub-basin, as shown below:

Table 5-3: Summary of Measured Discharge at two gauge stations

Year	Measured Discharge (cumecs)					
	At Kud River			At Sinchi Bent		
	Min	Max	Average	Min	Max	Average
2000	0.000	17.461	2.481	0.113	44.282	3.342
2001	0.028	140.368	2.267	0.113	163.942	47.599
2002	0.000	48.676	1.167	0.255	12.579	6.864
2003	0.000	370.730	6.876	0.396	104.281	73.685
2004	0.000	44.714	0.969	0.396	52.504	38.709
2005	0.028	370.730	6.005	0.340	58.631	17.118
2006	0.000	277.538	4.652	0.283	67.444	33.244
2007	0.000	281.302	3.300	0.283	93.298	34.290
2008	0.000	116.370	1.940	0.340	95.987	31.814
2009	0.000	75.052	1.391	0.028	27.036	17.119

On average, 1,022 million m^3 of water is generated in the Porali River Basin. However, the current use of this water is estimated to be only 82.1 million m^3 of which only about 7% of average available water is currently used with the remaining draining into the Arabian Sea. The volume of available water with 80% probability is about 741 million m^3 which, exclusive of ground water, is still very high in comparison to current water consumption that includes ground water. This huge gap of water potential and current use obviously calls for genuine need for the development of water resources in the PRB to enhance the living condition of inhabitants of this basin.

5.3.2 Groundwater resources

There are three major components of groundwater (also known as aquifer water): recharge, storage, or cross-formational flow. Recharge is the amount of water that is added to the aquifer from infiltration/percolation of rainfall, melting snow, or flowing rivers. In a hydrologic cycle when rain and snowfall on the surface of the earth a part of it evaporates, part of it runs off into streams, a part of it evaporates, a part of it infiltrates into the soil, some of it evaporates back into the atmosphere, some of it is used by plants, and some of it percolates into the ground. The percolated water eventually reaches and recharges/replenishes the aquifer. The percent of precipitation that eventually recharges the aquifer is small, usually between 1 to 15% of the total rainfall depending upon the geological formations.

Storage is the amount of water stored in the aquifer. The water level changes in an aquifer reflect change in storage. When water levels rise, there is an increase in storage and vice versa. There are two types of storage: drainable storage and compressible storage. Drainable storage is the amount of water that can be drained from an aquifer. Similarly, compressible storage is the amount of water stored in the aquifer due to the compression of the aquifer and the water itself. Drainable storage is much larger than compressible storage.

Cross-formational flow is flow from a bordering geologic formation into the aquifer. This flow may occur naturally or may be induced by pumping. Depending on the aquifer and the surrounding geology, water from cross-formational flow may be of good or poor quality. With pumping, groundwater may flow into an aquifer from a bordering aquifer.

5.3.2.1 NRB Groundwater resources

The average annual recharge of the NRB has been evaluated on the basis of probable precipitations (20%, 50% and 80%). The following table gives the status of groundwater availability of the six sub-basins (Figure 5-10; Table 5-4).

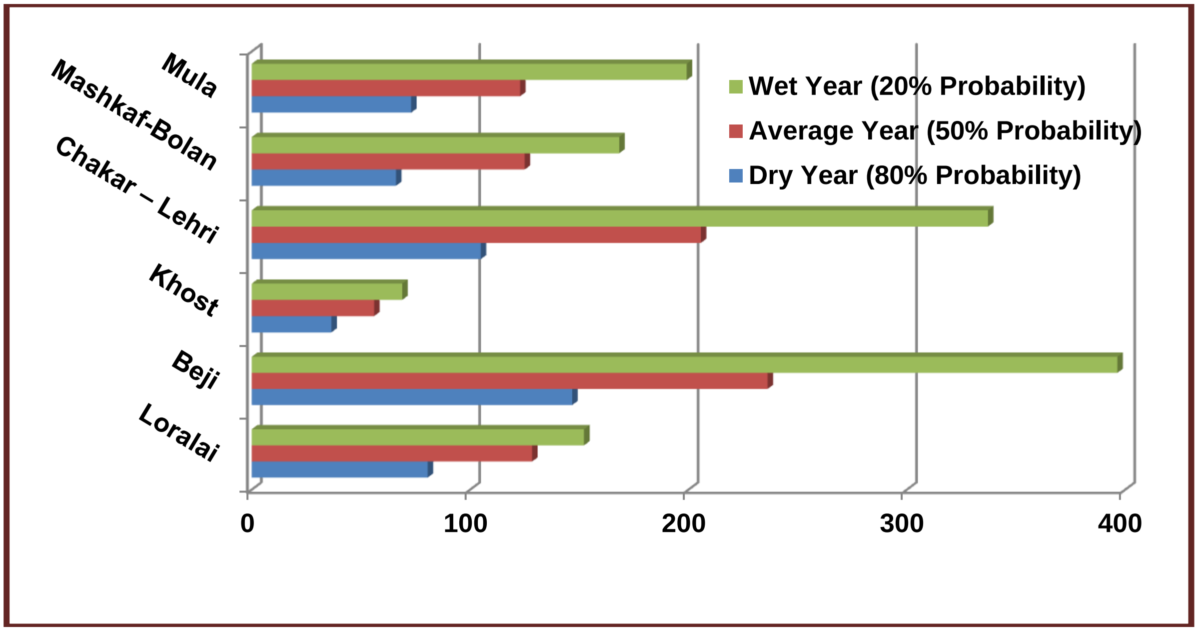


Figure 5-10: Groundwater recharge at the three probability levels of the sub-basins of the NRB

Table 5-4: Groundwater assessment for the sub-basins of the NRB

Sub-basins	Stored Water (million m^3)	Storage/meter (million m^3)	Recharge (million m^3)		
			Dry	Average	Wet
Loralai	58127.35	578.49	80.57	128.46	152.22
Beji	57624.48	629.03	146.74	236.24	396.46
Khost	7376.79	160.75	36.47	56.06	68.95
Chakar–Lehri	501782.91	2800.72	104.92	205.71	337.15
Mashkaf-Bolan	37600.03	609.75	66.04	125	168.29
Mula	63859.62	644.12	73.02	122.9	199.22
Total	726371.2	5422.9	508	874	1322

Source: GoB, 2013. Using data collected by the Water Resources Planning, Development and Monitoring Directorate of Department of Irrigation, Government of Balochistan.

The recharge to groundwater at the NRB level at the three probability levels of 80, 50 and 20% comes to 508, 874 and 1322 million m^3 per annum, respectively. The recharge to the NRB varies significantly in the dry, average and wet years and will have implications for the development of groundwater based agriculture in the province.

5.3.2.2 PRB Groundwater Resources

According to the 2014 project feasibility study (GoB, 2014), carried out under the World Bank-financed Baluchistan Small Scale Irrigation Project (BSSIP), there is currently no groundwater monitoring system in the PRB. There is a need to establish a monitoring system in order to understand and model the aquifer behaviour which is currently considered under stress and was reflected from farmers' concerns observed during interviews with farmers using the groundwater.

To make up for this gap and develop an understanding of the groundwater in the PRB, the study focused on the flood and drought management data available from the weather stations and institutional records.

Flood and drought management in the PRB

Historical records indicate that the southern portions of the PRB, mostly in Lasbella District, are vulnerable to various natural disasters. These include tsunami (1945), cyclone (2010), earthquakes and droughts (1998-2004). There is also a high incidence of floods in the area, with flash floods developing quickly, sometimes without visible signs of rain. The Porali River carries flash floods that have been known to severely damage major road infrastructure in the district. Flash floods also damage housing, sewerage systems and storm water drains in urban centres and cause landslides, mudslides and soil erosion (MFF, 2014).

The Porali River Basin feasibility study of 2013 (GoB, 2014) generated a future flood scenario based on 10-year records of highest rainfall values (Table 5-5). Volume of water obtained during flooding was calculated from the simulated stream flows and the stream flows imported to a hydraulic model in HEC-RAS, incorporated in WMS to generate flood inundation map.

Table 5-5: Highest Ten Precipitation Years for all Stations (Bela, Uthal, and Wadh).

	BELA		UTHAL		WADH	
	Year	Precipitation (mm)	Year	Precipitation (mm)	Year	Precipitation (mm)
1	1912	321.70	1912	239.02	1912	295.76
2	1913	565.54	1913	407.27	1913	425.30
3	1914	319.16	1914	237.27	1914	300.99
4	1933	258.36	1944	223.25	1933	246.43
5	1944	298.84	1964	216.24	1976	251.00
6	1964	288.68	2003	250.20	1982	273.05
7	2003	333.26	2006	243.20	2002	297.96
8	2007	386.50	2007	338.30	2005	302.30
9	2010	281.70	2010	199.02	2010	255.76
10	2011	525.54	2011	367.27	2011	385.30

Source: GoB, 2014

Table 5-6 shows the highest amount of flow that can be expected in Porali River. The average annual volume of water in Porali River Basin, obtained for flooding scenario is 2,010 million m^3. This is the forecasted amount of water for the watershed which is almost 2 times more than the amount in normal conditions 1,022 million m^3 which can cause massive destruction over vast areas especially agricultural lands.

Table 5-6: **Annual volume of Porali River Basin for flood scenario**

Years	Annual volume of Porali River Basin (MCM)
1912	1,960
1913	3,209
1914	1,962
1933	1,595
1944	1,501
1964	1,560
2003	1,690
2007	1,984

Years	Annual volume of Porali River Basin (MCM)
2010	1,695
2011	2,945
Annual Average	**2,010**

Source: GoB, 2014

This volumetric analysis shows the amount of water that has to be managed for future scenarios. Graph illustrates that volume can reach up to 3,209 million m^3 which means there can be a lot of water that can be stored at the times of heavy flooding.

In order to evaluate the destruction and identify the vulnerable areas for simulated amount of water, hydraulic modelling is performed. DEM, other GIS based shape files and HSPF simulated flows are imported to WMS and HEC-RAS is run to illustrate inundation for future floods. The hydraulic modelling output of HEC-RAS provides values for various hydraulic constituents including area, flow, hydraulic depth, velocity, wetted parameter, etc.

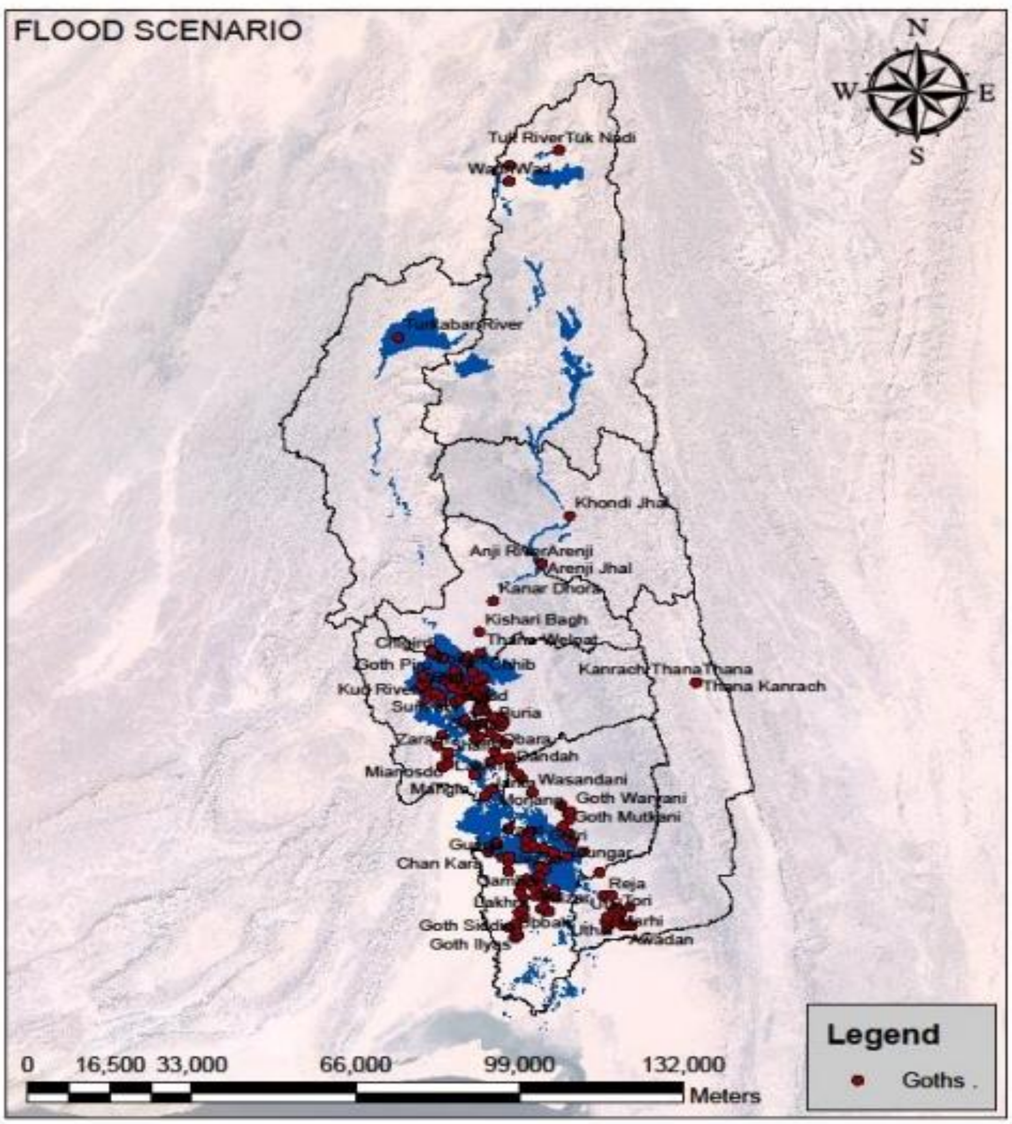


Table 5-7: Flood inundation map of Porali watershed (Source: GoB, 2014)

The map in Table 5-7 is the generated flood inundation map for peak discharge of Porali watershed. It is overlaid on the GIS layer of settlements that depicts the prone areas with the settlements layer filtered in order to highlight only the areas near inundation. In the upper region, overflow of Tuk Nadi floods its banks. On the upper west of Porali watershed, Turka bar River inundates a large area. As the Porali River flows downstream, it inundates the riverbanks and surroundings such as Khandi Jhal and Arenji Jhal. The area where Porali and Kud rivers meet, receives most discharge inundating most of the agricultural lands and settlements. Comparison of existing and forecasted inundation maps show that Bela is highly vulnerable since flow from flow the upstream come down to a relatively gentle slope making water stand for a longer period of time and inundating more areas. The model predicts that the following settlements are likely to get inundated from future floods: Goth Piru, Buria, Sumrani, Chib, Nalat, Chigirdi, Bhit, Gador, Lakhu, Goth Haji Mian Wasaya, Dadar Dhora, Haji Bhutti, Loilani, Jhandro Bagh and many more. These settlements are to be given priority in the mitigation strategies. Mangia, Gunga, Chan Kara, Jezan, and Gambat are a few settlements in Uthal region that are prone to future flooding.

5.4 Climate change impacts on flooding

Glacier melt in the Himalayas is projected to increase flooding will affect water resources within the next two to three decades. This will be followed by decreased river flows over time as glaciers recede (PDMA, 2011). This could lead to a decrease in freshwater availability, resulting in biodiversity loss and reduced availability of freshwater for the population. Coastal areas bordering the Arabian Sea in the south of Pakistan, such as the downstream areas of the Porali River Basin, will be at greatest risk due to increased flooding from the sea and in some cases, the rivers.

Climate change is estimated to affect crop yields in this predominantly agro-based economy, in turn affecting livelihoods and food production. Decreased yields with the current rapid population growth and urbanization will likely increase the risk of hunger and food security. Endemic morbidity and mortality due to diseases primarily associated with floods and droughts are expected to rise. Increases in coastal water temperatures would exacerbate the abundance of cholera.

The impact of climate change will also aggravate the existing social inequalities of resource use and intensify social factors leading to instability, conflicts, displacement of people and changes in migration patterns.

Balochistan has the highest climate change vulnerability index ranking of all the agro-ecological zones in Pakistan (Malik et al, 2012). This ranking clearly indicates the need for focused climate change adaptation strategies in Balochistan that will need to be built into the BWIMDP.

5.5 Seismology

5.5.1 NRB seismology

NRB is situated in a highly seismically active region and there are historic records of several disastrous earthquakes. The Ziarat earthquake in October 2008 was of magnitude Mw 6.4.The NRB lies in seismic zones which are shown in Figure 5-11.

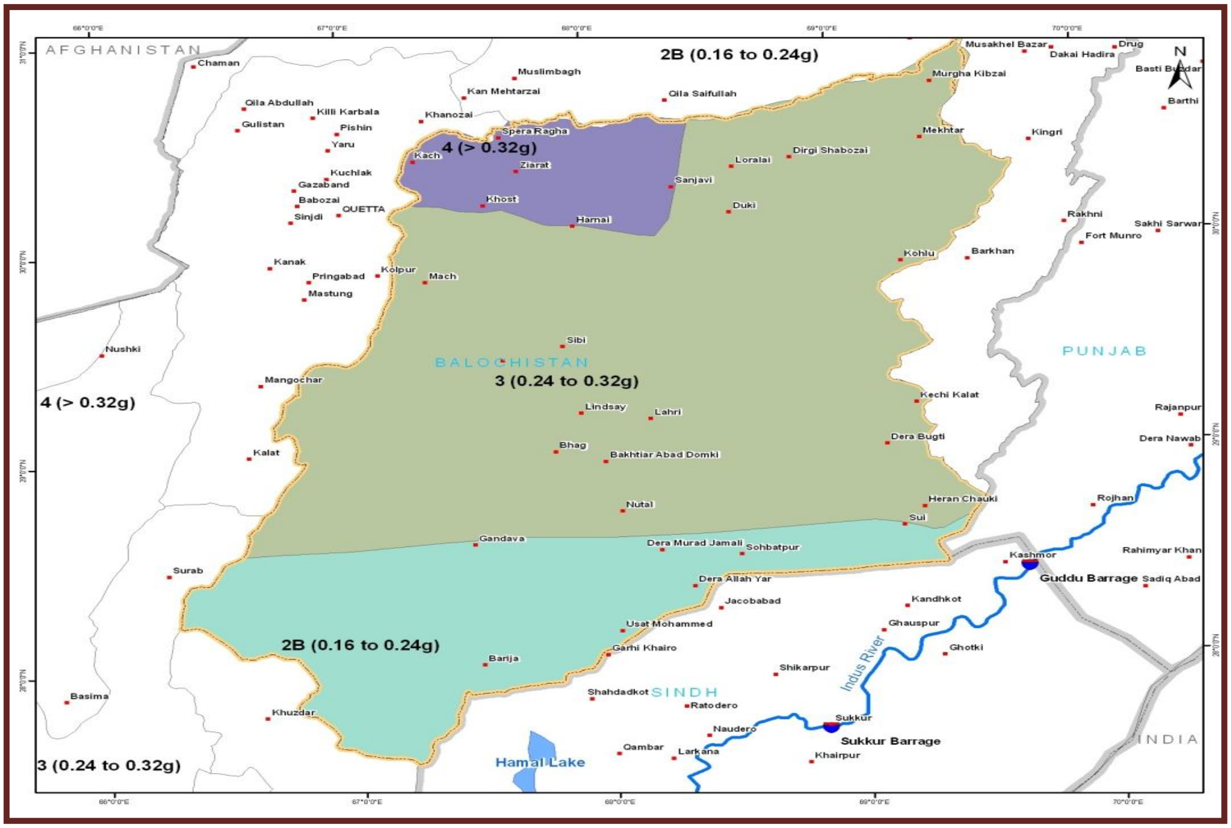


Figure 5-11: Seismic map of NRB

5.5.2 PRB Seismology

Porali river basin is divided into four major tectonic zones (Figure 5-12) that are as follows: Chaman-Ornach Nai Fault Flysch Zone, Bela Ophiolite Belt, Porali Trough, Kand Range Fold Belt.

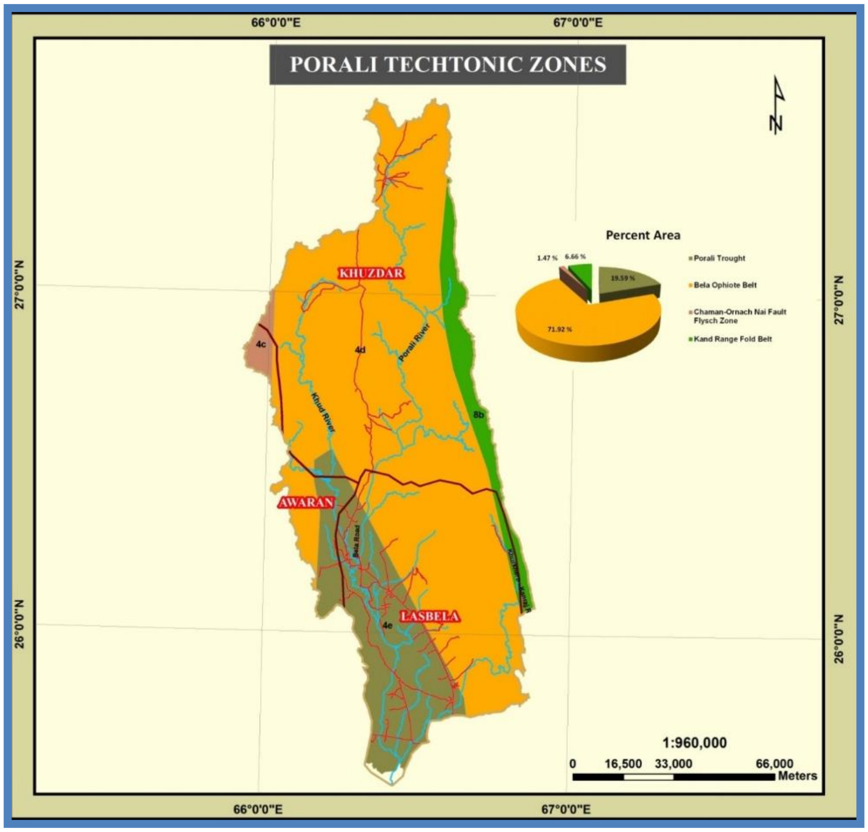


Figure 5-12: Major Tectonic Zones in PRB

5.6 Terrestrial biodiversity[2]

There is a paucity of recent data on terrestrial biodiversity in the project regions and the information presented here is based on documentation from expert organisations and academic journals.

5.6.1 Forests and flora

5.6.1.1 NRB forests and flora

The NRB has one of the largest blocks of juniper (*Juniperus excelsa*) forests in the world, covering approximately 141,000 ha. The most extensive and best-known examples are found in the Ziarat and Zarghoon valleys, which occur at elevations between 2000–3500 m. Growth conditions are harsh. The trees are very slow growing. Consequently, these forests are believed to be among the primitive in the world.

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[2] Key references used for the development of the biodiversity baseline (including on flora, fauna and fish) include:

Siddiqui, P.J and Amir, A.A (n.d). Baseline Survey of Fish Diversity at Miani Hor, Balochistan. Available at: http://www.pakistanwetlands.org/reports/Baseline%20Survey%20of%20Fish%20Diversity%20at%20Miani%20Hor.pdf
Chaudhry, MJI; Arshad M, Akbar G, 2012. Some Observations on Threatened and Near Threatened avifauna of Pakistan. In Records Zoological Survey of Pakistan. 21: 65-72. Available at: http://www.pakistanwetlands.org/reports/Baseline%20Survey%20of%20Fish%20Diversity%20at%20Miani%20Hor.pdf

IUCN, 2013. Ziarat Juniper Biosphere Reserve: Management Plan.

Coniferous forests occur at elevations of 1500-3500m in the NRB, while scrub Forests are found at elevations of 500-1500m. These forests protect soil erosion and reduce intensity of flash floods. Three types of scrub forests exist in the NRB area. These are:

(i). *Dry Temperate Scrub*. The dominant species is Steppe and available at NRB project area in Mustung and Kalat locations. Overgrazing and collection of fuelwood have affected these dry temperate scrub forests.

(ii) *Dry sub-tropical broad leaves Forest*: In the NRB project area these forests are located in Beji sub-basin. The dominant species are *Olea ferruginea* and *Pistacia Khnijik*.

(iii).*Tropical thorn Forests*: In the NRB these forests exist in Sibi plains. These are generally open forest of thorny and woody species with stunted growth, low branching and other xerophytic habitat. Grazing and cutting of fuelwood have converted these forests into scrub form.

A list of existing tree and other flora species of the NRB is presented in Annex A.

5.6.1.2 PRB forest and flora

The PRB is characterized by hot deserts, semi-deserts and savanna with scanty terrestrial vegetation consisting mainly of xerophytes including the thorny *Euphorbia caducifolia*, *Caragana polyacantha*, and *Convolvulus spinosus*. Seasonal rivers, streams, and gorges as in the mountain areas of Hingol National Park, and small valleys, such as Bilawal in the Pub mountains have patches of vegetation including tree species. Their lifeline is rainwater or water springs. *Fagonia arabica, Acacia rupestris, Astragalus sp., Capparis aphylla, bushy and leafy Salsola spp*., the stiff leaved fan palm or mazri palm, and the rigid *Tamarix spp*. (kirri) also grow naturally in the district. Mesquite (*Prosopis juliflora*), an exotic species that is bushy in shape, has spread over large areas in the south-eastern parts of the district. These plants are exceptions in the prevailing barren landscape.

Species diversity is generally better in the relatively moist, deeply incised mountain valleys and northern slopes of mountains and higher altitudes. Several endemic species and species with limited distribution belong to the genera Tamarix and Heliotropium. Annex A includes a cumulative list of flora in Porali River Basin.

5.6.2 Terrestrial Fauna

5.6.2.1 NRB terrestrial fauna

The recorded species of mammals and reptiles in the NRB are presented in Table 5-8.

Table 5-8: **List of Mammals in the NRB**

Common Name	Scientific Name
Mammals	
Wolf	*Canis lupus*
Jackal	*Canis aureus*
Common hill fox	*Vulpes vulpes griffithi*
Markhor	*Capra flaconeri jerdoni*
Cape hare	*Lepus capensis*
Afghan pika	*Ochotona rufescens*
Indian crested porcupine	*Hystrix indica*
Mouse-like hamster	*Calomyscus bailwardi*
Migratory hamster	*Cricetulus migratorius*
Afghan mole vole	*Ellobius fuscocapillus*
Reptiles	
Gecko, Mountain Dwarf	*Tropioclotes depressus*
Tortoise Afghan	*Testudo horsfieldii (IUCN Red List: Vulnerable)*

Northern wolf snake	*Lycodon striatus*

NRB project area is a main route of migratory birds (Annex A) from Afghanistan and India. The Demoiselle and Eurasian cranes migrate from Afghanistan to India, cross Zoab River and Loralai area before entering into Punjab. It is estimated that more than 40,000 demoiselle Cranes pass through NRB, of which 5,000 are trapped each year. The Saker falcon is another migratory bird, during the winter season, in Loralai and Khost sub-basins. A list of migratory birds found in the NRB is presented in Annex A.

5.6.2.2 PRB terrestrial fauna

There is no reliable data study on the composition of fauna in the PRB, and the list of mammals and reptiles presented here is based on the known list (Annex A) of fauna in the Hingor National Park (HNP) which is in proximity to the PRB and has similar physiographic features.

About 30 mammal species were reported from HNP, indicating that the park has a relatively high diversity of species given its desert environment. However, the population of a number of species is critically low including Wolf, Leopard, Hyena, and possibly Caracal and Honey Badger.

5.6.3 Aquatic Fauna

Balochistan's overall climate has arid conditions and is identified for the seasonal flash floods which flow during high intensity showers of monsoon and spring.

5.6.3.1 NRB aquatic fauna

The aquatic fauna is mostly confined to the fish species that are present in lagoons. Besides, many migratory birds including cranes and ducks also visit many of the lagoons of the Nari River Basin during the migration and on the way back.

In the upper reaches of the Nari river basin, i.e., in Sehan and Beiji Sub-basin, *Mahasheer* is the common fish species present in the lagoons and other water bodies. While in the lower reaches of Nargi Gorge, Mushkaf area, the fish species found include: *Rohu, Palli, Palwar, and Mally* (Table 5-9).

It is, however, expected that with the passage of time, the farmers of the area falling in the jurisdiction of Perennial Irrigation Schemes may switch over to fish farming because it has become a lucrative business in view of the increasing meat demand in the country/province.

Table 5-9: Common species observed in NRB

Common Name	Scientific Name
Fish	
Mahaseer	*Tor putitora*
Rohu	*Roho labeo*
Botchee	*Scaphiadon irregularis*
Amphibians	
Marsh Crocodile	*Crocodilus palustris*

5.6.3.2 PRB aquatic fauna

The distinguishing characteristics of the mangrove community are the great variety of land and water organisms that live together there because the habitats of land and sea overlap. Probably no other habitat in the marine environment is associated with such a variety of fauna as the mangrove swamps. They provide food and shelter to fish and waterfowl as well as jackals, wild boars, bats and dolphins etc. The mangrove swaps act as nurseries and nutrients suppliers for economically important fish species on which many coastal communities in developing countries depend. Some of the forest birds move seawards to live amongst the branches of mangrove forests; on the surface of the mud, the marine animals migrate inland, so far as salinity permits. Many marine animals live on the trunks and roots of the mangrove attached in the same way as they are on rocks elsewhere (IUCN, 2005). Important species observed in PRB are presented in Table 5-10.

Table 5-10: Important species observed in PRB

Common Name	Scientific Name
Reptiles	
Olive Ridley turtle	*Lepidochelys olivacea*
Green Turtles	*Chelona mydas*
Annulated sea snake	*Hydrophis cyanocinctus*
Many toothed sea snake	*H caerulescens*
Beaked sea snake	*H mamillaris*
Common small headed sea snake	*Microcephalophis gracilis gracilis*
Pelagic sea snake	*Pelamis platurns*
Beaked sea snake	*Ephydrina schistosa*
Marsh crocodile	*Crocodylus palustris*
Amphibians	
Olive Ridley turtle	*Lepidochelys olivacea*
Green Turtles	*Chelona mydas*
Marsh crocodile	*Crocodylus palustris*

PRB Fish

Nearly 100 species of fish have so far been recorded from the mangroves, of which 46 species were in fingerling or young stages while 52 in sub-adult or adult stages. Among the fish fauna of the swamps, mudskippers (Periophthalmidae) are the best adapted for this peculiar type of habitat. Many mudskippers (Genus: Boleopthalmus) have become partially independent of water. They jump about in the swamps and when alarmed or when the tide begins to recede they burrow into the ground. In these fishes respiration is taken over by skin; well vascularised papillae on the bark and the sides of the body allow gaseous exchange between humid air and the blood.

Another type of mudskipper (Genus: *Periophthalmidae*) has gone a step forward: it lives about entirely out of water. As the tide comes in, some species actually flee from the water, clinging to the trunks or prop roots of the mangrove a few centimeters above surface; when the tides recedes, they descend and hunt for food. During the breeding season, these fish build funnel shaped nests in the mud; leading down to the ground water when the young grow until they have become adapted to life on land. Bottom dwelling fish such as Pleuronectiformes living on muddy bottom in channels or other water masses near mangrove swamps generally move towards the swamps to share the food at high tide. Many detritus feeders like elupeids, gray mullets etc find this region perfectly suitable and pony fish (*Leiognathidae*) also like this environment, as they are safer here compared to the open environment where there is little or no refuge against their predators (IUCN, 2005). Fish in the mangrove areas is further discussed in the Miani Hor.

5.7 Species of Special Concern

The subject of species of special concern will be considered in this section as a cross-cutting issue in both river basins. There are four species of threatened mammals in Balochistan. Table 5-11 presents the main species, in the two Basins, which are internationally and nationally recognized as threatened.

Table 5-11: **Threatened species in the project area**

Common Name	Scientific Name	IUCN/National Conservation Status
Mammals		
Baluchistan Black Bear	*U. thibetanus gedrosianus*	Critically endangered
Chiltan Wild Goat	*Capra Aegagrus Chiltanensis*	National: Threatened[3]
Straight horned (Suleman) Markhor	*Capra Falconeri jerdoni*	Endangered
Urial	*Ovis vignei*	IUCN: Vulnerable
Amphibians		
Olive Ridley turtle		
Green Turtles		
Plants		
Loop-root mangrove, red mangrove or Asiatic mangrove	*Rhizophora Mucronata*	
Spurred mangrove, Indian mangrove	*Ceriops Tagal*	
Birds		
Houbara Bustards		Threatened

The presence of Miani Hor Ramsar site and Hamal Lake downstream catchment of Nari river basin are regional and global important wetland habitats especially when viewed in the perspective of an arid environment. They attract a variety of waterfowl including swans, geese, ducks, grebes, herons, and several species of waders.

1. Balochistan Black Bear

The Balochistan black bear is found in the higher ranges of the province of Balochistan in Southwest Pakistan and Southeast Iran. Its greatest stronghold is in the hills south of Khuzdar in the PRB. The Baluchistan Black bear is currently confined to the arid sub-tropical thorn forest of the Khuzdar hills (WWF Pakistan, 2015). The main threats to the Baluchistan Black bear are: habitat loss due to expansion of human settlements and development projects; retaliatory killing by herders and poaching for bear pelts.

2. Straight horned Suleman Markhor

The straight horned Suleman Markhor is found in the mountains of Torghar between 7500-9500 feet. Not found in project area or area of influence.

3. Balochistan Urial

Urial is found in the rich habitats of Torghar, Takatoo & Torgbag in Balochistan Whereas, the Blandford Urial and Sind Ibex are found in Durreji (Balochistan) and also in Sumbuk, Surjan, Halalo, Pachran, Eiri and Hathiano in the province of Sindh. This animal is not found in the project area or area of influence.

4. Chiltan Wild Goat

This species is found primarily in the Hazarganji-Chiltan National Park in Quetta. It is not found in the project area or area of influence.

[3] Source: http://www.wildlifeofpakistan.com/ProtectedAreasofPakistan/Hazarganji_NP.htm

5.8 Scheme-Level Baselines for Nari and Porali Basins

5.8.1 NRB scheme-level baselines

Figure 5-13 shows the scheme locations in the Nari basin.

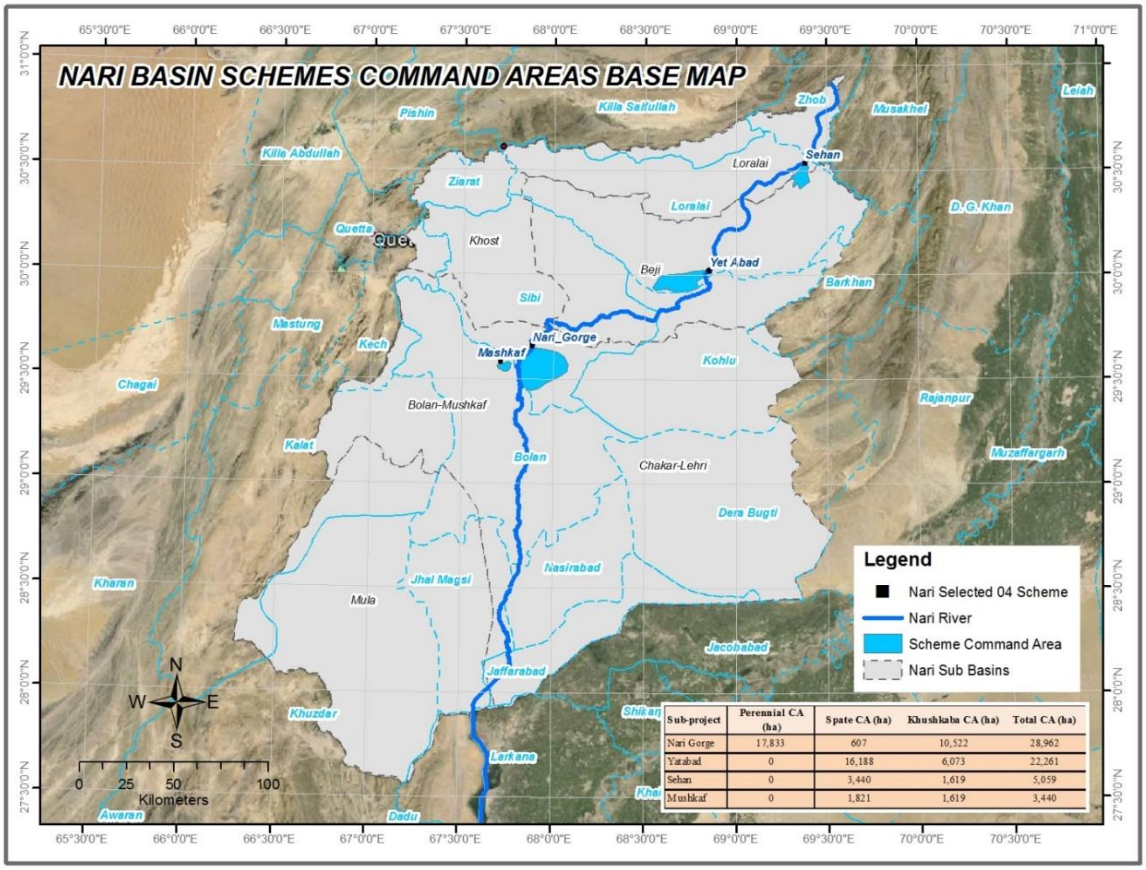

Figure 5-13: **Scheme locations in the Nari Basin**

The **Sehan Scheme** is in the Loralai sub-basin and covers approximately 642 km^2. The climate is semi-arid, sub-tropical and continental highland varying with elevation. Annual average rainfall is 335 mm. In July-August, weather is influenced by the monsoon season. 90% of cultivated land is under Sailaba and Khushkaba systems. The productivity of tubewell-irrigated wheat ranges from 2 to 6 T/ha with most farmers getting yields of 3.5 T/ha in wet years. 5,000 ha is under Spate irrigation but due to a lack of irrigation control wheat productivity is less than 1.5 T/ha in an average year; in dry years no grain is harvested and crops are used for fodder. The wheat productivity of Khushkaba wheat is even less and drought-tolerant barley is recommended instead, with a productivity of around 2.5 T/ha. Table 5-12 gives the baseline summary of the scheme and Figure 5-14 shows the potential command area.

Table 5-12: Sehan scheme baseline summary

Drainage	A large numbers of streams stemming from mountain ranges and highlands exist in the area. Some of them have perennial flows throughout their courses. Main drainage direction of the area is almost from mountain highlands to the centre of the valley and then flows north to east directions as Sehan River, which is perennial in places with reasonable level of TDS from November to July.

Climate	The climate of the area is dry but varies with the elevation. At high elevation it is cold and dry with occasional snowfall and severe frosts, whereas in the lower elevation, especially in the south and east, temperature is more uniform but hot in summer. The average minimum temperature was -2.4 ^{0}C in January and mean maximum temperature was highest (37.2 ^{0}C) in the month of June. The annual rainfall in the scheme area varies from 300 to 350 mm as shown in the spatial map of rainfall with an average annual rainfall of 335 mm (Figure 2).The scheme's geographic area can be distributed climatically into semi-arid, sub-tropical and continental highlands. The winters are very cold and windy and summers are mild. Rainfall occurs twice a year in its peak. Weather is dominantly influenced by the monsoon season. Two-thirds of rainfall is in the Kharif season and rest in the Rabi season.
Environment	The sub-basin has a wide range of problems of environmental and resource degradation – depletion of aquifers, loss of vegetation in watersheds and rangelands, destruction of wildlife habitats and depletion of wild flora and fauna. The major driver of these problems is population growth resulting in poverty. In the absence of industrial units there is no brown pollution. Shortage of fuels has caused deforestation and much of the shrubs have also been used for cooking and heating. All these processes have resulted in green pollution. The cutting of trees not only increased deforestation but also decreased recharge to groundwater and heavy load of sediments in floodwater due to increased soil erosion attributing to degradation of watersheds. The lack of facilities for proper solid waste management in urban areas has increased grey pollution. In rural areas, the waste is being used as fertilizer and there is no system of collecting and disposing the solid wastes. On the conservation side there is neither any action being taken for conservation of resources nor is there any planning for the future. The population pressure is worsening the situation.
Socio-economic	There is wide variation in the households of the Sehan integrated scheme, where large and small landholders, landless, women and children are the stakeholders for the design of the scheme. Poverty is more related with the access to land and water. The Khushkaba farmers are the poorest-of-the-poor, whereas irrigated farmers are relatively rich. The vulnerable groups are landless, women, children, grazers, etc. The low income is largely due to low productivity of agriculture and livestock as services and inputs are not available to the farmers. There is a potential to double productivity through provision of water, supplies and services, and access to the markets and market information.
Key Species	*Olea ferrugenea, Acacia modesta, Zizyphus nummularia, Acacia jacquemontii, Tecoma undulata*

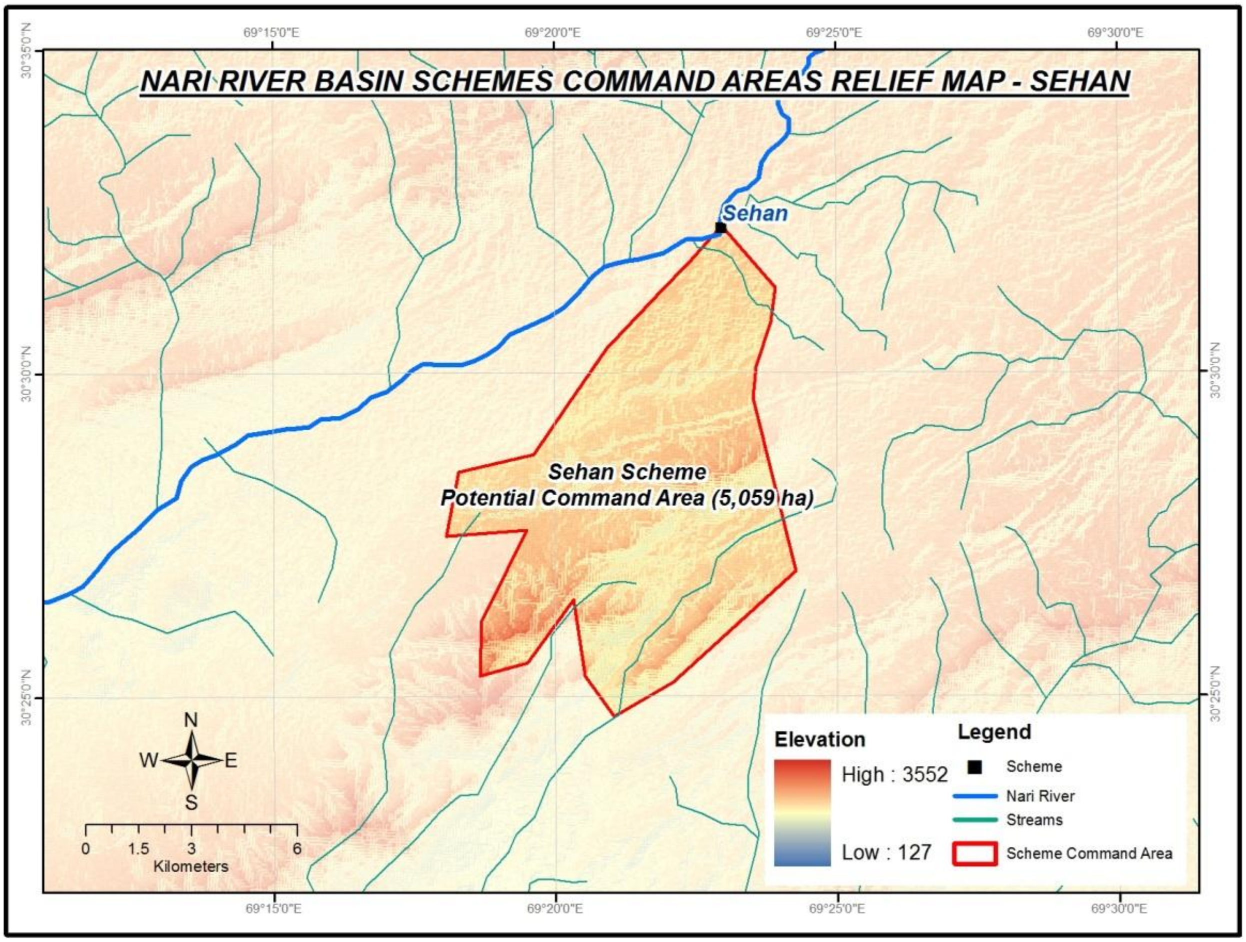

Figure 5-14: Sehan Scheme

The **Yetabad Sub-Project** is in the Beji sub-basin of the Nari Basin and is to Quetta and D. G. Khan with metaled roads. The scheme area is ~1470 km^2. The climate is semi-arid, sub-tropical and continental highlands varying with the elevation. The annual average rainfall is 341 mm with varying significantly between years. In July-August along the eastern belt on Sulaiman ranges, weather is influenced by the monsoon.

There is wide variation in households in the scheme area. Vulnerable groups include landless, women, children and grazers. Khushkaba farmers are the poorest. Low incomes are largely due to low agricultural productivity as services and inputs are not available. There is a potential to double productivity through provision of water, supplies and services in partnership with the private sector and with improved access to markets and market information. Table 5-13 gives the baseline summary of the scheme and Figure 5-15 shows the potential command area.

Table 5-13: Yetabad scheme baseline summary

Drainage	There are two main rivers: the Loralai and the Yetabad Rud. The Loralai starts from North Tor Tangi area, near Chinjan Killi and flows east and called Dargai Manda, up to Chinali killi and after Ahmaqzai it converted in to Loralai river and flows in east and joins Yetabad Rud near Kotkai. Yetabad Rud starts from Zakriazai North east parts of the area and flows in south directions and join the Loralai river, flows with the name of Anambar Rud up to Gumbaz city and near the boundary of command area of Yetabad the name of river converts to the Beji River and flows east to west direction. A large numbers of stream stemming from mountain ranges and highlands exist in the area. But due to meagre rainfall, none of these have perennial flows throughout their courses and their direction is almost from mountain highlands to the center of the valley.
Climate	The climate is dry but varies with the elevation. At high elevation it is cold and dry with occasional snowfall and severe frosts, whereas in the lower elevation, especially in the south and east, temperature is more uniform but hot in summer. The average minimum temperature was -2.4 ºC in January and mean maximum temperature was highest (41.5ºC) in the month of June. The annual average rainfall in the Sub-Project area is 341 mm using the detailed data of the Sub-Project catchment area. The Yetabad geographic area can be distributed climatically into semi-arid, sub-tropical and continental highlands. The winters are very cold and windy and summers are mild. Rainfall occurs twice a year in its peak. In July-August along the eastern belt on Sulaiman ranges, weather is dominantly influenced by the monsoon season. The average rainfall received in the Kharif season is around 220 mm and it is almost 121 mm in the Rabi season. Therefore, the command area will receive monsoonal rains in Kharif season.
Environment	The sub-basin has a wide range of environmental and resource degradation problems. The major problems are depletion of aquifers, loss of vegetation in watersheds and rangelands, destruction of wildlife habitats and depletion of wild flora and fauna. The other problem ispopulation growth resulting in poverty.In the absence of industrial units there is no brown pollution. Shortage of fuels has caused deforestation and much of the bushes and shrubs have also been used for cooking and heating. All these processes have resulted in green pollution. The cutting of trees not only increased deforestation but also decreased recharge to groundwater and heavy load of sediments in floodwater due to increased soil erosion, which are attributed to degradation of watersheds. The lack of facilities for proper solid waste management in urban areas has increased grey pollution. In rural areas, the waste is being used as fertilizer and there is no system of collecting and disposing the solid wastes. On the conservation side there is neither any action being taken for conservation of resources nor is there any planning for the future. The population pressure is worsening the situation.
Socio-economic	There is a wide variation in the households of Sub-Project, where large and small landholders, landless, women and children are the stakeholders for the design of the Sub-Project. Poverty is more related with the access to land and water. The Khushkaba farmers are the poorest-of-the-poor, whereas irrigated farmers are relatively rich. The vulnerable groups are landless, women, children, grazers, etc. The low income is largely due to low productivity of agriculture and livestock as services and inputs are not available to the farmers. There is a potential to double the productivity through provision of water, supplies and services through partnerships with the private sector and access to the markets and market information.
Key Species	*Prosopis juliflora, Zizyphus nummularia, Periploca spp*

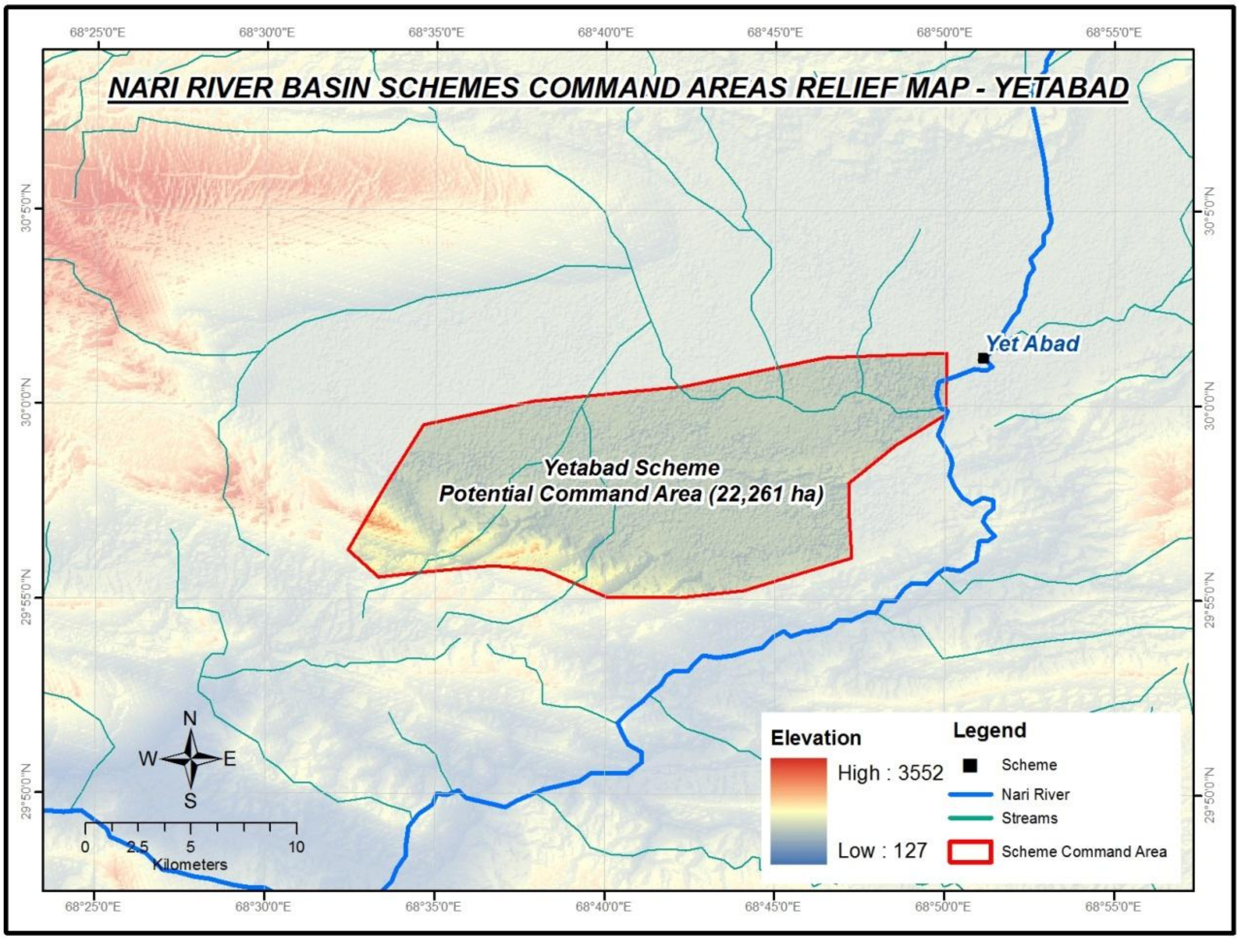

Figure 5-15: Yetabad scheme

The **Nari Gorge** scheme is in the Chakar-Lehri sub-basin and is connected with Quetta and Jacobabad by metaled roads. The scheme area is ~9,470 km^2. Currently, 6990 ha are cropped under the Perennial Canal irrigation and productivity is extremely low -average yield of wheat of 1.25 tonnes/ha. Some farmers are getting a yield of over 3 tonnes/ha. The area under spate irrigation is only 20 ha because of lack of irrigation control; average productivity for wheat is only 0.40 tonnes/ha); in dry years farmers no grain is harvested and crops are used as fodder. Khushkaba productivity for wheat is even lower (0.25-0.50 tonnes/ha) therefore drought-tolerant barley is recommended. Availability of perennial water is around 3.4 m^3/s which is adequate to irrigate 17,840 ha of command area at a cropping intensity of 133%. The average floodwater for the two small-scale spate irrigation systems has been assessed as 1.8 MCM. Design command area is 607 ha and in wet years floodwater can be utilized without affecting canal irrigation. Table 5-14 gives the baseline summary of the scheme and Figure 5-16 shows the potential command area.

Table 5-14: Nari Gorge scheme baseline summary

Drainage	There are two main rivers: the Loralai and the Sehan Rud. The Loralai river starts from North Tor Tangi area, near Chinjan Killi and flows to east direction and called Dargai Manda, up to Chinalikilli and after Ahmaqzai, it converted in to Loralai river and flows in east and joins Sehan Rud near Kotkai. Sehan Rud starts from Zakriazai North east parts of the area and flows in south directions and join the Loralai river, flows with the name of Anambar Rud up to Gumbaz city and near the boundary of command area of Nari Gorge Schemes the name of river converts to the Beji River and flows east to west direction, enters in Bolan Mushkaf sub-basin and all the schemes of Nari Gorge emerged from the Nari river from this sub-basin and entered in Chakar-Lehri sub-basin. A large numbers of stream stemming from mountain ranges and highlands exist in the area. But due to meagre rainfall, some of these have perennial flows throughout their courses and direction is almost from mountain highlands to the center of the valley say towards near Sibi.
Climate	The climate of the area ishot desert climate (Köppen climate classification *BWh*) notable for its exceptionally hot summers with the average maximum reaching 46.0 °C in June. Winters are mild, and nights can even be quite chilly with temperatures approaching 0 °C. The maximum temperature recorded in the city is 53 °C, and the minimum is −7.1 °C. Precipitation is light and mainly falls in two distinct periods: in the early spring in March and April, and in the monsoon in July and August. The mean annual rainfall in the Nari Gorge area is around 208 mm.
Env	
Socio-economic:	There is wide variation in the households of the Sub-Project, where large and small landholders, landless, women and children are the stakeholders for the design of the Sub-Project. Poverty is more related with the access to land and water. The Khushkaba farmers are the poorest-of-the-poor, whereas farmers having access to the perennial water from Nari canal are relatively rich. The vulnerable groups are landless, women, children, grazers, etc. The low income is largely due to low productivity of agriculture and livestock as services and inputs are not available to the farmers. There is a potential to double the productivity through provision of water, supplies and services through partnerships with the private sector and access to the markets and market information.
Key Species	*Prosopis cineraria, Ziziphus nummularia, Salvadora oleoides, Capparis aphylla*

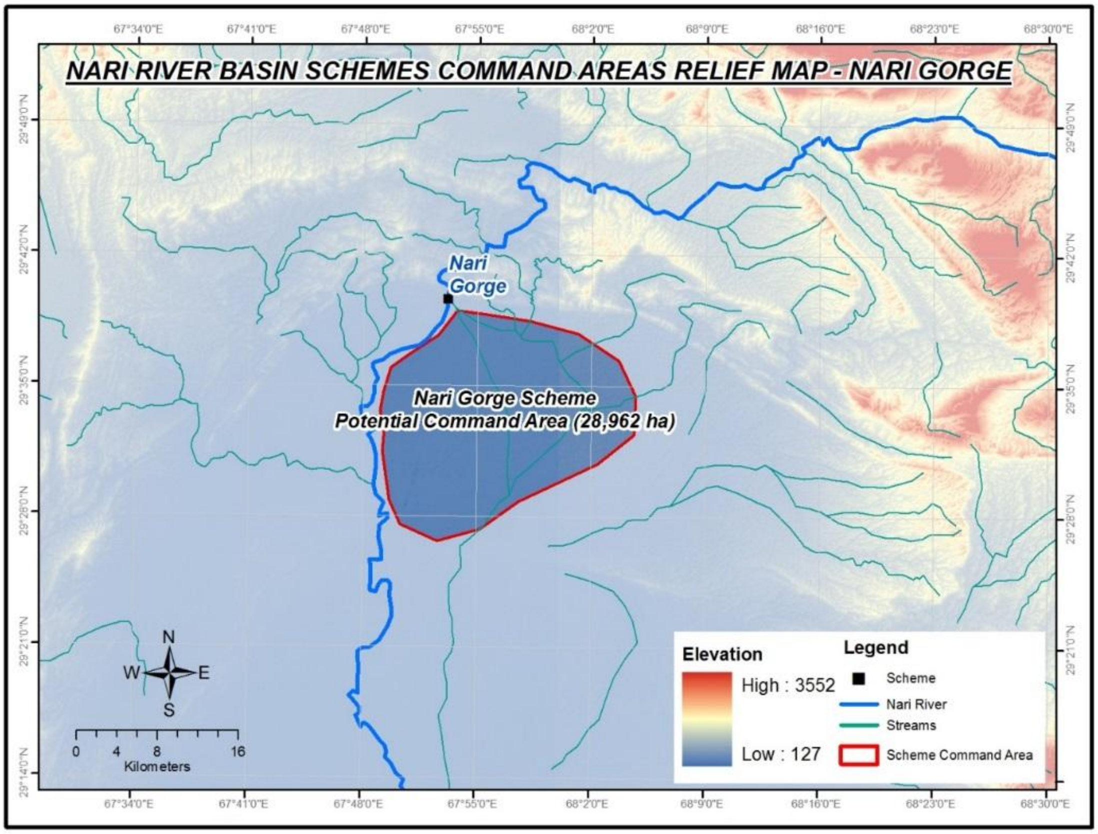

Figure 5-16: Nari Gorge scheme

5.8.2 PRB scheme-level baseline

Figure 5-17 and Table 5-15 present PRB perennial irrigation schemes with command area. In the **Nimmi Perennial Irrigation Scheme**, the Porali River runs in a gorge with the small patches of agricultural land on both sides. The land on both sides is partly cultivated because most of the potential areas are high elevated. The settlements along the river course are also at high risk. The proposed weir at Nimmi will provide a suitable head to water to flow in the channels on right side of Nimmi. Ecological Species: *Prosopis cineraria, Ziziphus nummularia, Acacia nilotica, Capparis aphylla, Calotropis procera.*

In the **Gundasha Nurg Hingri** Perennial Irrigation Scheme there is an existing protection bund in the area of Gundasha. A narrow opening serves as an irrigation intake. The existing structure at Nurg Hingri does not fulfill its purpose because it is located at downstream from the Gundasha intake. The existing weir is buried by siltation causing improper diversion because of inadequate head. A weir is proposed at upstream of Gundasha with an irrigation channel on right hand side and a partition wall or protection bund on existing trifurcation structure for proper flow in the Nurg Hingri structure. Ecological Species: *Prosopis cineraria, Ziziphus nummularia, Acacia nilotica, Capparis aphylla, Calotropis procera.*

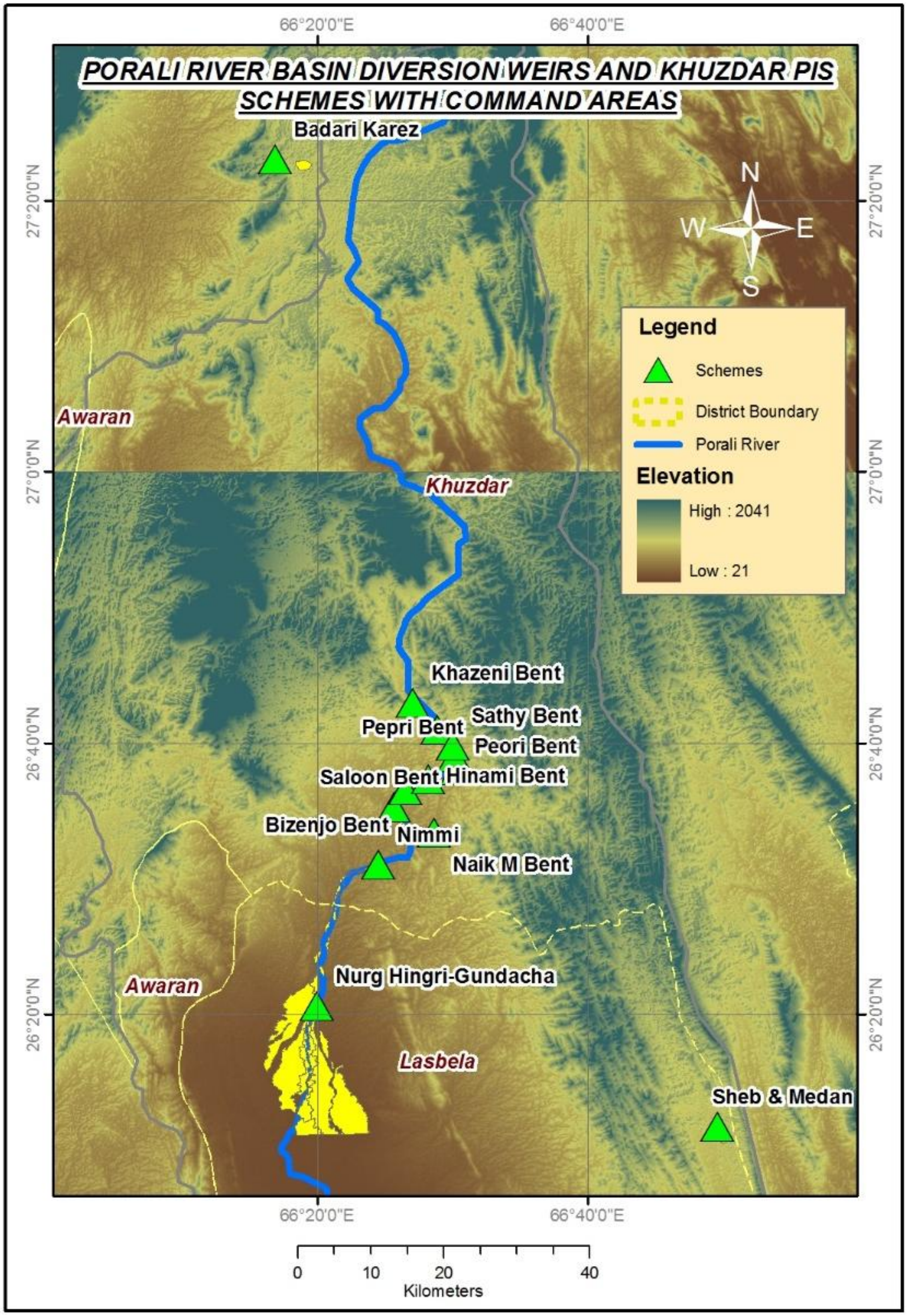

Figure 5-17: Porali River Basin Perennial Irrigation Schemes

Table 5-15: Porali River Basin Perennial Irrigation Schemes

Names	Type of water intake	Water Drawn (m^3)
Badri Karez	Karez	542,731
Naik M Bent	River diversion	370,044
Khanzeni Bent	River diversion	616,740
Hassan Mengal Bent	River diversion	986,784
Saloon Bent	River diversion	912,775
Bazenjo Bent	River diversion	986,784
Hinnami Bent	River diversion	740,088
Peori Bent	River diversion	493,392
Pepri Bent	River diversion	296,035
Sathy Bent	River diversion	370,044
Nimmi	Diversion weir	8,877,356
Nurg Hingri	Diversion weir	127,169,321
Sheb & Medan	Diversion weir	5,918,237

In the **Sheb & Medan** Perennial and Flood Irrigation Scheme area local farmers divert the perennial flow to their lands by locally available means and on a temporary basis. The cultivable land in the area of Sheb & Medan is about 971 ha, but due to absence of proper irrigation structure only 162 hectare land is under cultivation. The proposed weir will not only divert the water in the required amount for Sheb and Medan but will also spill over the excess water to downstream. Ecological Species: *Prosopis cineraria, Ziziphus nummularia, Acacia nilotica, Capparis aphylla, Calotropis procera.*

In the **Khuzdar** Perennial Irrigation Scheme area (the Porali River runs in a small gorge. Agriculture is restricted to small land areas within the river course on both sides. There is no engineered intake structure for these patches of lands. It is proposed to provide proper off take structures at nine different bents. These off-takes will be designed according to the need of potential available land for the agriculture. Ecological Species: *Prosopis cineraria, Zizyphus nummularia, Acacia nilotica, Acacia jackmontii, Tamarix spp, Salvadora oleoides, Capparis aphylla, Calotropis procera, Euphorbia spp.*

Figure 5-18 and Figure 5-19 show the Porali basin PIS schemes and Weir diversions, respectively.

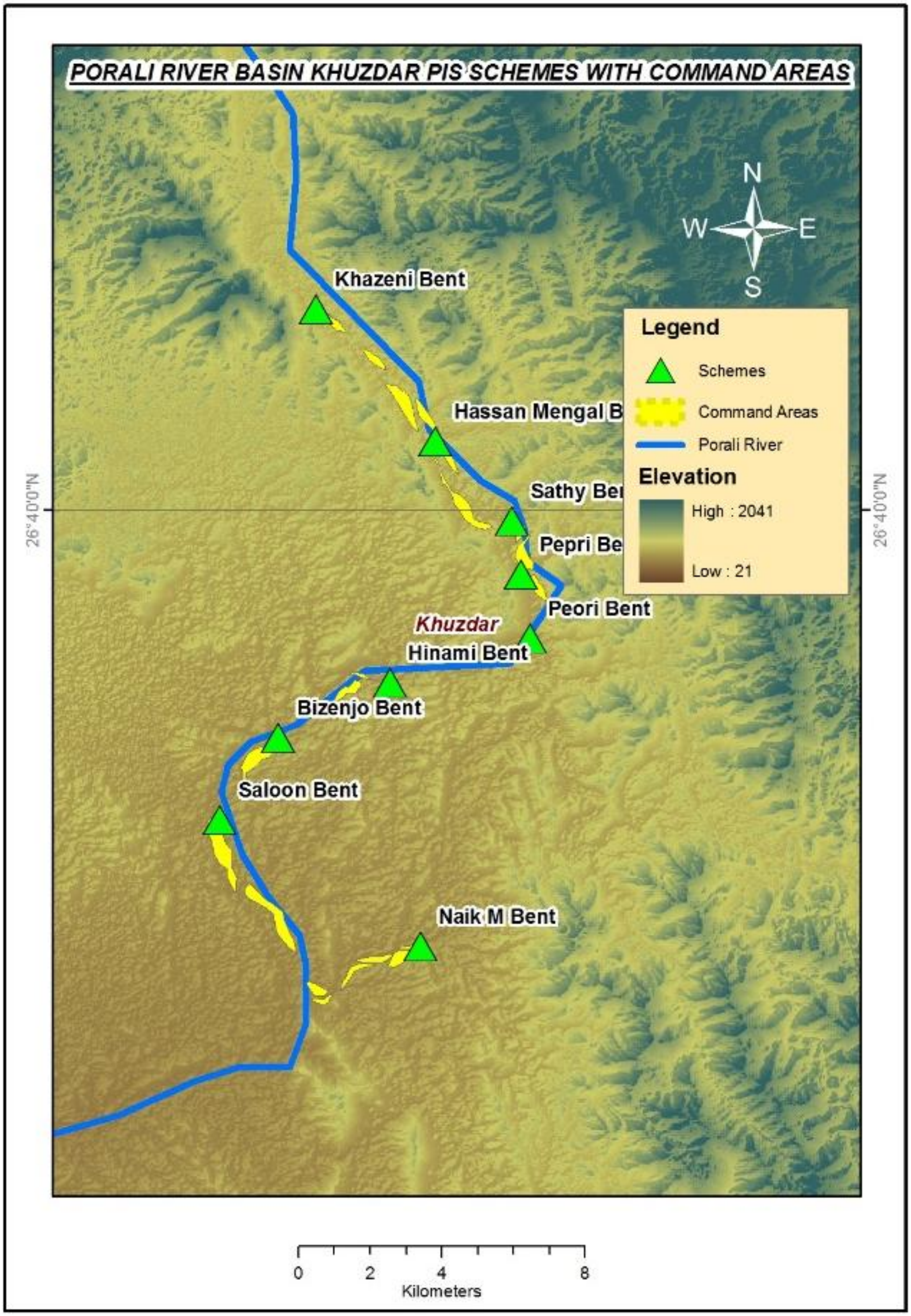

Figure 5-18: Porali Basin PIS Schemes

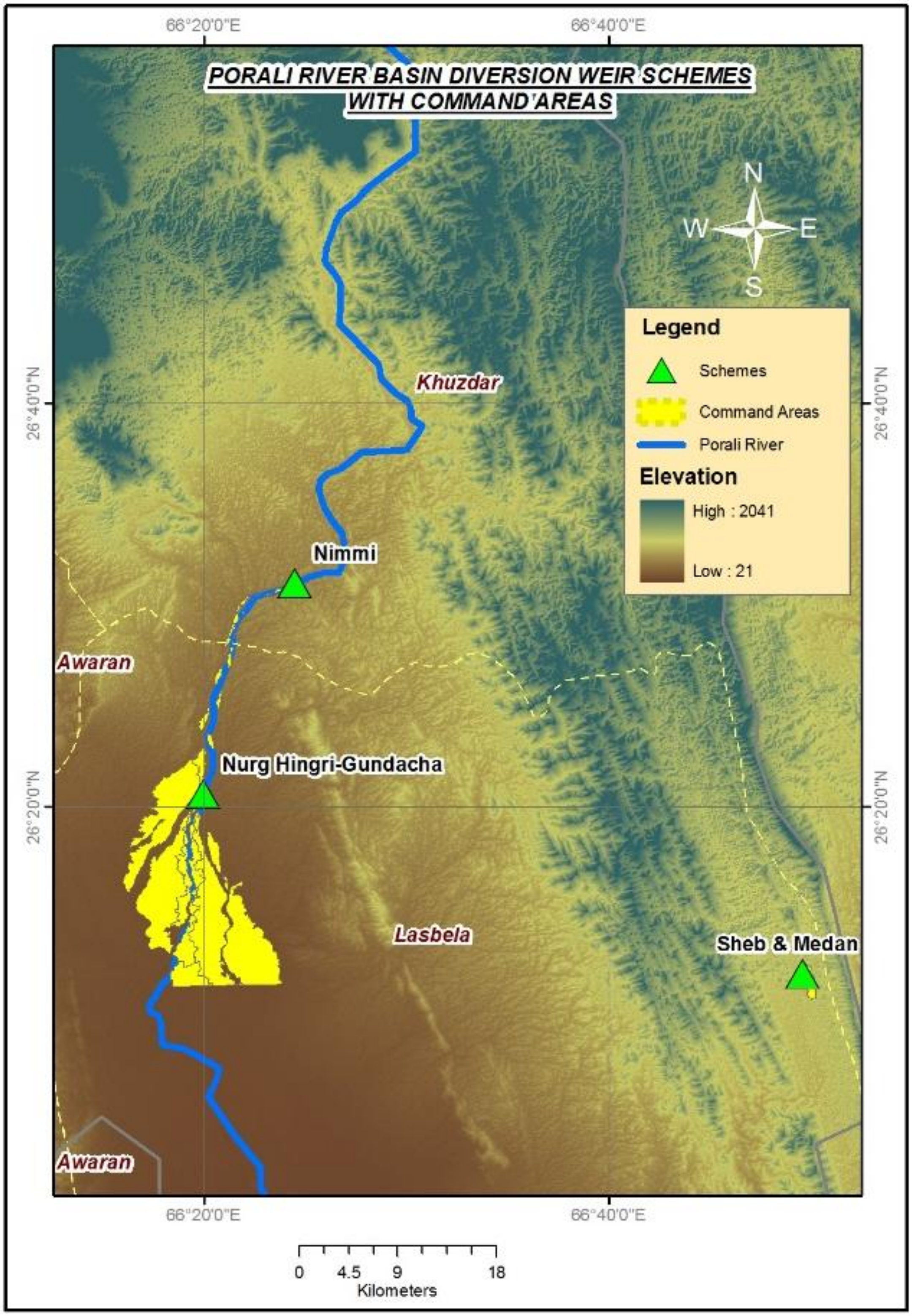

Figure 5-19: Porali Basin Diversion Weirs

5.9 Borrow Areas

There are designated borrow and quarry sites close to the Project schemes. Figure 5-20, Figure 5-21, and Figure 5-22 show the location of these sites. Sufficient quantities of material are available for the construction works of the schemes.

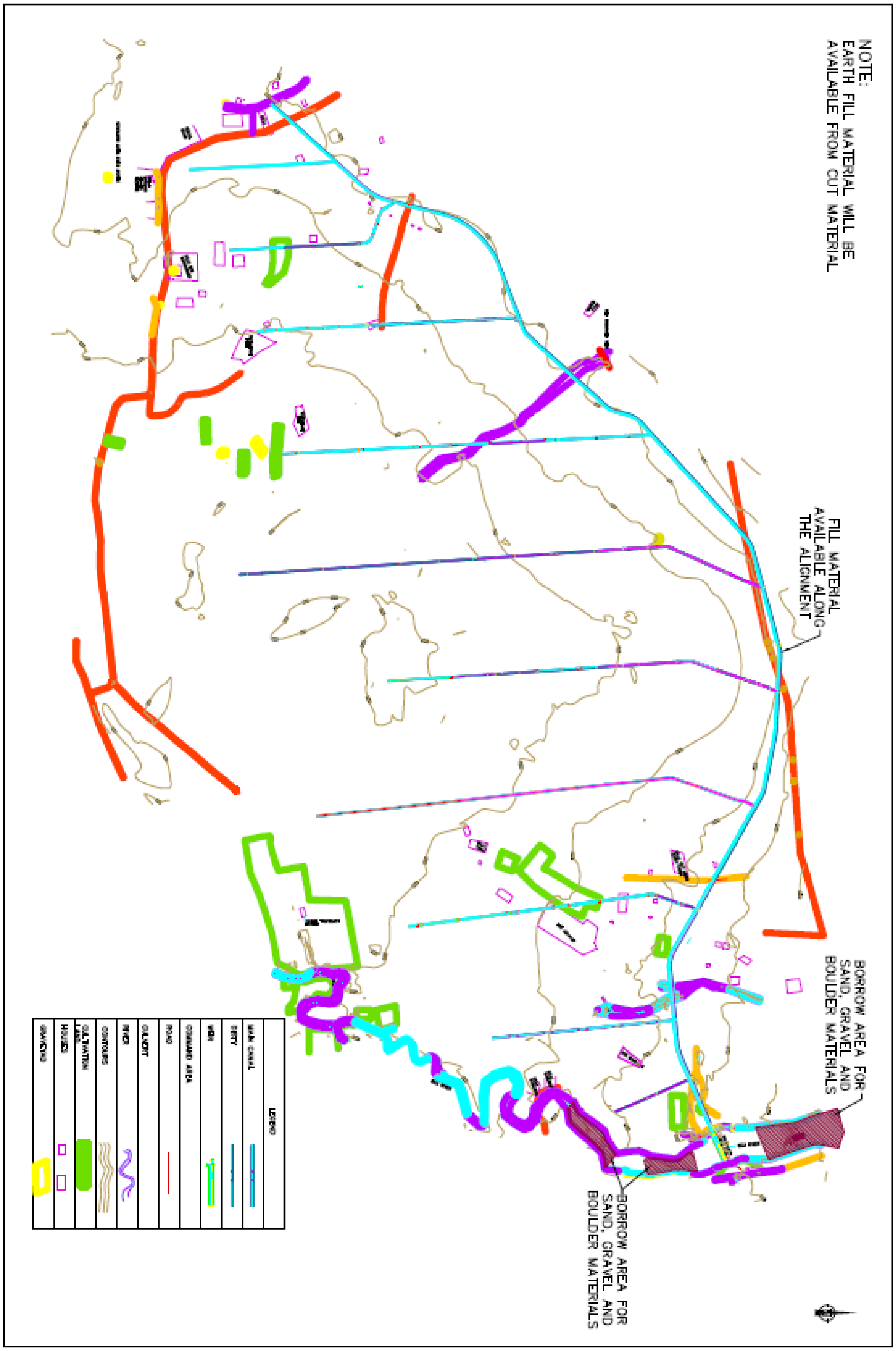

Figure 5-20: Map of the borrow areas close to Yetabad scheme

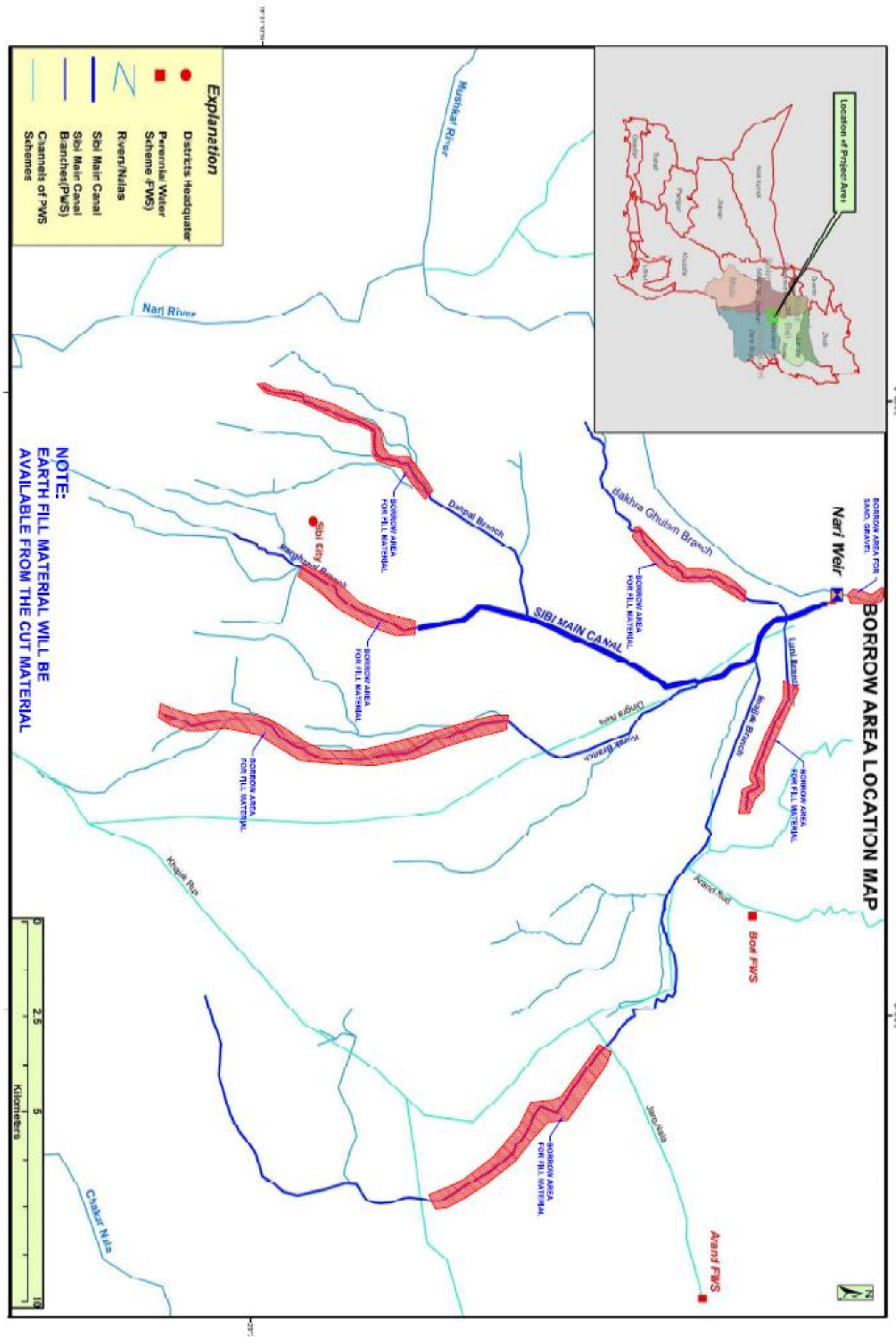

Figure 5-21: Map of the borrow areas close to Nari Gorge scheme

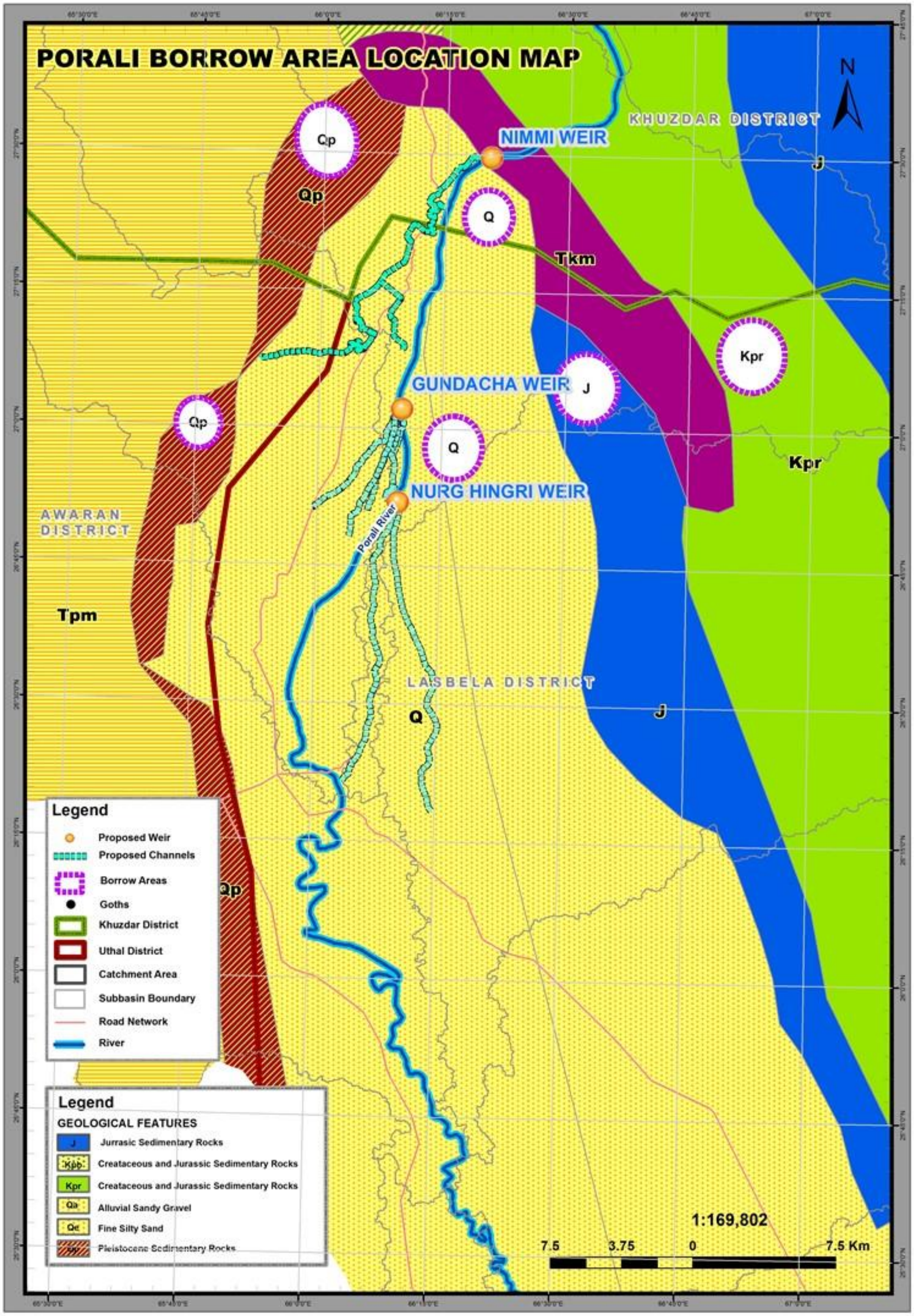

Figure 5-22: Map of borrow area in Porali River Basin

5.10 Protected Areas

The protected areas in the NRB and PRB are increasingly threatened by various factors. Competition with other land uses such as agriculture and livestock grazing, indiscriminate and uncontrolled hunting, and the removal of natural vegetation for fuel are some of the contributing factors. The indiscriminate use of agrochemicals is a cause for concern. The Biodiversity Action Plan for Pakistan provides the basis for action to address issues related to biodiversity. It sets out the steps to be taken to promote the conservation and sustainable use of Balochistan's biodiversity.

5.10.1 NRB protected areas

There are two main environmental hotspots in the NRB project area. The environmental hotspots are at Khost and Beji sub-basins. The Khost sub-basin consists of the largest blocks of juniper (*Juniperus excelsa*) forests in the world and is rich in biodiversity. Figure 5-23 and Table 5-16 show the protected areas within and in close proximity to Nari River basin.

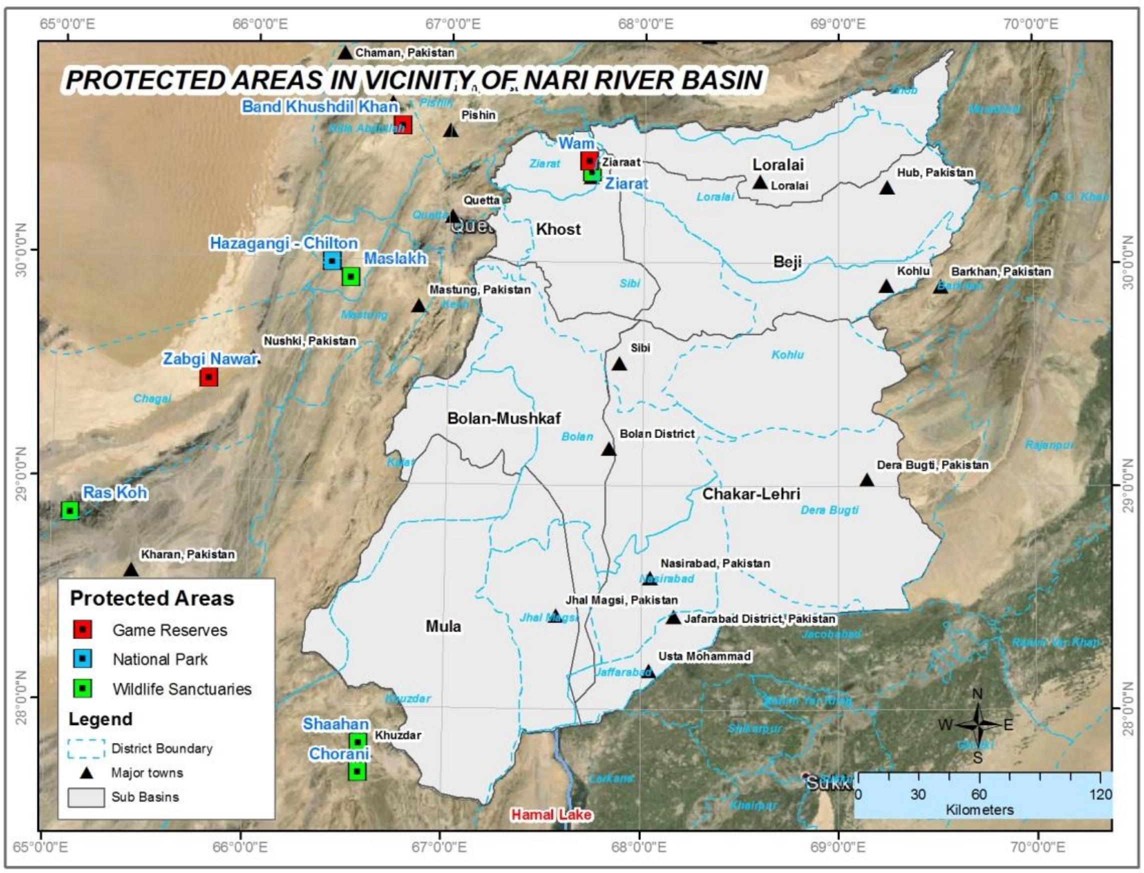

Figure 5-23: Protected areas within and in close proximity to Nari River Basin

Table 5-16: Protected areas in the Nari River Basin

Description	District	Area (ha)
Juniper forest		
Ziarat Juniper Biosphere Reserve	Ziarat	37,247
Game Reserves		

Description	District	Area (ha)
Wam	Ziarat	3,887

Wam Games Reserve

Wam Games Reserve is located in Nari Basin and covers an area of 10,364 ha. It falls in the Juniper forest ecosystem and comprises the following species: *Juniperus excelsa*, *Prunus eburnea*, *Caragana ambigua*, *Berberis lycium, Sophora spp, Artemesia spp*.[4] Large shrubs such as *Caragana ambigua* and *Prunus eburnean* provide a second cover layer while the ground is covered by *Aretemesia spp*. This provides an excellent habitat to wildlife such as: Fox, Jackals, Chakoor partridge, See see partridge, and Black-throated Thrush. Documentation on the full list of the flora and fauna of the Reserve was available for this assessment. It will not be impacted upon by the proposed project.

Ziarat Juniper Biosphere Reserve

Ziarat Juniper Bioshere Reserve (formerly Ziarat Wildlife Sanctuary), located in Ziarat District, was declared a protected area in 1995 and was declared a Biosphere Reserve in May 2013, under UNESCO's "Man and Biosphere" project. It covers an area of 37,247 ha (92,000 acres). It is located at about 130km to the North East of the provincial headquarters in Quetta and falls within the Juniper forest ecosystem. IUCN has developed a management plan has been developed for the Biosphere Reserve. The IUCN management plan contains a list of the plant and animal biodiversity in the Reserve, presented in Annex A. Ziarat Wildlife Sanctuary supports a dense vegetation growth comprising large stands of Juniper trees, interspersed with Ash as the co-dominant species. Vegetation comprises: *Juniperus excelsa*, *Fraxius xathoxyloides, Berberis lycium, Caragana ambigua, Ephedra nebrodensis, Prunus eburnea, Sophora spp*. At the lower reaches of the sanctuary, the vegetation changes to Juniper–Pistacia community, while in the valley bottom, Olive–Pistacia community and finally Olive alone takes the ground.

The project will have limited effects on the Reserve in terms of watershed management and sediment discharge.

5.10.2 PRB protected areas

Miani Hor Ramsar site

Miani Hor is located near Sonmiani Bay. It is a swampy, subtropical lagoon lying on the coast of Lasbela district of Balochistan. Spread over an area of 7,471ha, the lagoon is 60km long and about 4 to 5km wide. It receives freshwater input from a number of seasonal streams, the most important of which are Porali and Windor, arising in the hills of eastern Balochistan located in the north of the lagoon. The Mangroves eco-system of Balochistan supports the coastal area, hardy in the arid and semi-arid climatic conditions and the high salinity of the coastal estuaries. Figure 5-24 shows the protected areas of Porali River basin. The area supports dense growth of Mangrove trees and provides a variety of habitats to a wide range of animals. It is worth mentioning here that it is the only place in Pakistan where three species of mangroves, *Avicennia marina, Rhizophora mucronata, and Ceriops tagal,* occur naturally in the same place.

Miani Hor was declared a Ramsar site in May 2001 on account of its large concentrations of water and migratory birds. It also supports a sizeable population of other birds and predatory species. The lagoon acts as a natural physical barrier to cyclones and typhoons. A full list of the biodiversity in Miani Hor is presented in Annex A.

The project will have limited effects on Miani Hor in terms of watershed management and sediment discharge.

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[4] Included in the list of the flora species in the NRB in Annex A.

There are some villages located in the Miani Hor area: Dam Bunder, Sonmiani, Bhira and Baloch Goth. The people living in these villages belong to different tribal groups which include: Lasi, Rajput, Baloch (Zikri Baloch in Bhira and Baloch Goth), Khaskhali and Somra. Total population in these villages has been estimated at over 14,000 individuals. In addition to this resident population, another 14,000 individuals migrate to the area from different parts of the country, during the fishing season (7-8 months) thus bringing the total population to 28,000 individuals. These communities are directly dependent on coastal resources such as fisheries and mangrove forests for their livelihoods. A large fleet of more than 1100 fishing boats operates inside the lagoon.

Besides the fish and shrimp production, Miani Hor is also famous for its migratory birds and thriving dolphins and its beautiful landscapes.

In order to conserve, rehabilitate/regenerate degraded mangroves forests, increase resource of fodder and fuel wood in coastal area of the province and to improve the socio economic condition of the local community a development scheme: “Extension of Mangrove Plantations in Coastal Districts of Balochistan” was initiated in 2014 by the Balochistan Forest Department. Under the scheme, 355,000 (1000 acres) mangrove propagules/wildlings have been planted in Miani Hor.

Despite such efforts, the lagoon currently faces threats from domestic waste disposal and accumulated solid waste debris. The mangrove forests are also threatened by local fuel wood consumption. Local communities also depend on the forests to feed their domestic animals, thus adversely affecting the health of trees in the area. Figure 5-25 shows the receding trend identified in the Miani Hor mangroves.

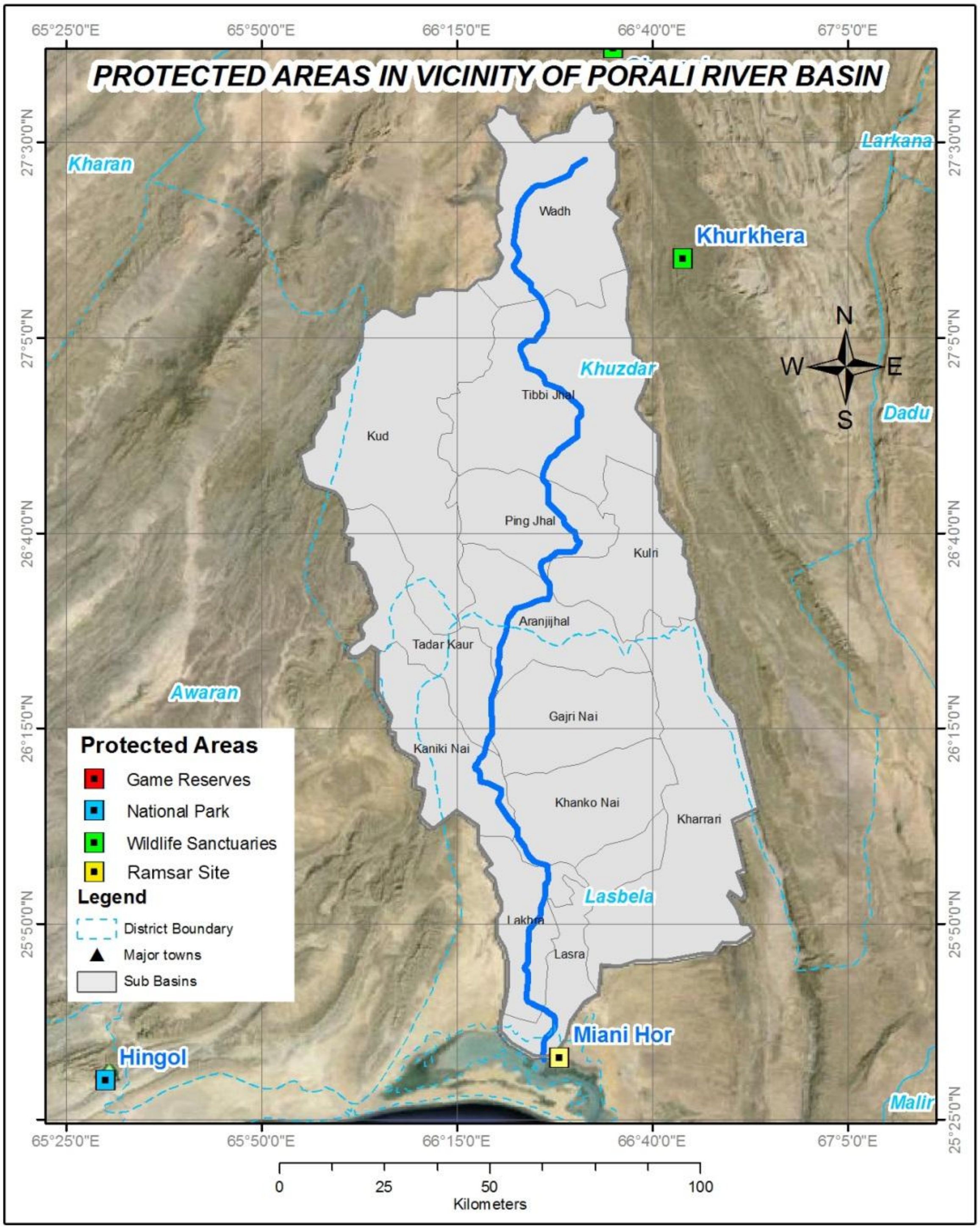

Figure 5-24: Overall Ecological and Protected areas map of Porali River Basin

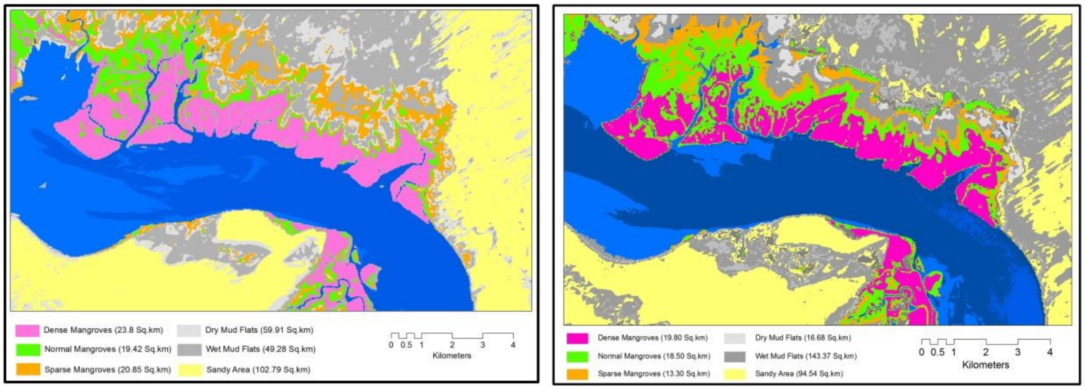

Figure 5-25: Receding Trend identified in Miani Hor Mangroves assessed using 2005 & 2010 Multispectral Landsat Imagery

5.11 Water Balance Assessments

River flow regime characteristics (flow quantity, temporal patterns of flow, seasonal timing, frequency, predictability and duration of floods, droughts, and rates of flow change) determine the physical habitat template for aquatic flora and fauna (Poff et al. 1997; Olden and Poff 2003) and thus have a pivotal role in establishing and maintaining the ecological health of rivers. Hydrological alteration of river flow regimes can cause significant environmental degradation.

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The hydrological analysis was conducted during the feasibility study, using climate data in terms of mean and maximum tempratures and assessment of the mean annual rainfall in the watershed. The evaluation of the watershed rainfall pattern and contribution from summer and winter rainfall is also assessed to determine the ecological and environemental seasonal impacts. The Project area is characterized as semi-arid with rainfall less than potential evapo-transpiration, however, precipitation based on snowfall during winter is also taken into account in the hydrological analysis.

Table 5-17 provides an indication of the inter-annual variability of rainfall and hence water availability in Nari sub-basin. Table 5-18 shows the annual water demand in the Nari sub-basins. Table 5-19 shows the water availability and demand assessment for Porali river basin. The water balances are based on preliminary estimates of the water demand for "nature[5]". Nonetheless, the water balances indicate that on average, the volumes of water for consumptive demands are relatively small and there is additional water that can be sustainably diverted in these basins to improve livelihoods of local inhabitants. Figure 5-26 and Figure 5-27 show schematics of the average annual water balances for the Nari and Porali basins including estimated consumptive demands for the proposed irrigation schemes.

Table 5-17: Surface water availability for Nari sub-basins

Sub-basins	Precipitation (mm)			Water Availability (MCM)		
	Dry	Average	Wet	Dry	Average	Wet
Loralai	116	225	346	25	133	207
Beji	153	263	481	124	351	791
Khost	103	178	251	46	110	212

[5] In the feasibility study, "nature" is defined as "the ecological health of rivers and perennial streams depend on the availability of rainfall water. The studies indicate that the amount of internally generated surface flows of a basin contribute to requirements of ecology of stream channels".

Chakar-Lehri	55	116	202	59	466	952
Mashkaf-Bolan	67	147	221	51	147	328
Mula	25	65	155	4	107	569

Table 5-18: Annual water demand in Nari sub-basins (MCM)

Sub-basins	People	Livestock	Agriculture	Nature	Total	Balance
Loralai	<<1	<<1	11	13	25	108
Beji	<<1	<<1	18	35	53	298
Khost	<<1	<<1	6	11	17	93
Chakar-Lehri	<<1	<<1	19	17	36	429
Mashkaf-Bolan	<<1	<<1	18	15	33	114
Mula	<<1	<<1	22	11	33	74

Table 5-19: Porali River Basin Water availability and Demand Assessment

Scheme	Type of water intake	Water Drawn (m^3)
Badri Kareze	Karez	542,731
Naik M Bent	River diversion	370,044
Khanzeni Bent	River diversion	616,740
Hassan Mengal Bent	River diversion	986,784
Saloon Bent	River diversion	912,775
Bazenjo Bent	River diversion	986,784
Hinnami Bent	River diversion	740,088
Peori Bent	River diversion	493,392
Pepri Bent	River diversion	296,035
Sathy Bent	River diversion	370,044
Nimmi	Diversion weir	8,877,356
Nurg Hingri	Diversion weir	127,169,321
Sheb & Medan	Diversion weir	5,918,237
Total		**148,280,331**

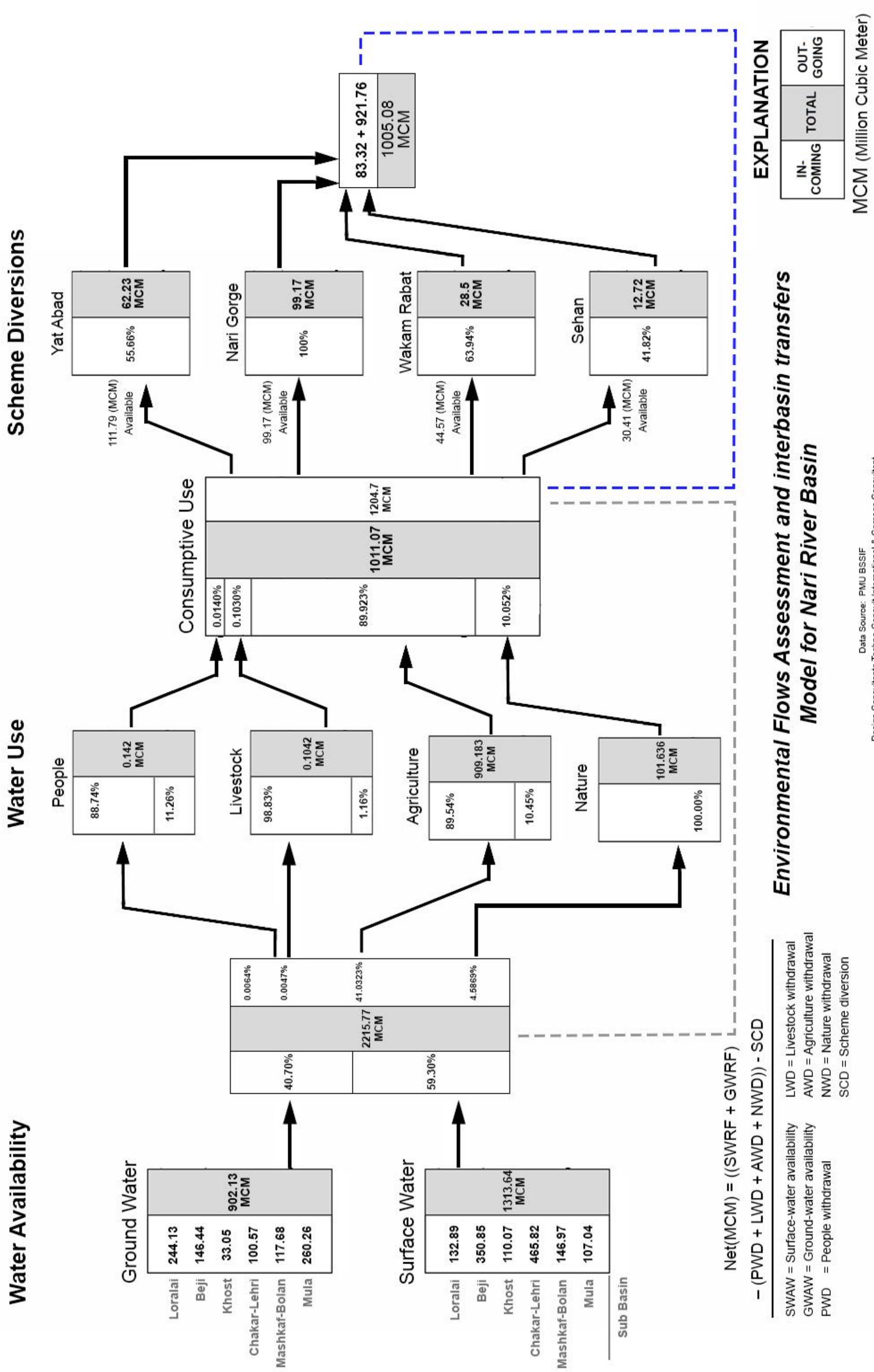

Figure 5-26: Nari Basin average annual water balance

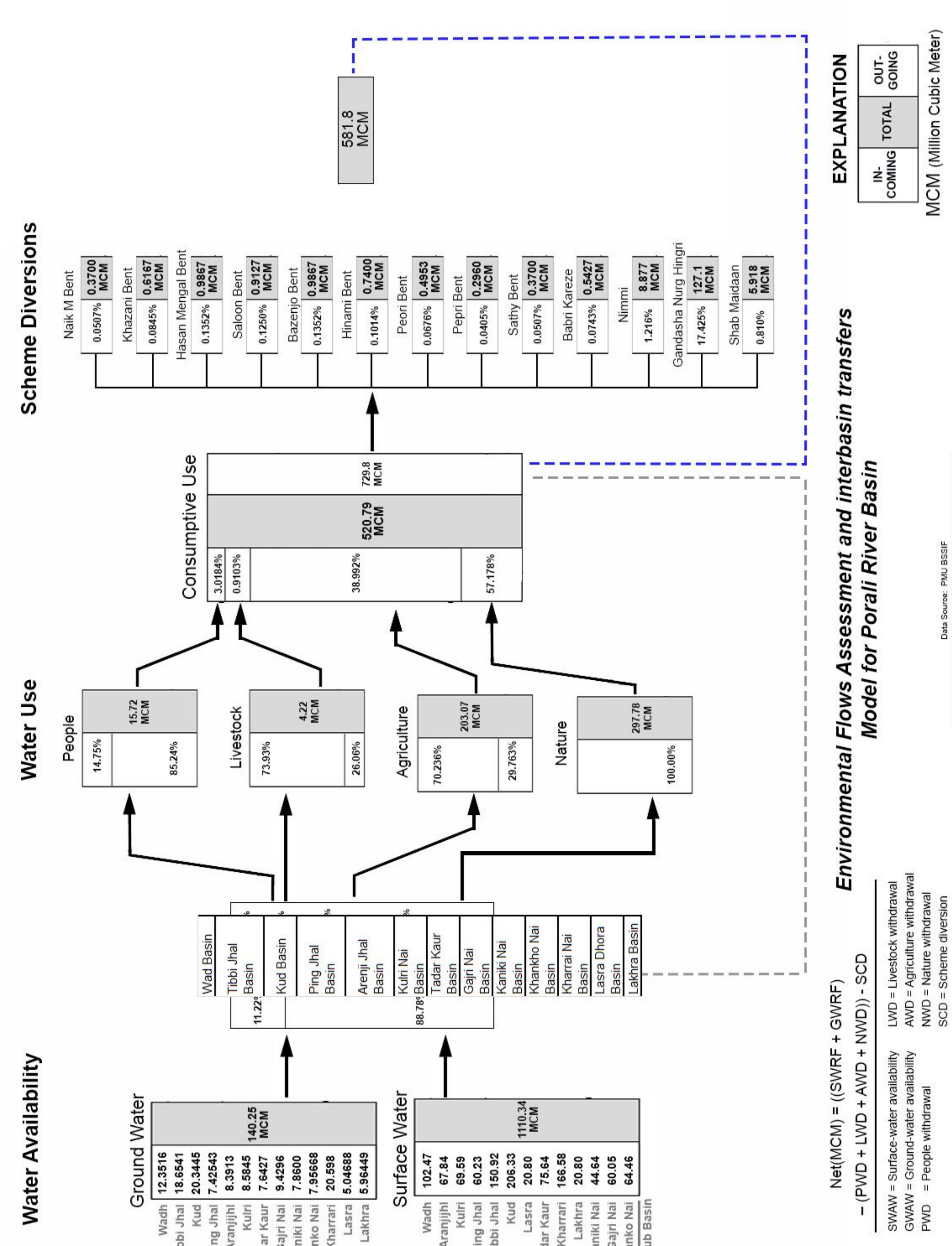

Figure 5-27: Porali Basin average annual water balance

5.12 Socioeconomic Baseline

This Chapter presents a summary of the socio-economic conditions in the BWIRDP area. The complete social assessment is presented separately in individual social assessment reports for each of the basins.

5.12.1 Demographics and Population Distribution

5.12.1.1 NRB Demographics and Population Distribution

The current population of the NRB is 1.854 million. The population growth rate was estimated considering population Census data in the last 50 years and same was used for projections. It is expected that the population will increase to 2.838 million by 2040 with a population density of 41 per km^2 - most populous basin of the province (Table 5-20). The projections have shown that same trend will be continued till 2040.

Table 5-20: Sub-basin current population and decadal projections

Sub-basins	Population Projections			
	2013	2020	2030	2040
Loralai	102,804	117,524	135,988	157,354
Beji	204,095	233,317	269,975	312,392
Khost	91,801	104,945	121,433	140,512
Bolan-Mashkaf	323,028	369,279	427,298	494,434
Chakar-Lehri	992,496	1,134,601	1,312,864	1,519,135
Mula	139,517	159,493	184,551	213,547
Total	**1,853,741**	**2,119,159**	**2,452,109**	**2,837,374**

5.12.1.2 PRB Demographics and Population Distribution

The inhospitable terrain and climate of the Porali River Basin make for a small and clustered population. The Population of Lasbela District according to 1981 census was 188,139 which increased to 312,695 in 1998 census. The growth rate was 3.03 %. With the same growth rate, the current population of the district is estimated at 489,301. Although only 30% of the Lasbela District is within Porali Basin, it is estimated from the settlements in the district that at least 60% of District population equal to 293,600 resides in the Porali Basin as both the major towns Bela and Uthal along with most of the major settlements including Lyari and Lakhra are within the Porali Basin.

The population in the Khuzdar District according to 1998 census was 417,466 and the present population is estimated to be 659,935 on the basis of inter-census period 1981-1995 growth rate of 3.1%. Corresponding to share in total area, about 11% of this population (72,600) resides in the Porali River Basin.

A small part of Porali Basin lies in Awaran District with coverage of approximately 606.56 sq.km. Based on current estimated population and percentage area coverage of 2.80% Porali Basin, the estimated population of Awaran District in PRB is 35,130. Table 5-21 shows the population statistics for the districts in Porali River basin.

Table 5-21*: Demographics of the PRB*

S.No	District	Census 1998	Current Estimated	Growth Rate	Porali Basin Population
1	Lasbela	312,695	489,301	3.03%	293,600
2	Khuzdar	417,466	659,935	3.1%.	72,600
3	Awaran	**118,173**	125,465	0.4%	35,130

5.12.2 Ethnic and Language Groups

Balochistan is a fragmented society in which tribe and tribal networks dominate social organization. The main ethnic groups are the Baloch, Brahvi and Pashtun. Details of the historic background of the social fabric of the Province are presented in the individual social assessment reports for the NRB and PRB, available in project files. According to the 1998 Population Census, the largest ethnic group is Baloch-Brahvi which makes up 55% of the population. The next largest group is Pashtun making up 30%. Others included Sindhis (6%), Punjabis (3%) and Seraikis (2%). The ethnic groups are mostly regionally segregated. Pashtun inhabit the districts of the northern and north-eastern part of the province, bordering Afghanistan and FATA, Brahvi occupy a north-south corridor along the centre of the province, while the Balochi are divided between the west and south-west and the east. There are large concentrations of Sindhi in the south-east the Kacchi plains of NRB. The provincial capital of Quetta is “shared” between the two main ethnic groups, though there is a sense that the city has its distinctive Pashtun and Baloch-Brahvi clusters. Quetta has a large minority of Punjabi (16%), who along with the Urdu-speakers **(**6%) are often collectively referred to as “settlers”. Another important group in Quetta are Hazaras who migrated from central Afghanistan in the 19thcentury. There are also several ethnic minorities.

The predominance of tribal social organization impacts on development outcomes in two ways. First, kinship groups, sub-tribes and tribes constitute vertically aligned social networks that act as important domains of political action. The presumed division between the social, economic and political domains that supports the development of institutions such as anonymous markets, civil society and political representation, therefore, cannot be expected to work in the same way in tribal societies. Tribal leaders are quite often political leaders as well as channels for accessing economic resources. Second, tribal social organization tends to favour vertically-aligned cooperative behaviour, often at the expense of consensus building, or even horizontal class-based mobilization. Conflicts between tribes and kinship groups and cooperation within these groups can make it costly to obtain agreement on issues that affect people across kinship and tribal lines.

The key issues in their incorporation into the main tribe appear to be strategic and political rather than racial. If a clan or group of families joined themselves with the main tribe, accepted the rules and conventions, and gave political allegiance to the sardar, they were incorporated as members. In general this means that within tribes there is a hierarchy between clans and sub-tribes, often based on proximity to the sardari sub-tribe or clan. The sardars of the Mengals, for example, come from the Shahizai clan. Among the larger sub-tribes there might be further sardarkhels or clans entitled to lead the sub-tribe, and so on.

5.12.2.1 NRB Ethnic and Language Groups

In the NRB, two broad ethnic groupsare Pashtun and Baloch with different tribes and sub-tribes. Pashto, Balochi, Brahvi, Saraiki and Sindhi are the languages spoken in the sub-basins but Urdu is a common language. Basin-wise details of tribes and languages spoken by these tribes are presented in Table 5-22. Tribes in the six sub-basins are well differentiated. The upper three sub-basins (Loralai, Beji and Khost) are largely concentrated by Pashtuns and the lower three sub-basins (Chakkar-Lehri, Mashkaf-Bolan and Mula) are largely concentrated by Baloch, Brahvi, Sindhi and Siraiki.

Kinship and lineage are, arguably, the bases of any tribal system. In fact myths of origin among the Baloch lay great emphasis on the shared lineages of respective groups. People claiming descent from some historical figure are acknowledged as belonging to one “super- tribe”, and divisions between tribes and sub-tribes are thought to represent family divisions over the generations. Relations within tribes and between tribes and sub-tribes are often expressed in such familial terms.

The tribes, sub-tribes and extended families reproduce their structures over successive generations through shared rules of marriage. Family identity is traced through the male line, though marriage relations with other tribes through receiving or sending brides also establish social and political affinity.

The ceremony for appointing a new sardar requires the presence of representatives of all sub-tribes and clans. There have been cases of the assembled representatives deviating from the nomination of the previous sardar in their choice of leader, because they have felt that a person more suitable to the job was available. In general, however, the choice of potential candidates is restricted to male members of the sardar family – his brothers, sons, or nephews – and to other ordinary tribe members.

Baloch society tends towards multi-ethnicity and multi-racialism. One clear example of this is with respect to Baloch-Brahui relations. Although Balochi and Brahui are distinct languages, that suggest distinctive racial and ethnic origins of their speakers, there is virtually complete identification between the two linguistic groups. Similarly, in Lasbela and the Kachhi plains areas speakers of Lasi and Jadgali (names for dialects of Sindhi) and people claiming specifically Sindhi (Sammat or Jam) racial origins have been incorporated into the broader Baloch tribal structures.

In fact the Baloch tribe consists of many sub-tribes of various origins. The key issues in their incorporation into the main tribe appear to be strategic and political rather than racial. If a clan or group of families joined themselves with the main tribe, accepted the rules and conventions, and gave political allegiance to the sardar, they were incorporated as members. In general this means that within tribes there is a hierarchy between clans and sub-tribes, often based on proximity to the sardari sub-tribe or clan. The sardars of the Mengals, for example, come from the Shahizai clan. Among the larger sub-tribes there might be further sardarkhels or clans entitled to lead the sub-tribe, and so on.

Table 5-22: Major tribes of the sub-basins of NRB

Sub-basins	Tribes	Languages
Loralai	Luni, Tareen, Nasir, Shadozai, Dumer, Humzazai, Kibzai, Utmankhail, Sarghah, Zakhpal, Jogezai, Jalalzai, Sanzarkhel, Panezai, Sarangzai, YaseenzaiVanechi and Pecchi tribes of Pashtun and Mari, Buzdar and Brahvi of Baloch tribe	Pashto, Balochi and Brahvi
Beji	Tareen, Panezai, Sarangzai, YaseenzaiMarri, Kethran, Dumer, Humzazai, Utmankhail, Sarghah, Zakhpal, Jogezai, Jalalzai, Sanzarkhel, Vanechi, PecchiLoni, BarozaiDehpal and Khajak tribes of Pashtun	Pashto is the mostly spoken language but Balochi, Sindhi and Saraiki are also spoken in the Beji sub-basin.
Khost	Tareen, Panezai, Sarangzai, YaseenzaiMarri, Dumer, Vanechi and PecchiLoni, BarozaiDehpal, Marghzani, Kurak, Safi, Khajak and Bravi	Pashto is the mostly spoken language but Balochi, Sindhi and Brahvi are also spoken.
Mashkaf-Bolan /Chakar-Lehri	Raisani, Shahwani, Domki, Kurd, Bangulzai, sayed, Kosa, Rind and Patan.	Balochi, Brahvi, Sindhi, Siraiki, Hindku and Pashto
Mula	Zehri, Sumalani, Mengal, Kalandrani, Mohammad Hasni, Sajdi, Bizenjo, Nichari, Qambrani, Pandrani, Mirwani, Rekizai, Gurgnari, Jattak, Rodeni and Sasoli.	Balochi, Brahvi, Sindhi and Siraiki.

5.12.2.2 PRB Ethnic and Language groups

The PRB occurs mostly in the Lasbela District whose population presents many features of special interest to the ethnologist. The principal tribes among the Lasis claim to be descendants of the Sumras and Sammas, who formerly resided in Sindh. It is quite clear from their tribal names that many of them are of Hindu origin. The term Lasi is a geographical name, which is applied to all the tribes other than Baloch, Med, Khoja and Hindus, who are settled in Lasbela. There are five principal Lasi tribes: Jamot, Roonjha, Sheikh, Angaria and Burraf. These are called the Panjraj or the five tribal confederacies. Under each Raj, there were a large number of heterogeneous groups. Some other tribes include the Gunjas, Sinars, Sangurs, Burfats, Chhuttas and Khojas. A large number of Hindus are also residing in Uthal, Bela and Hub. They all belong to the Arora caste. The Hindus are mostly of the orthodox school; however, they are not strict in the observance of their religious rites and have modified several of their ordinary daily customs. Among other tribes are the Babbar, Gadras, Langhas and Koris.

5.12.3 Development Status, Potential and Poverty Situation

5.12.3.1 NRB Development Status, Potential and Poverty Situation

The NRB covers largely the agro-ecological zones where poverty is low or medium because most of the irrigated lands and production of high value crops fall in the NRB. Only the Khushkaba farmers are the poorest-of-the-poor because they depend largely on the occurrence and distribution of precipitation.

The HDI Index and Food Security map produced by the Pakistan Poverty Alleviation Fund is used to develop HDI and Food Security map of the NRB. The NRB has the rating of lowest, low and moderate HDI and food security and thus qualify as top three priorities for poverty alleviation.

Investing in health, education, nutrition, family planning services, water supply and sanitation, are some of the activities where the social returns are very high. The public-sector can provide these services to the poor so that their productivity is raised and then may be helped to lift themselves out of poverty. One of the most important elements impeding economic development in the backward areas is the unequal distribution of wealth. This problem also persists in Balochistan and the NRB. The gap between the rich and poor is widening and the number of poor is increasing. The mass ignorance among masses in Balochistan particularly in the rural areas is the main cause of poverty. People are ignorant about population planning, and the tradition of having more children are further aggravating the situation in Balochistan. The public-sector role of taxing the rich and providing services to the poor to reduce the income distribution gap is very important. This ensures the flow of resources from the rich to the poor.

5.12.3.2 PRB Development Status, Potential and Poverty Situation

As a whole, the Lasbela district has a critical role for Balochistan. It accounts for 90% of industrial output and 70% of revenue generated by the province. However, the industrial activity is mainly concentrated in areas with closer proximity to Karachi (e.g. Hub Industrial Area). While there is some industrial and commercial activity in the towns of Uthal and Bela, the study area potentially affected by the proposed project is generally devoid of any industrial and major commercial activities.

However, in terms of development potential, this area could be ranked high. This is due to its proximity to the port, availability of highways, and relatively encouraging record of industrial areas located nearby. There is a huge potential for the development of a marble processing industry in the area.

5.13 Land Use statistics

5.13.1 NRB Land Use Statistics

The NRB encompasses 6.92 million ha of the geographical area of Baluschistan and comprises of sixteen districts. Based on the geographical area of various districts falling in the NRB the total cultivated area under each district was computed. The net fallow area was computed by subtracting the net cultivated area from the total cultivated area of a particular district in the NRB, which provides information regarding fallow area available within the current cultivated area. Total current fallow area in the NRB is 0.628 million ha, which is a significant area for future development. This area is currently fallow because of inadequate availability of water from existing sources. In addition to the current fallow within the cultivated area of the Basin, there is a significant portion of land mass available as cultivable waste. Total cultivable waste is around 0.664 million ha. The cultivable waste refers to the land area which could be cultivable if water is made available (Table 5-23).

Table 5-23: Land use statistics of NRB (after GoB 2011)

No	Description	Area (ha)
1	Total Geographical area	6,922,870.0
2	Total cultivated area	1,231,163.7
3	Net cultivated area	603,647.9
4	Current fallow	627,515.8
5	Culturable waste	663,864.8

Source: after GoB 2011a.

5.13.2 PRB Land Use Statistics

Land is a major Natural Resource available in the PRB, including the barren and cultivable lands. The upper part of Porali River Basin lies in the Khuzdar District and is among the most disadvantaged area of Porali River Basin. Most of the land is locked within rocky hills, leaving only little patches amenable to agricultural activities in Wadh and its surroundings.

The size of landholding, along with environmental and climatic factors, keeps the incomes towards lower side. This also inhibits any meaningful accumulation of capital, which is clearly evident from the obsolete cultivation practices.

A large area of the Porali River Basin in Lasbela District can be cultivated if water is provided for irrigation. Physiographical details of the project catchments area are stated in Table 5-24.

Table 5-24: Physiographical Details of the Project Catchments

S. No.	Sub Basin Name	Total Area Boundary Km^2	Settlements Km^2	Cultivation Km^2	Barren Land/ Shrubs Km^2	Water Bodies	Road Network
1	Arenji Jhal Basin	695	1.15	0.46	674.47	19.38	-
2	Gajri Nai Basin	781	5.87	90.35	657.19	24.84	2.75
3	Kaniki Nai Basin	651	2.97	8.66	608.28	25.55	5.54
4	Khanko Nai Basin	659	3.06	12.75	619.96	17.25	5.98
5	Kharrai Nai Basin	1,706	13.93	38.78	1,606.10	42.97	4.22
6	Kud Basin	1,685	6	6.7	1,618.88	48.4	5.02
7	Kulri Nai Basin	711	4.37	14	652.49	33.51	6.63
8	Lakhra Basin	494	2.21	9.98	464.14	13.48	4.19
9	Lasra Dhorai Basin	418	2.11	-	405.11	5.38	5.4
10	Ping Jhal Basin	615	0.79	0.9	548.83	15.44	4.27

11	Tadar Kaur Basin	633	6	31.67	548.83	41.42	5.08
12	Tibbi Jhal Basin	1,545	0.71	-	1,609.67	31.06	3.56
13	Wad Basin Cultivation	1,023	9.42	7.66	974.91	22.21	8.8
Total		**11,616**	**59**	**222**	**10,989**	**341**	**61**

5.13.3 Land Tenure and Holdings

Major land tenure types here are classified on the land ownership of the user of that land as follows.

Ownership: Ownership is the first tenure type in Balochistan. Private individuals and entities can obtain freehold rights to land, and communal ownership rights are recognized under customary law.

Lease/Contract: Term leases are common for parcels of agricultural land over 30 hectares. Leases are for fixed rates, generally run at least a year and may have multi-year terms. Leases may be written or oral agreements.

Sharecropping: Sharecropping arrangements are common on small- and medium-sized parcels of agricultural land (less than 30 hectares). Sharecropping arrangements usually provide the landowner with half the production from the land; arrangements vary regarding provision of inputs. Most agreements are unwritten.

5.13.3.1 NRB Land Tenure and Holdings

Land ownership in the NRB is of two types: individually owned lands and communal lands. Individual clans own communal lands and production from these lands is divided among the entire clan. Labour during the crop growing season is engaged by the owners for cultivation either on cash payment or by sharing of crop produce. Large landholders employ crop-sharing tenants. Small farmers and their families work as farm labour at their own farms. Agricultural labour is primarily done by men while women and children are involved in selected activities and vary considerably from location to location and tribe to tribe in each district. Table 5-25 gives the agricultural and land distribution statistics for NRB.

Table 5-25: NRB agricultural land distribution

District	% Cultivation by ownership			% size of cultivated land			% cultivable land lying Fallow
	Owners	Owner-cum-tenants	Tenants	<2ha	2–10ha	>10ha	
Kila Saifullah	83%	16%	1%	33%	33%	34%	27%
Zhob	97%	2%	1%	72%	27%	1%	3%
Loralai	97%	2%	<1%	27%	53%	20%	38%
Sibi	62%	5%	33%	9%	50%	41%	85%
Kohlu	98%	1%	1%	52%	35%	13%	30%
Barkhan	95%	3%	2%	48%	46%	6%	43%
Mastung	91%	7%	2%	24%	66%	10%	38%
Ziarat	97%	2%	1%	80%	20%	0%	8%
Dera Bugti	80%	12%	8%	17%	73%	10%	30%
Kalat	91%	2%	7%	20%	69%	11%	29%
Jhal Magsi	57%	4%	39%	32%	40%	28%	47%

Khuzdar	93%	5%	2%	26%	57%	17%	24%

5.13.3.2 PRB Land Tenure and Holdings

Table 5-26 gives the village/settlement wise prevalent land ownership.

Table 5-26: PRB agricultural land distribution

Tehsil	Village/Settlement	Prevalent Land Ownership
Bela	Kohan Village	Ownership
	Abdur Rehman Nimi Goth	Ownership
	Jani Village	Sharecropping
	Sordeer Bizinja Goth	Ownership
	Kannar	Sharecropping
	Kundi	Sharecropping
	Kishari	Sharecropping
	Juman Bhit	Sharecropping
	Akri	Ownership
	Gajri Village	Ownership
	Seayan Goth	Sharecropping
	Soonari	Sharecropping
	Bara Bagh	Sharecropping
	Lungra Village	Ownership
	Gundacha Jagir	Leased/Contract
	Jamali Goth	Sharecropping
Kanraj	Abdul Wahid (Moza North Kanraj)	Leased/Contract
	Karan Khan Gorgeja	Leased/Contract
	Muhammad Umar Jamot Goth	Ownership
	Abdul Karim Jamot Goth	Ownership
	Raza Muhaamad Goth	Ownership
Uthal	Soomar Goth	N/A
	Haji Mir Muhammad Goth	N/A
	Haji Muhammad Ibrahim Jamot Goth	Sharecropping
	Kheer Golae	Leased/Contract
	Muhammad Yaqoob Gonga Piprani Goth	Leased/Contract
	Khareri	Ownership
	Faqir Goth	Ownership
	Bashwani Goth	Ownership
	Jamot Colony (Moza Marri No 1)	Ownership
	Tori Moza	Ownership
	Pir Goth	Sharecropping
	Muka Goth	Ownership
	Kandyaro Goth	Ownership
	Angario Goth	Ownership
	Khantra	Sharecropping
	Sheikh Mitha Khan Goth	Ownership
	Molvi M. Hassan Goth	Ownership
	Khan M. Goth	Ownership
Lakhra	Soomar Goth	Ownership
	Khakhacho	Ownership
	Orki	Leased/Contract
Sonmiani	Gajro Pat	Ownership
	Damb	N/A
Liari	Lairi	Ownership

5.14 Economic Activities and Livelihood Patterns

5.14.1 NRB Economic Activities and Livelihood patterns

The main economic activity of the NRB project area is agriculture with labour and keeping livestock, as a secondary source of income. Tenancy is common in the area and the main source of income of landless households is tenancy in Sailaba and Khushkaba farming systems. In NRB, one-third of the households depend primarily on agricultural activities for income generation as land tenants. Due to the unpredictability of the Sailaba and Khushkaba agriculture, the agricultural incomes are usually slightly above subsistence levels. Most farmers supplement their income from livestock keeping, tenancy and labour.

It is uncommon to take credits from Zari Taraqiati Bank Ltd or from other banks. However, social mechanisms exist in which interest free loans can be taken from relatives, traders and shopkeepers and repay at the time of harvest. Most the farmers plough their land on credit from tractor owners of the area, paying only the cost of fuel and oil at the time of ploughing and paying the tractor hire cost at the time of harvest. The economy of the province is largely based upon the production of natural gas, coal and minerals. The provincial natural resources significantly help to meet the energy needs of Pakistan. Due to the tribal lifestyle of many Baloch and Brahvi, livestock is important as trading bazaars are found throughout the NRB. Table 5-27 gives the sources of household income in the NRB.

Table 5-27: Sources of household income in the NRB

Source	Percent of Income		
	Urban	Rural	All
Wages and salaries	55.49	54.77	56.07
Crop production	1.99	15.59	11.86
Livestock	0.60	7.27	5.45
Other non-agricultural activities	19.52	8.15	11.26
Property excluding owner occupied houses	1.32	0.64	0.83
Owner occupied houses	11.99	8.11	9.18
Social insurance benefits including pension	0.82	0.13	0.32
Gift assistance	3.03	3.81	3.60
Foreign remittances	1.41	1.31	1.34
Domestic remittances	-0.08	0.04	0,00
Other sources	-0.09	0.18	0.10
Total	**100**	**100.0**	**100.0**
100 = Rs/month	**22772**	**17278**	**18500**

Source: GOB. 2011b.

5.14.2 PRB Economic Activities and Livelihood patterns

The main economic activities in the PRB are agriculture and livestock. This includes cultivation of land, livestock grazing, reaping and harvesting of the produces and other allied subsidiary occupations. Some of the population is engaged as unskilled labour in road infrastructure and general. Others are either employed in Government services or in the private sector. Most people who live along the coast are involved in fishing activities.

The 60% of the population which earns an income from agriculture and allied occupations, depends on the quality and quantity of crops harvested and the availability of water. The average annual income per household in these villages is about Rs 160,000. This includes income from livestock and agriculture. On an average, a household earns about Rs 45,000 from livestock each year. Household incomes from the sale of crops and seasonal agricultural labour are about Rs 70,000. People involved in trade and business reported the highest income, followed by those earning salaried income through government and private jobs. Salaried employment often has a higher educational requirement, so the lower employment in such positions indicates the low literacy level in this area.

5.15 Traditional Water Rights and Management

In Balochistan, water-rights in spate-irrigated areas, whether perennial or non-perennial, are essential for conflict resolution. However, there is a categorical difference between water rights in spate-irrigation systems and neighbouring canal irrigation systems in arid lands.The perennial spate-irrigation system basically originates from the springs fed by the aquifer, but is subject to devastations caused by the floodwater supporting non-perennial spate-irrigation system. Therefore, perennial spate-irrigation system is an integral part of overall stream-network of the floodwater. The water-rights of the perennial spate-irrigation system are often sharply defined in fixed and even exchangeable proportions of the flow and allowed usage-time compared to the non-perennial spate irrigation system, where water-rights are reactive. Water-rights of perennial spate irrigation system are also disturbed in terms of availability of water at the source or at any point in the conveyance channel due to medium-term changes in the river-morphology, scouring, siltation and change of river course (Ahmad et al. 1998). Water distributions in the floodwater irrigation systems are based on allocation rules rather than alienable property.

Irrigation water rights are based on customary tribal laws and can be differentiated in o three linguistic groups namely Pashtuns, Balochs and Brahvis and they directly derive from land rights. The water can be used freely for domestic and stockwater uses. The domestic use rights apply only to water used on the spot or fetched in buckets and pitchers, but do not allow for the construction of channels or pipes to homes for this purpose. Detailed descriptions of the traditional water management systems in both basins are provided in the social assessment reports.

In the local water resource management of the indigenous water harvesting systems, the public sector is considered as an external player. Indigenous systems are managed completely by the local water users' institutions. Therefore, for any change, there is a need to have clear focus on resource users' institutions itself and see what factors influence change, stagnation or sustainability. Furthermore, it is also useful to define role of public sector in setting more transparent conditions for change, stagnation or collapse.

Transaction costs are the cost of arranging, monitoring and enforcing contracts. In local water resource management these are often social contracts, regulating access and usage of the resource within group of resource users. This is referred to first order transaction costs related to management of the indigenous systems in traditional framework.

The second order transactions costs deal with institutional or technological change. Second order transaction costs are generally high in comparison to first order transaction costs. Institutional change requires learning rather than information collection, and bargaining rather than contract preparation. Moreover, institutional change is not repetitive, but incidental. Its outcome is uncertain and the behaviour of various actors cannot be predicted. Whereas at the level of institutional management interests are often defined by the institutions and a status quo exists, in institutional change interests are open. They may differ and conflict and complicated negotiation is necessary. The costliness of institutional change explains why some changes – although they could improve resource utilization – do not take place at all. There are several examples of institutional stagnation in local water resource management in Pakistan that can be attributed to high second order transactions costs. The failures of groundwater management regimes in most valleys of Balochistan, the inability to reach agreement on water rights in new agency-developed systems, and the lack of adjustment in water delivery schedules in perennial-spate-irrigation systems are the few examples (Steenbergen, 1997).

5.16 Archaeological and Cultural Sites

There are 27 federally protected monuments and sites in Balochistan (Table 5-28), several of which are present in the NRB and PRB.

Table 5-28: Federally-protected sites and monuments in Balochistan

District	Name of Monument
Kacchi	Pirak Mound, Kolachi Village
Kalat	Nindo Damb, Ornach Valley, Tehsil Wadh
Kharan	Fort Wall of Jalawarr Pass, Jhalawar, Kharn
	Fort of Azad Khan (Kharan Fort), Kharan Twon
	Pally Kalat, Washbohi
	Nauroze Fort
	Ancient Tomb, Jhalawar
	Har-o-Goke, Garul
Lasbela	Ancestral graveyeard of Jam of Lasbela, Babrs
	Tomb of General Mohammed Ibn-e-Haroon, Bela Town
	Tombs of Hinidan, Pir Mubarakm
	Chowkundi (Rumi) graves, Bhawani Sarai, 5 miles from Hub Chowki
Loralai	Tordheri site, Tordheri
	High Court, Dabarkot
	Pre-historic mound, Harian Haider Zai
Nasirabad	Damb Judeir or Judeir-jo-daro, Deh Jodher No 2, between Jhatpat and Dera Murad Jamali
Quetta	Mound No 2, Village Samangali, West Side of Airport
	Mound No 1, Village Kotwal, Near Killi Gul Muhammad
	Mound No 3, Damb Sadat, 14 miles from Quetta
	Mound No 5, Ahmad Khan Zai
	Mound No 6, Shahi Khan, near Pir Ballo or Sariab Road
	Mound No 7, Kachlak on Chaman Road
	Mound No 8, Village Samali (Dosak-i-Khasyan)
	Mound No 9, Village Village Metar Zai
	Mound No 10, Shaikh Manda on Chaman Road
	Mound No 11, Village Vauhisar
Sibi	Quaid-i-Azam Residency Building, Ziarat

In addition to these listed sites, there are several religious buildings and cultural sites are located throughout both river basins where the proposed project activities will be implemented. Some villages have shrines of religious leader's and almost all villages have mosques and graveyard which are of cultural significance to local populations. However, based on the site visits and field surveys, it was concluded that none of these religious properties will be affected by the proposed project schemes.

6 Potential Impacts and Mitigation Measures

6.1 General

The project aims to implement (i) Eight irrigation schemes, four in Nari River basin and four in Porali River basin (ii) Sixteen potable water supply sub-projects in 16 villages, (iii) Nine flood protection works, (iv) Watershed and rangeland Managements, and (v) environmental protection.

No private land acquisition is expected and most of the impacts from the proposed activities are temporary in nature and limited to the construction period. Based on the experience of other similar projects in Pakistan, many of the environmental issues are mainstreamed in the project design. The Project involves construction and or rehabilitation of irrigation infrastructure and resultant increase in the volume of water diverted for irrigation. There is sizeable number of indigenous trees (about 1,385 in Nari and 47,350 in Porali) along the irrigation canals of Nari Gorge, Yetabad, Gundacha, Nimmi, and Jamot canals were observed and recorded. The Nari River Basin also has one of the largest blocks of juniper (*Juniper usexcelsa*) forests in the world, which are very slow growing and some of the oldest in the World. They cover approximately 110,000 ha and occur at elevations between 2,000–3,500 m. Growth conditions are harsh. The trees are very slow growing. Juniper Forests of Ziarat serve as a critical watershed to the Nari River.

The Porali River and its tributaries drain into the Miani Hor, a subtropical lagoon lying on the coast of Lasbela district of Balochistan. The area supports mangrove forests and is a designated Ramsar site located downstream of the Porali River basin. The Nari River drains into Hamal Lake and then into Manchor Lake, both of which are important wetland areas downstream of the NRB. Hamal Lake serves as a nursey for freshwater fish and is a stopover for many migratory birds such as geese, flamingos, egrets, ducks, coots, gulls, shorebirds, terns, herons, cormorants, ibises. Manchor Lake is also an important stopover for migratory birds.

Overall, the Project will have a net positive impact on the farming households and people in the area. Total number of beneficiaries from all schemes is expected to total 705,579 people (about 86,549 households). A large population will benefit indirectly from the project, including landless farm laborers and temporary and permanent laborers in the construction and manufacturing sectors. It is expected that 77,000 ha of additional land will be under improved irrigation by 2021. Flood protection works are expected to directly benefit 81,760 people (10,220 households) and protect 14, 557 ha of land. Potable water supply sub-projects are expected to directly benefit 29,220 people (3, 653 households).

6.2 Impact Assessment Methodology

Potential environmental and social impacts were identified by reviewing the independent ESIA, feasibility study reports, stakeholder consultations, and other sources. The significance of potential impacts was assessed using the criteria and methodology given below.

Impact Magnitude

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

The magnitude of potential impacts of the Project has generally been identified according to the categories outlined in Table 6.1.

Table 6-1: Parameters for Determining Magnitude

Parameter	Major	Moderate	Minor	Minimal
Duration of potential impact	Long term (more than 20 years)	Medium Term Lifespan of the project (6 to 20 years)	Limited to construction period	Temporary with no detectable potential impact
Spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond immediate 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	Baseline requires a year or so with some interventions to return to baseline	Baseline returns naturally or with limited intervention 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 breaches international lender guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable
Likelihood of potential impacts occurring	Occurs under typical operating or construction conditions (Certain)	Occurs under worst case (negative impact) or best case (positive impact) operating conditions (Likely)	Occurs under abnormal, exceptional or emergency conditions (occasional)	Unlikely to occur

Sensitivity of Receptor

The sensitivity of a receptor has been determined based on review of the population (including proximity / numbers / vulnerability) and presence of features on the site or the surrounding area.

Each detailed assessment has defined sensitivity in relation to the topic. Criteria for determining receptor sensitivity of the Project's potential impacts are outlined in Table 6.2.

Table 6-2: Criteria for Determining Sensitivity

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

Assigning Significance

Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor has been determined and the significance of each potential impact established using the impact significance matrix shown in Table 6.3.

Table 6-3: Significance of Impact Criteria

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

6.3 Summary of Assessed Impacts

The project's potential impacts and their significance have been assessed using the methodology described in Section 6.2 above. A summary of these impacts and their significance is presented in Table 6.4.

Table 6-4: Potential impacts and their significance

Impact from various activities	Phase	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
Environmental and Social impacts during pre-construction stage:						
Negative Impacts						
Failure of previous similar interventions/projects and schemes.	Pre-construction	High	Minor	Moderate adverse	• The causes of failure of previous interventions in terms of design and / or construction faults will be studied and incorporated into the detailed designs.	Minimal
Schemes will only benefit some influential people of the area and not benefit the poor and vulnerable people most in need.	Pre-construction	High	Minor	Moderate adverse	• Location of proposed schemes are identified based on field survey, need assessment, and consultations with local community to have a proper geographical dispersion of interventions to ensure equitable distribution of benefits. • The project intervenes in both basins in a manner that ensures that there are many individual beneficiaries from project activities.	Minimal
Impacts on Ecology, Soil and Land						
About four acres of land may be required on temporary basis for contractor' camp.	Pre-construction	Very High	Major	Major adverse	• Only government land to be used; no private or community land to be used. • In extreme case where private land acquisition is unavoidable, it will be compensated under the guidelines presented in the resettlement policy framework included in the Social Impacts Assessment and Mitigation Plan.	Minimal
Sub-basin / Watershed and Scheme site location. Improper selection with reference to site ecology (i.e. improper project siting) may lead to erosion and loss of useful agricultural land.	Pre-construction	High	Major	Major adverse	• Appropriate site selection and design were conducted according to national and the WB guidelines in order to entail no or minimal disturbance to local ecology, soil and land.	Minimal
Improper site selection and design can lead to removal of vegetation and cutting of trees.	Pre-construction	High	Major	Major adverse	• Schemes located in ecologically sensitive areas not approved, in order to avoid impact on flora /fauna.	Minimal
Sub-basin / Watershed and Scheme site location may lead to deforestation in the sub-basins.	Pre-construction	High	Major	Major adverse	• Plantation plan / forest / rangeland management consideration during design phase.	Minimal
Impacts on Surface Water						
Watershed / Scheme Site interventions may affect natural drainage / run-off. This can stress local natural stream flow –which may cause surface water quality degradation and contamination of water resources and affect downstream ecology.	Pre-construction	High	Major	Major adverse	• During design stage, watershed hydrological modelling is being considered at the scheme site to account for effects on natural drainage and surface water quality.	Minimal
Improper design considerations for suspended silt / maintenance of	Pre-construction	High	Major	Major adverse	• Designs to consider flow regulatory structures / schemes and minimum flow requirements.	Minimal

Impact from various activities	Phase	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
minimum flows may degrade downstream ecology.						
Excessive diversion/use of surface water resources may lead to depletion of natural surface water resources in the area.	Pre-construction	High	Major	Major adverse	• Design to consider proper water utilization rates under schemes as not to deplete water resources.	Minimal
Impacts on Groundwater						
Improper assessment of sub-surface ground water levels prior to design stage for Non- perennial schemes may lead to depletion of ground water resources.	Pre-construction	High	Major	Major adverse	• Extensive ground water table studies have been carried out during feasibility stage. • Schemes are designed according to Ground water recharge/ pumping regulations.	Minimal
Improper capacity lead to inappropriate fertilizer and pesticide use in irrigation may lead to degradation of sub-surface water quality and contamination.	Pre-construction	High	Major	Major adverse	• An integrated pesticide management plan is prepared under the national regulatory guidance and in line with WB safeguard policies. • Extensive training is designed under the On Farm Water Management Program for the proper use of pesticide.	Minimal
Social impacts during construction stage						
Positive Impacts						
Generation of employment.	Construction	Medium	Moderate	Moderate beneficial	• Temporary employment for local workers and technicians, local unskilled labors. Also, employment of locals during surveys.	Moderate beneficial
Increased economic activity.	Construction	Medium	Moderate	Moderate beneficial	• Establishment of new businesses and commercial enterprises; local employment. • New market for local produces, more sale and revenue generation. • As a result of the influx of a workforce, there shall be a higher demand for locally produced food, goods and services benefiting local farmers, producers, traders including small shops within project area.	Moderate beneficial
Negative Impacts						
Temporary land acquisition by the contractor during construction.	Construction	Medium	Moderate	Moderate adverse	• Only government land to be used; no private or community land to be used. • In extreme case where private land acquisition is unavoidable, it will be compensated under the guidelines presented in the resettlement policy framework included in the Social Impacts Assessment and Mitigation Plan.	Minor adverse
Safety hazards due to increased traffic especially for children and elderly people.	Construction	Medium	Moderate	Moderate adverse	• Traffic Management Plan addressing general access to be implemented. • Safety and security actions and procedures to protect local community during construction phase.	Minimal

Impact from various activities	Phase	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
Risk of accidents and unsafe working conditions for workforce.	Construction	Medium	Moderate	Moderate adverse	• Occupational Health and Safety Plan to be implemented. • Emergency Preparedness Plan to be implemented. • Contractor follows IFC Performance; Standards on Labor and Working Conditions; • Safety training for all workers.	Minimal
Security risks for workers and project staffs, especially in Porali River basin area.	Construction	Medium	Moderate	Major adverse	• Continued consultations with the tribal leaders and local community leaders on security matters. • Security at the work sites and camps. • Identification cards to workers. • Access to the camps must be controlled through gated entrances and entrance and exit logs shall be maintained at each gate. • Preparation and implementation of the contractor's Communication plan to engage local leaders and community. • Implement ECP 19: Construction and Operation Phase Security	Minimal
Inadequate construction site security poses a significant risk to assets, construction materials and property. Theft/vandalism of assets, materials and property would increase construction costs and cause delays in project completion.	Construction	Medium	Moderate	Moderate adverse	• Ensure security at the work sites and camps. • Employ night watchman for periods of significant on-site storage or when the area necessitates. • Ensure there is proper fencing around construction site perimeter, chain-link at least 2.4 m high and secured with a steel chain and lock. • Pre-employment screening investigations should be used to verify the applicants relating to their employment, education and criminal history background. • Identification cards to workers • Implement ECP 19: Construction and Operation Phase Security	Minimal
Possible cultural conflicts between communities and workers.	Construction	Medium	Moderate	Moderate adverse	• Awareness campaign; Code of conduct for workers. • Grievance mechanism developed and implemented. • Develop and implement strong community participation plan.	Minimal
Risks of HIV/AIDS and STI due to the flow of migrant workers.	Construction	Medium	Moderate	Moderate adverse	• Awareness creation on HIV/AIDS infection and diseases through a well-designed campaign implementation plan targeting all risk-prone groups. • Empowering women through employment in the construction work.	Minimal
Increased pressures on local facilities (i.e., mosques, health care facilities) due to in-flux of migrant labors.	Construction	Medium	Moderate	Moderate adverse	• Construction contractors will provide all required facilities for workers, so workers will not put pressure on local facilities.	Minimal
Health and safety risk of the	Construction	Medium	Moderate	Moderate	• The Contractor shall follow IFC EHS guidelines as detailed	Minimal

Impact from various activities	Phase	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
community due to the existence of a construction site(s) and the storage and use of hazardous chemicals.				adverse	in bidding documents to be reviewed by the Bank. • If there are any hazardous materials, they shall be safely stored on construction site locations under lock and key.	
Some local communities rely on canal water for their drinking water needs, and excessive use of these resources by the contractor will adversely impact upon the availability and quality of drinking water.	Construction	Medium	Minor	Minor adverse	• The surface water quality is not suitable for drinking purposes and it is expected that the contractor shall fulfil his domestic water requirements for labour camps through his own arrangements.	Minimal
Temporary interruption of irrigation water supply during construction works. During construction, supplies of water may be insufficient to satisfy the requirements of crops growing in the command area of each Canal, thus reduce the income of these farmers which shall have a negative impact on the socio-economics of the impacted area.	Construction	Medium	Moderate	Moderate adverse	• Prepare construction schedule to avoid farming seasons. • For longer construction scheme, the contractor shall be prohibited from interrupting the water supply to any canal or reducing it below the allocated discharge of these canals by proving diversion canals on the section where work is planned on priority basis. • The Contractor shall programme the Works to utilize the low water demand periods in the command area. • The Contractor shall submit a construction schedule to the Engineer for approval on mobilization. If in case, the closure of water supply is unavoidable, the Contractor needs to share his plan with the farmers and get their consensus.	Minimal
Environmental impacts during construction stage						
Negative Impacts						
Emissions of dust and air pollution will be generated from excavation works, operation of construction equipment and vehicles, material transport, and site clearance	Construction	Medium	Moderate	Moderate adverse	• Water the soil surface and any non-asphalted roads, especially in the dry season. • Water the soil before starting excavating. • The storage and handling of spoil, subsoil, topsoil and materials should be carefully managed to minimize the risk of wind-blown material and dust. • Cover hauling vehicles carrying dusty materials moving outside the construction site. • Fit vehicles with appropriate exhaust systems and emission control devices. • Limit the idling time of vehicles not more than 2 minutes. • Implement ECP 10: Air Quality Management.	Minimal
Clearing of natural vegetation and trees during construction activities in project areas. There may also be pressure on forests (illegal logging) by influx of workers. Around 1,385 indigenous trees were	Construction	Medium	Moderate	Moderate adverse	• Vegetation clearance shall be limited to the extent required for execution of works. • Avoid cutting down of tree species of conservation significance and those that are protected, even those that act as nesting and breeding sites. • Tree planation will be carried out in and other suitable areas near the river training works at a ratio of 5 new trees	Minimal

Impact from various activities	Phase	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
recorded along the length of existing canals within the RoW of Porali River Basin schemes. In Nari River Basin, around 47,350 small bush like trees were observed along the alignment of the main and branches of the proposed irrigation system within the RoW.					per each tree cut. • Contractor will follow ECPs 12 and 13 on Protection of Flora and Fauna while tree cutting. • Include environmental management and awareness as part of training for employees during construction.	
Access routes through agriculture land will damage the land quality as well as standing crops.	Construction	Medium	Moderate	Moderate adverse	• Construction Contractors will be prohibited from using agricultural lands for access routes.	Minimal
Earthworks will impact the fertile top soils that are enriched with nutrients required for plant growth or agricultural development.	Construction	Medium	Moderate	Moderate adverse	• Strip the top soil to a depth of 35 cm and store in stock piles of height not exceeding 2m. • Remove unwanted materials from top soil like grass, roots of trees and others. • Spread the topsoil to maintain the physico-chemical and biological activity of the soil. The stored top soil will be utilized for covering all disturbed area and along the proposed plantation sites. • Implement ECP 7: Top Soil Management	Minimal
Excavation works will impact on the loss of habitats especially the terrestrial invertebrates that live in the ground.	Construction	Medium	Moderate	Moderate adverse	• Avoid construction during the rainy season • Minimize digging of trenches and vegetation clearance to minimum required level.	Minimal
Operation of piling activities, excavation, operation of heavy equipment and transport vehicles, and blasting operation will cause noise and vibration affecting workers and the nearby population.	Construction	High	Moderate	Major Adverse	• Construction activities near settlements will be limited to day time only (8AM – 6PM). • High noise producing equipment will be provided with mufflers or acoustic enclosures. • Install acoustic enclosures around generators and install temporary noise control barriers where appropriate to reduce noise levels. • Fit high efficiency mufflers to appropriate construction equipment. • Notify affected communities in advance regarding major noisy operation, e.g. blasting. • Implement ECP: 11 Noise and Vibration Management	Minimal
Impact on surrounding environment and communities from Construction Camps	Construction	Medium	Moderate	Moderate adverse	• During construction phase the contractor site camps should be properly managed. Water usage, fuelwood cutting, deforestation, trees injury should be avoided. Community of the area should not be affected. Proper sanitation and construction machinery should be maintained according to environmental standards.	Minimal

Impact from various activities	Phase	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
					• The Contractor needs to establish main and site camps. The main camp may be a rented building in the Lasbela city and will be for the Contractor project management staff while site camps shall be for the labour and Contractor's machinery operators. The site camps shall be located where the construction works are in progress.	
Increased Traffic on local roads will affect access to the trading centre and, houses close to the road, deteriorate safety (especially the school children), spillage of fuels and chemicals, and damage to infrastructures and properties due to vibration	Construction	Medium	Moderate	Moderate adverse	• Contractor will implement traffic management plan to ensure uninterrupted traffic movement during construction. • Restrict truck deliveries, where practicable, to day time working hours. • Restrict the transport of oversize loads. • Enforce on-site speed limit, especially close to the sensitive receptors, schools, health centres, etc. • Implement ECP 15: Road Transport and Road Traffic Management • Inspect structures within the close proximity of construction site for damages.	Minimal
Contamination of soil and water due to the accidental spills and leakage of fuels and chemicals.	Construction	Medium	Moderate	Moderate adverse	• Contractor will prepare and implement Pollution Prevention Plan and ECP. • Implement ECP 2: Fuels and Hazardous Goods Management • Contractor to confine the contaminants immediately after such accidental spillage • Contractor to collect contaminated soils and washouts containing petroleum products treat and dispose them in environment friendly manner • All areas intended for storage of hazardous materials to be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation	Minimal
Impact of spoils, solid waste, and waste effluents.	Construction	Medium	Moderate	Moderate adverse	• Implement ECP 1 Waste Management and ECP 2 Fuels and Hazardous Goods Management. • Siting of fuel and hazardous material storage sites, including refuelling facilities, batching plants and construction yards are to be located outside the flood embankments and at least 500 m away from any residential areas. • Hazardous waste will be disposed of by designated contractors.	Minimal
Impact of borrow and quarry activities.	Construction	Medium	Moderate	Moderate adverse	• Borrow/quarry areas will be developed close to the project area for extraction of earth material and aggregates for river protection works. • No private lands or agriculture lands will be used for	Minimal

Impact from various activities	Phase	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
					borrowing. • Minimize volume of borrow material by using dredged material generated from the project. • The use of explosive should be used as low as possible to reduce noise, vibration, and dust. • Control dust and air pollution by application of watering. • Photographs recorded of each borrow area showing pre-construction baseline for comparison with after rehabilitation • Implement ECP 9: Quarry Areas Development and Management.	
Disturbance/damage to unidentified archaeological asset or graveyard.	Construction	Medium	Moderate	Moderate adverse	• No archaeological sites are reported with in the construction areas. However, in case any artefact or site of archaeological, cultural, historical, or religious significance are discovered during construction activities, the works will be stopped in that area, and the appropriate department will be informed. Relevant procedures are provided in Annex B. • An additional study to develop a cultural heritage management plan will be carried out in the first six months of the project. Terms of Reference are provided in Annex C.	Minimal
Disturbance to sites of religious importance	Construction	Medium	Moderate	Moderate adverse	• Location of all schemes are at a safe distance from sites of religious importance	Minimal
Impacts on Ecology, Wildlife and Habitats						
Loss of faunal habitat at locations of construction works, camp, staff quarters and on access/haul routes due to the felling of trees. Fragment and lead to loss of critical habitats for resident and migratory birds. The Nari River basin is a main route of migratory birds from Afghanistan and India.	Construction	Very high	Moderate	Major adverse	• Minimize construction in the critical habitats of birds. • Care should be taken to make sure bird nests are not destroyed. If there is no option available, rehabilitate them in other neighbouring trees. Also protect and rehabilitate injured or orphaned birds. • Use of existing access road and limit the width of new access roads. • Implement ECP 13 Protection of Fauna for species with conservation significance especially endangered and near threatened.	Minimal
Deforestation due to construction activities and loss of habitat may affect the Balochistan black bear (found in found in Ziarat, Kalat and Khuzdar), which is a critically endangered species.	Construction	Very High	Major	Critical adverse	• Tree clearance shall be limited to the extent required for execution of works. • Contractor will follow ECP 12: Protection of Flora while tree cutting • Implement ECP 13: Protection of Fauna for species with conservation significance especially endangered and near threatened. • Include environmental management and awareness as	Minimal

Impact from various activities	Phase	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
					part of training for employees during construction	
Urial is an endangered species and is found in the rich habitats of Torghar of Sibi district, Takatoo in Pishin district and Torgbag in Balochistan. The Blandford Urial and Sind Ibex are found in Durreji in Lasbela district.	Construction	Very High	Minimal	Minimal adverse	• No construction activities are expected to take place in the mountainous areas of the Urial habitat.	Minimal
Straight horned Suleman Markhor is endangered and Chilton Wild Goat is critically endangered. Both are found in the mountains of Torghar of Sibi district between 2,300-3,000 m.	Construction	Very High	Minimal	Minimal adverse	• No construction activities are expected to take place in the mountainous habitat areas of the Suleman Markhor and Chilton Wild Goat.	Minimal
The Afghan tortoise is also found in Lasbela Valley and is listed as vulnerable in IUCN.	Construction	Very High	Minimal	Minimal adverse	• No construction activities are expected to take place in the habitat areas of the Afghan tortoise, which is found in barren habitats such as rocky deserts and hillsides, as well as sandy steppes and grassy areas close to springs.	Minimal
Impact on river habitats (i.e., breeding and nesting sites) from construction activities, including riverine vegetation clearance.	Construction	Medium	Moderate	Moderate adverse	• Control of sediment flow from the construction activities • Silt curtains along river training works to control sediment runoff. • Minimize and restrict clearing of riverine vegetation as much as possible. • Implement ECP 13 Protection of Fauna for species with conservation significance especially endangered and near threatened. • Project activities are mostly confined to the diversion of flood water or diversion sub-surface water through Perennial Irrigation Schemes, so are not expected to affect the fish and marsh crocodile, which mostly reside in lagoon areas.	Minimal
Loss of temporary breeding pools and pans due to refilling of such pools by construction soil or gravel.	Construction	Medium	Moderate	Moderate adverse	• Schedule construction during the dry season to reduce impact since the amphibian populations will be low during non-breeding season • Fence off the trenches with nets to prevent amphibians falling into the trap. • Implement ECP 13 Protection of Fauna for species with conservation significance especially endangered and near threatened.	Minimal
Green and Olive Ridley Turtles in the Porali basin are endangered species.	Construction	High	Minimal	Minimal adverse	• The turtles are found near the coastal areas and will not be affected by the construction activities.	Minimal
Impacts on Downstream and Protected Areas						

Impact from various activities	Phase	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
Impact on downstream river habitats from construction activities, such as construction of flood protection and river training works. The Porali River and its tributaries drain into the Miani Hor, a designated Ramsar site.	Construction	High	Minor	Moderate adverse	• Control of sediment flow from the construction activities. • Implementation of ECPs, including ECP 1 Waste Management and ECP 2 Fuels and Hazardous Goods Management. • Silt curtains along river training works to control sediment runoff.	Minimal
Social Impacts during operation & maintenance stage						
Positive Impacts						
Access to irrigation water, farming capacity and technology, flood protection, potable water supply, watershed and rangeland management, and environmental protection.	O & M	High	Major	Major adverse	• Benefit 705,579 people (about 86,549 households) by 8 Irrigation, 16 Potable Water, and 2 Flood Protection schemes; improved Watershed and Rangeland Management, and environmental protection of protected and wetland areas.	Extremely beneficial
Access to improved irrigation system and improved water use practices	O & M	High	Major	Major adverse	• Improved irrigation system and improved water use practices will lead to a considerable increase in cultivatable land, thus increase crop production and improve income and livelihoods of farmers. • The implementation of project will result in increased crop production, resulted by increase in cropping intensity from 20% to 100% and improvement in yield /acre. • Productivity of crops is expected to more than double after project implementation. • After project implementation, in the Porali River basin, total crop production is expected to increase from 184,235 tons to 450,627 tons (an increase of 266, 392 tons). • The irrigation sub-projects and on-farm water management practices are expected to benefit 544,490 people (68, 061 households). • It is expected that by 2021, 77,000 ha of additional land will be under improved irrigation.	Extremely beneficial
Damage of command areas by flood waters	O & M	High	Major	Major adverse	• Prevention of floods from entering into the command area by constructing flood protection works, will improve the livelihood of the population and protect crops, • Flood schemes will reduce the likelihood of devastating damage and the economic burden associated with recovery following the flood. • Flood protection works are expected to directly benefit 81,760 people (10, 220 households) and protect 14, 557 ha of land. • The estimated avoided damages/year due to flood protection works are in USD $753,882, $462,271, $124,720 and $1,340,873 for infrastructure, livestock	Extremely beneficial

Impact from various activities	Phase	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
					production, crop production, respectively. • Construction of flood water diversion structure will play a pivotal role in increasing the income of households at farm level. This will help in increasing the area under cultivation along with cultivation of improved varieties. • Flood water diversion schemes in the province will help in improving the family nutrition through availability of better and nutritious food and thus contribute to better health of households.	
Loss of opportunities for women and social uplift	O & M	High	Major	Major adverse	• Project will enhance opportunities for women to participate in profitable agriculture, by tailoring interventions to their specific needs and by promoting gender equity in rural communities. • It is expected that 352,789 women will benefit directly from implementation of Irrigation Schemes, Potable Water, Flood Protection and Watershed and Rangeland Management.	Major beneficial
Water supply and waterborne disease in the Project area.	O & M	High	Major	Major adverse	• Potable water supply sub-projects are expected to directly benefit 29,220 people (3, 653 households). • Lifestyle in surrounding areas will be improved by ensuring sustained supply of potable water. • Sanitation and water borne diseases in the area will be improved. • Sustained water supply will contribute significantly on reduction to households spending on water borne diseases. • Improvement in livestock quantity and composition due to consistent availability of water will improve economic income and food security of people.	Extremely beneficial
Loss of nutrient rich sediments in upstream areas and deprive the benefit from better crop production.	O & M	Medium	Moderate	Moderate adverse	• Diversion schemes are designed to distribute nutrient rich sediments in the command area, which will work positively for cropland and increase crop production, without discharging them to the downstream water flow.	Moderate beneficial
Social Impacts of Watershed and Rangeland Management - Poor Watershed and Rangeland Management.	O & M	High	Major	Major adverse	• About 280,161 people (32,960 households) are expected to benefit from the implementation of the improved Watershed and Rangeland Management practices. • Watershed management activities will be undertaken in both Project river basins, including soil and water conservation measures, rainwater harvesting and plantations.	Extremely beneficial
- Biomass productivity for sustenance.	O & M	High	Moderate	Major adverse	• Production of fuel wood for use by low income households.	Moderately beneficial

Impact from various activities	Phase	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
- Social forestry jobs	O & M	High	Moderate	Major adverse	• Will create local jobs for harvesting timber and non-timber products.	Moderately beneficial
- Grazing area and food stock for livestock.	O & M	High	Moderate	Major adverse	• Improvement in livestock (quantity and composition) due to more consistent food stock availability for grazing animals. • Develop livestock potential of the area through management of pasture lands	Moderately beneficial
Negative Impacts						
Social disturbance due to poor expectation management of the project.	O & M	Medium	Moderate	Moderate adverse	• Make formal arrangement for continued communication and engagement with local stakeholders, in the form of a community engagement cell. • Hire an independent monitoring consultant, for regular monitoring of the project. • Ensure consistent communication with local communities, even if there are hurdles in project implementation	Minimal
Poor governance resulting in unequal utilization and distribution of water.	O & M	Medium	Minor	Minor adverse	• Development of integrated community formal structure of social community participation plan.	Minimal
Low system efficiency due to poor maintenance.	O & M	High	Minor	Moderate adverse	• Development and implementation of a proactive maintenance plan for the proposed project/site with predefined periodicity. • Monitoring on regular basis at each project /site location and reporting maintenance status.	Minimal
Impacts due to Watershed and Rangeland Management - Restriction on open-access grazing may affect livelihoods of farmers.	O & M	Medium	Moderate	Moderate adverse	• Development of comprehensive and fair rotational grazing plan. • All users of grazing land will be given equal rights and access.	Minimal
Social Impacts on Downstream and Protected Areas - Alteration of Ecological flows (less water available for maintaining environmental flow) of the Porali River may have an effect on the fish and shrimp in Miani Hor and thus impact livelihoods' of people which depend on these resources.	O & M	High	Moderate	Major adverse	• Environmental flow assessments are determined to maintain the hydrological regimes and provide protection of river flows and ecosystem characteristics. • Assessments show that the minimum environmental flow required for Porali River is 0.111 BCM and after diversion and consumption 0.582 BCM water will be released downstream, which is more than 5 times minimum requirements. Thus, there should be no negative impact.	Minimal
- More cultivated land will lead to increase in the use of pesticides and fertilizers,	O & M	Medium	Moderate	Moderate adverse	• Disseminate information regarding sustainable use of fertilizers and insecticides to keep the use at an optimal level.	Minimal

Impact from various activities	Phase	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
which have negative effect on downstream areas, especially the Hamal and Manchor Lakes, Miani Hor and eventually impact the livelihoods of people.					• A comprehensive education and awareness programme for farmers; development of a biodiversity database; community-based sustainable use programmes. • The EMP included an Integrated Pest Management.	
Environmental Impacts during operation stage						
Positive Impacts						
Groundwater recharge	O & M	High	Moderate	Major adverse	• Improved recharge of ground water tables in the project area by water storing techniques and plantation. • Improved watershed and rangeland management technologies to improve soil moisture retention, reducing erosion and improving groundwater recharge.	Major beneficial
River morphology and flood protection.	O & M	High	Major	Major adverse	• The regulated hydrology regime will be more beneficial for the overall ecosystem health, even with reduced total quantity of water, than the current erratic regime. • Flood water diversion schemes will bring very positive impact on the environment through increased fodder and agriculture crop production, which would take off pressure from the rangelands of the area in terms of provision of fodder and fuelwood. • Flood water diversion scheme will also help in increasing the productivity of ecosystems and will therefore attract more faunal species in the area. This will help in maintaining and increasing the biodiversity in the project/scheme area.	Major beneficial
Impacts due to Watershed and Rangeland Management - Highland pastures and biomass	O & M	High	Major	Major adverse	• Prevent grazing on degraded land, protect areas with good natural regeneration potential, reseeding/sowing rangelands with palatable species, • Establish grazing management plans based on carrying capacities, and construction of watering ponds for livestock. • Planting of palatable shrubs and trees and reseeding of grass as well as introduction of stall feeding based on fodder production • Rangeland management will introduce rotational grazing and stocking rate limits. • At the irrigation scheme level, watershed management will include drainage improvement, soil and water conservation measures and rehabilitation/protection of irrigable land degraded/endangered by erosion gullies.	Major beneficial
- Soil erosion	O & M	High	Major	Major adverse	• River basin level activities will include soil and water	Major

Impact from various activities	Phase	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
					conservation measures (e.g., hillside drains, contour trenches, rainwater harvesting in micro-catchments and plantations). • Construction of water conservation and erosion control works (e.g., loose and pack stone check structures, groundwater recharge ponds, gabions, Kareze rehabilitation, streambed ponds, ditches etc.). • Improved watershed and rangeland management technologies to improve soil moisture retention, reducing erosion and improving groundwater recharge. • By 2021, it is expected that 70,000 ha of land area with high erosion risk will be treated.	beneficial
- Destruction of ecosystem and deforestation.	O & M	High	Major	Major adverse	• Conservation of two important ecosystems in Balochistan, namely the Juniper forest in the catchment areas of Nari river basin and the Mangroves forest in the delta of Porali river basins. • The Project will supplement existing environmental protection including enlargement and conservation of protected juniper and mangrove forests. • Reforestation efforts will also help in the recovery of the critically endangered Balochistan Black Bear.	Major beneficial
Negative Impacts						
Enhanced/ induced use of fertilizers and pesticides due to increased cultivation.	O & M	High	Moderate	Major adverse	• An Integrated Pest Management (IPM) plan is being prepared as part of the EMP and will be implemented during project operation stage. • Disseminate information regarding sustainable use of fertilizers and insecticides to keep the use at an optimal level. • A comprehensive education and awareness programme on sustainable fertilizer use is planned under On Farm Water Management component. • Development of a biodiversity database; community-based sustainable use programmes; developing and strengthening the protected areas system; developing a policy for ex-situ conservation of biodiversity; developing an effective policy framework and enabling legislation; and developing institutional capacity to manage biodiversity.	Minimal
High Residual Sodium Carbonate levels in river water can cause crusting of seed beds, temporary saturation of the surface soil, high pH and the increased potential for diseases, weeds, soil erosion, lack	O & M	High	Major	Major adverse	• Farmers will be educated on best practices to solve the RSC problem, which will include some of the following: – Injection of sulfuric acid to dissociate the bicarbonate ions (PH around 6.2) giving off carbon dioxide. It allows the calcium and magnesium to stay in solution in relation with the sodium content.	Minimal

Impact from various activities	Phase	Sensitivity	Magnitude	Significance Prior to Mitigation	Mitigation and Enhancement Measure	Residual Significance
of oxygen and inadequate nutrient availability.					– Add gypsum when soils have low free calcium plus leaching. – Add sulfur to soils with high lime content plus leaching	
Land conversion due to improved irrigation and agricultural potential.	O & M	Medium	Minor	Minor adverse	• Schemes are designed in such a way to include cultivable land only, without affecting land of ecological significance.	Minimal
Forest land conversion, degradation by increased overgrazing, firewood collection, etc.	O & M	Medium	Minor	Minor adverse	• Rangeland and Watershed Management plan will ensure that no forest land is converted to cropland. In addition, the project will include more sustainable watershed agriculture especially livestock farming (increased livestock productivity and production due to increased production of fodder and improved rangeland management).	Minimal
Impacts on Downstream, mangrove forest and wetland						
Diversion will alter the natural flow rates and hydro period, degrade bankline and riparian habitats, and alter aquatic community structure and diversity in downstream areas. This may have a negative effect on the ecosystems in the Miani Hor	O & M	High	Major	Major adverse	• At the feasibility level, Porali and Nari flows are not assessed to be negatively impacted by the project in terms of their vitality for Miani Hor and Hamal Lake. • Assessments show that the minimum environmental flow required for Nari and Porali Rivers are 0.082 BCM and 0.111 BCM[6] and that after diversion and consumption, 1.005 BCM and 0.582 BCM water will be released downstream, which is 12 times and 5 times more than the minimum requirement, of these rivers.	Minor adverse
Pesticide residue in water bodies	O & M	High	Minor	Moderate adverse	• Based on secondary information organochlorine pesticide residue in water is low but high in sediments in Miani Hor. • Monitoring of organochlorine pesticide residue is recommended to establish the baseline during the early stage of project implementation and follow-up monitoring to compare with the baseline. • The concentrations of DDT, HCH, Aldrin, Dieldrin, Endrin and Heptachlor in marine biota of Miani Hor are very low than the limit of Carcinogenicity from fish consumption as set by United States Environmental Protection Agency.	Minimal
Limited sediment discharge in Maini Hor	O & M	Medium	Minor	Minor adverse	• Porali is a seasonal river that drains only when there is rain in its catchment area so very seldom it makes any impact on the water quality of Miani Hor.[7] • Sediment will be evenly distributed both in project schemes and downstream stretches.	Minimal

[6] ADB TA 4560-PAK (2008); Supporting Implementation of IWRM Policy in Balochistan, Asian Development Bank, the Philippines.
[7] Syed, N. A. et. Al (2014); A Study of the Dynamics of Miani Hor Coastal Lagoon, Pakistan and Failure of Damb Fish Harbour, International Journal of Science and Technology Volume 3 No. 8.

6.4 Environmental and Social Impacts of the Project

Major and important moderate adverse impacts are discussed in more detail below. It is expected that minor and many moderate adverse impacts will be addressed through the implementation of Environmental Code of Practices (ECP) by the contractor.

6.5 Environmental and Social Impacts during Pre-construction Stage

During the public consultations, local people raised concerns regarding the design of the project, site selection and possible consequences. These concerns along with other impacts were addressed in the pre-construction assessment and are discussed in more detail below.

6.5.1 Land Acquisition

About four acres of land are expected to be required on temporary basis for the contractor's camp. This impact has been assessed as Major adverse, as shown in Table 6-4.

Mitigation

- Only government land to be used; no private or community land to be used.
- In extreme case, where private land acquisition is unavoidable, it will be done under the guidelines given in Social Impact Assessment Management Plan (SIAMP) and Proper compensation to the affected households will be provided.
- All temporary used sites will be properly decommissioned after completion of construction works before handing over to the owner.

6.5.2 Impacts on Ecology, Soil and Land

The Nari and Porali River Basins have a wide variety of biodiversity variations in physical features and the climatic conditions have produced diverse landscapes, ecosystems and habitats that are important to the national and global heritage. The basins also face a wide range of environmental and resource degradation problems. The major problems are depletion of aquifers, loss of vegetation in watersheds and rangelands, destruction of wildlife habitats, and depletion of wild flora and fauna. Improper Sub-basin / Watershed and Scheme site location may lead to:

- Erosion and loss of useful agricultural land
- Removal of vegetation and cutting of trees
- Deforestation in the sub-basins

These impacts have been assessed as Major adverse, as shown in Table 6-4.

Mitigation

- Appropriate site selection and designing according to the national and WBG guidelines in order to entail no or minimal disturbance to local ecology, soil, and land.
- Schemes located in ecologically sensitive areas were not included, in order to avoid impact on flora /fauna.
- Plantation / forest conservation/ rangeland management are considered during the design phase.

6.5.3 Impacts on Surface Water

Balochistan is divided into 18 river basins. The main water sources for irrigation are surface water from irrigation system, flood flows and perennial base flows in rivers, subsurface flow through river gravels, springs and groundwater through tube wells. Watershed / scheme site interventions and improper design considerations may:

- Stress local natural stream flow and cause surface water quality degradation and contamination of water resources and affect downstream ecology.
- Inadequate maintenance of minimum flows may degrade downstream ecology.
- Excessive diversion of surface water resources may lead to depletion of natural surface water resources in the area.

These impacts have been assessed as Major adverse, as shown in Table 6-4.

Mitigation

- During design stage, watershed hydrological modelling was conducted to identify the scheme location considering the natural drainage and surface water quality.
- Design has also considered flow regulatory structures / schemes and minimum flow requirements.
- Provision has made for proper water utilization rates under schemes so that water resources are not depleted.

6.5.4 Impacts on Ground Water

Balochistan is an arid country, where in most of the districts, a lot of water for agriculture crop production and drinking purposes is withdraw from ground water sources. Due to degradation of Rangeland and erosion the Porali and Nari River basins have lost considerable ability to re-charge groundwater. Improper assessment of sub-surface ground water levels prior to design for Non- perennial schemes may lead to depletion of ground water resources. Improper design considerations for irrigation schemes may lead to degradation of sub-surface ground water quality and contamination. These impacts have been assessed as Major adverse, as shown in Table 6-4.

Mitigation

- Extensive ground water table studies have been carried out during feasibility stage.
- Schemes have been designed according to ground water recharge/ pumping regulations.
- Regulatory measures for pesticide contamination/ sewage disposal to be followed.

6.6 Social Impacts during Construction Stage

6.6.1 Generation of employment in the project area

The project will employ unskilled and skilled construction workers. . Contractors are encouraged to employ local workers and technicians to the extent possible. Employing local people will also diffuse the conflicts between migrant workers and local community and also prevent possible spread of HIV/AIDS infection due to the migrant workers. All these new opportunities for work for local residents will boost employment and improve the social and economic position of the population. This impact has been assessed as Moderate beneficial, as shown in Table 6-4. Populations in project areas will be notified of these opportunities during the early stage of project implementation.

6.6.2 Increased economic activity in the project area

The influx of workforce will stimulate the local economy. There will be a higher demand for locally produced food, goods and services benefiting local farmers and small businesses, such as hotels, shops, fruit sellers, tea cabins, and poultry stalls. This impact has been assessed as Moderate Beneficial, as shown in Table 6-4.

6.6.3 Temporary Land acquisition by the contractor

No private land is required on permanent basis for project interventions. Only government land will be used for the project. In extreme case where private land acquisition is unavoidable, it will be done under the guidelines given in SIAMP and proper compensation to the affected households will be provided. This impact has been assessed as Moderate adverse, as shown in Table 6-4.

6.6.4 Safety hazards for children and elderly people due to increased traffic

The construction activities can potentially impact the residents of nearby villages, particularly the movement and safety of school children. The increased use of trucks and other vehicles on local roads may increase risk of traffic accidents on pedestrians, particularly elderly people and children. This impact has been assessed as Moderate adverse, as shown in Table 6-4.

Mitigation

- Contractor will develop a traffic management plan in compliance with ECP on traffic management
- The Traffic Management Plan will be implemented with aim at ensuring access to residential areas, and preventing unsafe situations, especially near schools, housing areas, construction areas, camps and office.
- Ensure that all construction vehicles observe speed limits on the construction sites and on public roads
- Provide adequate signage, barriers, and flag persons for traffic control.
- Fit audible warning devices in vehicles to alert during reversing

6.6.5 Increased risk of accidents for workers

Most of the construction activities will be carried on land and in River, the Contractors and project management will pay close attention to the increased risk of accidents, unsafe working conditions and health risks. Construction workers will be in risk if there is no proper safety protocols in place Construction activities also pose safety hazards for the site staff. This impact has been assessed as Moderate adverse, as shown in Table 6-4.

Mitigation

- Occupational health and safety procedures will be enforced at site. Each contractor will be required to prepare, obtain approval of, and implement an occupational health and safety (OHS) plan. These plans will be prepared in compliance with the ECP 18: Workers Health and Safety and World Bank Group's Environment, Health, and Safety (EHS) Guidelines.
- In-stream construction workers will be adequately trained and provided with proper personal protection equipment (PPE) before putting them in to work. Frequent supervision will be carried out by supervision consultants to ensure they are wearing proper PPE at all times.
- Contractor OHS plan describe the tasks and methods to be used by workers associated with water borne construction and diving operation, and how to perform them safely and state how potential hazards are identified and handled. Contractor will ensure that the construction workers associated with these works are adequately informed about the OHS plan. Emergency response mechanism will be put in place to rescue workers from drowning and providing immediate treatment to the injured workers
- Contractor will train the workers of water borne construction to deal with safety.
- Special attention will be focused on safety training for workers to prevent and restrict accidents and on the knowledge how to deal with emergencies.
- Road signage will be fixed at appropriate locations to reduce safety hazard associated with project-related vehicular traffic.

- Vehicle speeds near / within the communities will be kept low, to avoid safety hazards.
- The communication strategy complements awareness raising and information dissemination.

With the implementation of above mitigation measures, the residual impact on workers' health and safety has been assessed as minimal.

6.6.6 Security Risks for Workers

Due to tribal feuds, terrorism, insurgents and other issues, there may be a security risk for construction staffs and workers, especially in southern Balochistan (Porali River basin area). Also, if not properly managed, conflicts arising as a result of community disturbance and/or in-migration may escalate into violence, led by criminal elements. The impact has been assessed as Moderate adverse, as shown in Table 6-4.

Mitigation

- Continued consultations with the tribal leaders and local community leaders on security matters.
- Provide security at the work sites and camps.
- Ensure identification cards to all staffs and workers.
- Implement ECP 19: Construction and Operation Phase Security
- Preparation and implementation of the contractor's Communication plan. This plan shall focus on early and continued consultation by the contractor with influential figures within the project area,
- The Communication plan shall also include plan for ongoing consultation in local languages within project affected communities. As for the landlord consultations, the aim of these meetings will be to raise awareness amongst the local community of upcoming activities, and for community members to feedback any concerns or suggestions.
- All contractors' staff shall be required to carry identification cards issued by the Contractor which clearly state the staff member's identification details and affiliation with the contractor and the project. Cards shall also be issued to all sub-contracted staff and the Consultant's staff active in the project area. The issue of identity cards shall be strictly controlled by the contractor, and following termination/completion of staff contract the identity card shall be destroyed.
- Access to the camps must be controlled through gated entrances and entrance and exit logs shall be maintained at each gate. Access shall be restricted to project staff holding valid identity cards only.
- Assessing the situation and if required, the contractor will engage his own security companies, the contractor shall be responsible to ensure such companies or personnel do not have a history of past abuse and that personnel are trained in the use of force and in the applicable laws so that no contravention of national legislation takes place.
- The contractor shall provide training to security personnel using the guiding principle that force shall not be used except in defense and in proportion with the nature and extent of the threat.
- Finally, the contractor's emergency response plan shall be required to include details of emergency evacuation of the camp site in the event of an emergency and be supplemented by annual drills.

With the implementation of above mitigation measures, the residual impact has on workers security has been assessed as minimal.

6.6.7 Security risks, theft, and vandalism for construction workers and materials

Inadequate construction site security poses a significant risk to assets, construction materials and property. Theft/vandalism of assets, materials and property would increase construction costs and cause delays in project completion. The impact has been assessed as Moderate adverse, as shown in Table 6-4.

Mitigation measures are:

- Provide security at the work sites and camps. Employ night watchman for periods of significant on-site storage or when the area necessitates.
- Ensure there is proper fencing around construction site perimeter, chain-link at least 2.4 m high and secured with a steel chain and lock.
- Employ appropriate security personnel at job sites. Pre-employment screening investigations should be used to verify the applicants relating to their employment, education and criminal history background.
- Implement ECP 19: Construction and Operation Phase Security
- Maintain register to keep track of number of persons present in the camp at any given time.
- Ensure job sites are properly lighted at night.

With the implementation of above mitigation measures, the residual impact has on security risks, theft, and vandalism for construction workers and materials has been assessed as minimal.

6.6.8 Possible cultural conflicts between communities and migrant workforce

There could be potential conflicts between the local community and the migrant workforce. Workers coming from other parts of Pakistan may have norms and values in social behavior and religion that differ from those of the resident population. The influx and accommodation of a large work force will result in increased concerns for the health and safety of local population. The impact has been assessed as Moderate Adverse, as shown in Table 6-4.

Mitigation

- This situation will be addressed by an awareness campaign implemented in the beginning of the construction phase. The Contractors will be aware of the possibility and risks of miscommunications between local residents and workers, which easily could lead to conflicts. This will be prevented by raising awareness and implementing a Code of Conduct for the workers. The Contractor shall develop a Worker Code of Conduct to govern the behavior of workers on site, in camps, and in local communities.
- The contractor shall employ a Community Liaison Officer who shall be responsible for the preparation and implementation of a Communication Strategy. This strategy shall detail stakeholders, their information, disclosure, and consultation and participation requirements and shall aim to ensure relevant stakeholders are pre-warned of any activities on site which may result in their disturbance. The Communication Strategy will define a process for receiving, recording and responding to complaints and also monitoring of the success of any responsive action taken.
- In addition, complaints register shall be set up at the Contractor’s and Engineer’s offices to record any complaints received during the implementation of the works.
- Complementary measures are outlined in the Environmental Code of Practices presented in ECP 17 (Cultural and Religious Issues).

With the implementation of above mitigation measures, the residual impact has been assessed as minimal.

6.6.9 Risks of HIV/AIDS, STI and TB due to Outside Workers

There is a risk of the likelihood of spread of HIV/AIDS, STD/STI and TB infection and diseases through interaction between migrant workers and community women during project construction. This impact has been assessed as Moderate adverse as shown in Table 6-4.

Mitigation

- Awareness creation on HIV/AIDS infection and diseases through a well-designed campaign implementation plan targeting all risk-prone groups.
- The awareness campaign will be aimed at the risk of interaction between the resident population and the construction work force, including the spreading of sexually transmitted diseases such as HIV/AIDS
- Diagnose and treat STD/STI and TB through in-house medical facility constituted by the Contractor for workers' safety to be provided by the Contractor.
- Empowering women through employment in the construction work.
- Contractors will be encouraged to employ workers from the nearby communities so that they can be close proximity of their families and reduce the risk of mixing with other genders.

6.6.10 Interruption of Irrigation water due to Construction Works

Temporary interruption of irrigation water supply during construction works may affect water availability for crops in the command area of each Canal, thus reduce the income of these farmers which shall have a negative impact on the socio-economics of the impacted area. This impact has been assessed as Moderate adverse in Table 6-4.

Mitigation

- The contractor shall be prohibited from interrupting the water supply to any canal or reducing it below the allocated discharge of these canals by providing diversion canals on the section where work is planned on priority basis.
- The Contractor shall program the works to utilize the low water demand periods in the command area.
- The Contractor shall submit a construction schedule to the Engineer/PSIA Consultant for approval on mobilization. If in case, the closure of water supply is unavoidable, the Contractor needs to share his plan with the farmers and get their consensus.

6.7 Environmental Impacts during Construction Stage

6.7.1 Emissions of Dust and Air Pollution

Air pollution may be caused by emissions from construction related traffic and machinery. Dust will be generated from earth works at access road, excavation and construction works for guide walls, and river bank protection. This impact is characterized as Moderate adverse, as given in Table 6-4.

Mitigation

- Special care must be taken to inspect carefully whether all construction vehicles are properly maintained and correctly operated (including the use of dust filters or hoods).
- Water the soil surface and any non-asphalted roads, especially in the dry season.
- Water the soil before starting excavating.
- The storage and handling of spoil, subsoil, topsoil and materials should be carefully managed to minimize the risk of wind-blown material and dust.
- Cover hauling vehicles carrying dusty materials moving outside the construction site.
- Burning of any waste on site is prohibited.

- Fit vehicles with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition.
- Limit the idling time of vehicles not more than 2 minutes.
- Regular and proper maintenance of vehicles and machinery.
- Implement ECP 10: Air Quality Management.

6.7.2 Clearing of Natural Vegetation and Trees in Project Area

There are sizeable number of trees observed along the irrigation canals of Nari Gorge, Yetabad, Gundacha, Nimmi, and Jamot canals. Around 1,385 trees were recorded along the length of existing canals within the RoW of Porali River Basin schemes. In Nari River Basin, around 47,350 small bush like trees were observed along the alignment of the main and branch canals of the proposed irrigation schemes. Some of the trees may be cut/ uprooted during the construction phase. This impact is characterized as Moderate adverse as given in Table 6-4.

Mitigation

Following mitigation measures will be adopted to compensate the loss of vegetation and mitigate impacts associated with clearance of vegetation

- Vegetation clearance shall be limited to the extent required for execution of works.
- Avoid cutting down of tree species of conservation significance and those that are protected, even those that act as nesting and breeding sites.
- Care will be taken to make sure bird habitats are not destroyed. If there is no option available, rehabilitate them in other neighboring trees. Also protect and rehabilitate injured or orphaned birds.
- Tree planation will be carried out in the canal alignments and other areas near the river training works at a ratio of 5 new trees per each tree cut.
- Plantation will be developed only with indigenous species.
- Restrict developments of contractor’s workspace in critical habitats.
- Maintain buffer zones of plants and trees on river banks
- Include environmental management and awareness as part of training for employees during construction
- Contractor will follow ECPs 12 and 13 on Protection of Flora and Fauna while tree cutting

With the above mitigation measures, the adverse impacts tree cutting has been assessed as minimal.

6.7.3 Impact of Earthworks and Excavation

Earthworks will impact the fertile top soils that are enriched with nutrients required for plant growth or agricultural development. Excavation works will impact on the loss of habitats especially the terrestrial invertebrates that live in the ground. These impacts have been listed as Moderate adverse in Table 6-4.

Mitigation

- Strip the top soil to a depth of 35 cm and store in stock piles of height not exceeding 2m.
- Remove unwanted materials from top soil like grass, roots of trees and others.
- Spread the topsoil to maintain the physico-chemical and biological activity of the soil. The stored top soil will be utilized for covering all disturbed area and along the proposed plantation sites.
- Implement ECP 7: Top Soil Management
- Avoid construction during the rainy season
- Minimize digging of trenches and vegetation clearance to minimum required level.

6.7.4 Noise from Construction Equipment, Piling and Vehicles

Noise and vibration will be generated by piling activities, blasting, earth and excavation works, headworks of pier, guide walls, river bank protection, machinery, concrete mixing, and traffic from trucks and vehicles. This impact is characterized as Major Adverse, as given in Table 6-4.

Mitigation

- Noise and vibration awareness training for all construction workers including subcontractors as part of general site induction;
- Restrict construction and operation of heavy machines to daylight (8AM to 6PM);
- Ensure that noise level in all nature sanctuary sections of the watermain is kept 55 dBA during construction;
- Ensure noise emissions are kept within the World Bank standards;
- Inform local communities on the construction schedule in advance, especially blasting operation;
- All vehicles and construction machinery shall have an efficient muffler design in accordance with the manufacturer's specifications. This also includes high noise generating handhelds like power drills, saws, nail guns etc. The mufflers shall be well maintained and regularly tested with the results documented in the maintenance logs.
- Regular and effective equipment maintenance in order to ensure all machinery is in good working order and use does not generate excess noise/vibration.
- Implement ECP 11: Noise and Vibration Management

With the implementation of above mitigation measures, the residual impact on noise and air pollution has been assessed as minimal.

6.7.5 Risk from Increased Traffic

Increased Traffic (I.e. trucks, transport vehicles, construction machinery) on local roads will affect access to the trading center and, houses close to the road, deteriorate safety (especially the school children), spillage of fuels and chemicals, and damage to infrastructures and properties due to vibration. This impact has been characterized as Moderate adverse in Table 6-4.

Mitigation

- Include in the contractor's traffic management plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges, temporary diversions, necessary barricades, warning signs / lights, road signs, construction schedule etc.
- Provide signs at strategic locations of the roads complying with the schedules of signs contained in the National Traffic Regulations.
- Restrict truck deliveries, where practicable, to day time working hours.
- Restrict the transport of oversize loads.
- Operate vehicles, if possible, to non-peak periods to minimize traffic disruptions.
- Enforce on-site speed limit, especially close to the sensitive receptors, schools, health centers, etc.
- Implement ECP 15: Road Transport and Road Traffic Management
- Inspect structures within the close proximity of construction site and ensure that all affected persons are evacuated from the property before construction commences.

6.7.6 Potential risk of soil and water pollution

During construction there is a high risk of accidental spills and leakages from fuel and oil tanks, vehicles, machinery and stored chemicals that are used in construction areas, yards, batching plants, worker camps, and storage sites. These spills can pollute soils and contaminate surface and groundwater in the area. This impact is characterized as Moderate adverse, as given in Table 6-4.

Mitigation

The following mitigation measures will be implemented:

- Contractor will prepare and implement a Pollution Prevention Plan prior to the start of the work.
- Contractor will be required to implement the measures prescribed in the Environmental Code of Practices (ECP), which will be included in the contracts.
- Contractor will be required to take appropriate measures to avoid and contain any spillage and pollution of the soil and water resources both upstream and downstream.
- Periodic monitoring will be carried out by the Contractor and MEC.
- Implement ECP 2: Fuels and Hazardous Goods Management
- Contractor to confine the contaminants immediately after such accidental spillage
- Contractor to collect contaminated soils, treat and dispose them in environment friendly manner
- All areas intended for storage of hazardous materials to be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation

With the implementation of above mitigation measures, the residual impact on risk of soil and water pollution has been assessed as minimal.

6.7.7 Risk of pollution from spoils, solid waste and waste effluents

Excavation and earthwork will generate substantial quantity of soil, gravels, and spoil. Further construction works also generate large quantities of excess materials from construction sites (concrete, discarded material) and wastes from workers camp and construction yards, including garbage, recyclable waste, food waste, and other debris. In addition, small quantities of hazardous waste will be generated from maintenance activities, including contaminated soil, oil filters and other waste products. These impacts are characterized as Moderate adverse, as given in Table 6-4.

Mitigation

- Contractor will prepare and implement earth materials, solid waste collection, and disposal plan.
- Daily collection of solid waste from the Camps.
- The contractor will identify suitable sites for disposal of hazardous and non- hazardous waste. The selection will be done in consultation with local authorities.
- Protocols and measures prescribed in the ECP 1 Waste Management and ECP 2 Fuels and Hazardous Goods Management will be implemented.
- Contractor to develop and undertake construction waste management strategy for both hazardous and non-hazardous wastes separately.
- Siting of any fuel and hazardous material storage sites, including refueling facilities, batching plants and construction yards are to be located outside the flood embankments and at least 500 m away from any residential areas.
- Hazardous waste will be disposed of by designated contractors.

- With the implementation of above mitigation measures, the residual impact on solid waste has been assessed as minimal.

6.7.8 Impact from borrow and quarry activities

Construction of diversion weir, flood protection, and river training works will require stone, aggregates and earth fill. Improper siting and extraction of these construction materials will have significant impacts on physical and biological environment on the quarry and borrow areas. This impact is characterized as Moderate adverse as given in Table 6-4.

Mitigation

The following mitigation measures will be implemented:

- The contractor shall use the government approved quarry sites for procurement of stones and aggregates. Contractor will obtain necessary government permits before procurement of this material.
- Earth fill material will be excavated during low flow season when these areas are dry.
- No private lands or agriculture lands will be used for borrowing.
- The borrow areas will be approved by relevant authorities.
- The contractor will prepare borrow area management and restoration plan for approval.
- Minimize volume of borrow material by reusing material excavated elsewhere in the project
- Borrow/quarry areas will be developed close to the project area for extraction of earth material and aggregates for river protection works.
- Implement ECP 9: Quarry Areas Development and Management.

With the implementation of above mitigation measures, the residual impact on borrow sites has been assessed as minimal.

6.7.9 Impact on faunal habitats and resident and migratory birds

The Demoiselle and Eurasian cranes migrate from Afghanistan to India and cross Zoab River and Loralai area. It is estimated that more than 40,000 demoiselle Cranes pass through NRB. The Saker falcon is another migratory bird in winter season in Loralai and Khost sub-basins. The Hubara Bustard is also listed as threatened and is found in the project areas. Loss of faunal habitat at locations of construction works, camp, staff quarters and on access/haul routes due to the felling of trees can lead to loss of critical habitats for resident and migratory birds and habitats for species that are of conservation significance. Agricultural lands and ponds act as wintering grounds for many migratory birds, and habitat for many resident birds. However, due to the vast habitat range of the birds and the fact the birds are not confined to a particular location, the project is not expected to have any lasting impact on the birds. If any construction activities disturb their roosting, hunting and feeding grounds, they move to another lesser or undisturbed areas without any difficulty. The presence of avifauna in the project area will increase during the winter months, with the arrival of migratory birds. This impact of the project on overall avifauna is characterized as Major adverse as given in Table 6-4.

Mitigations

- Minimize construction in the critical habitats of birds.
- The Contractor will introduce and enforce a Code of Conduct and raise awareness about the protection of birds among the work force to reduce impacts such as disturbance and poaching.
- Care should be taken to make sure bird nests are not destroyed. If there is no option available, rehabilitate them in other neighboring trees. Also protect and rehabilitate injured or orphaned birds.

- Bird surveys will be carried out before vegetation removal for protection of nests.
- Contractor will be required to recruit a qualified ecologist to implement the mitigation measures and monitor the impacts on birds
- Contractor will Implement ECP 13 Protection of Flora, Fauna, and Fisheries by banning hunting, poaching, fishing and trapping of all fauna by all project personnel.
- Use of existing access road and limit the width of new access roads.

With the implementation of above mitigation measures, the residual impact on birds has been assessed as minimal.

6.7.10 Impact on Balochistan Black Bear

The Balochistan black bear is found in the higher ranges of the province of Balochistan in Southwest Pakistan and Southeast Iran. Its greatest stronghold is in the hills south of Khuzdar. It is also found in Takht-e-Suliman, Toba Kakar, Ziarat, and Kalat. The Balochistan Black bear is currently confined to the arid sub-tropical thorn forest of the Khuzdar hills (WWF Pakistan, 2015). The main threats to the Balochistan Black bear are habitat loss due to expansion of human settlements and development projects; retaliatory killing by herders and poaching for bear pelts. Deforestation due to construction activities and loss of habitat may affect the Balochistan black bear, which is listed as a critically endangered species. The impact on the Balochistan Black bear is characterized as Critical adverse Table 6-4.

Mitigations

- Tree clearance shall be limited to the extent required for execution of works.
- Contractor will follow ECPs 12: Protection of Flora while tree cutting
- Implement ECP 13 Protection of Fauna for species with conservation significance
- Include environmental management and awareness as part of training for employees during construction works.

With the implementation of above mitigation measures, the residual impact on the bear has been assessed as minimal.

6.7.11 Impact on River Habitats

In the Nari River Basin in the upstream of Nari Gorge area near Sibi, Marsh Crocodile (*Crocodilus palustris*) is found in the lagoons. Impact on river habitats (i.e. breeding and nesting sites) from construction activities for flood protection and river training works may require clearance of riverine vegetation. This impact is characterized as Moderate adverse in Table 6-4.

Mitigation

- Control of sediment flow from the construction activities
- Silt curtains along river training works to control sediment runoff.
- Minimize and restrict clearing of riverine vegetation as much as possible.
- Implement ECP 13 Protection of Fauna for species with conservation significance especially endangered and near threatened.
- Project activities are mostly confined to the diversion of flood water or diversion sub-surface water through Perennial Irrigation Schemes, so are not expected to affect the fish species and marsh crocodile which mostly reside in lagoon areas.

With the above mitigation measures, the adverse impacts with risk of water pollution have been assessed as minimal.

6.8 Social Impacts during Operation & Maintenance Stage

6.8.1 Access to irrigation water, farming capacity and technology, flood protection, potable water supply, watershed and rangeland management, and environmental protection

Balochistan is Pakistan's least developed province and an estimated 47 percent of people live below the official poverty line. Agriculture (crops and livestock) is the basis of the Balochistan economy, contributing 60 percent of the GDP and 67 percent of labor. Overall, the project components: (i) Irrigation Schemes, (ii) Potable Water, (iii) Flood Protection and (iv) Watershed and Rangeland Management will have a net positive impact on the farming households and people in the area. Total number of beneficiaries from all schemes is expected to total 705,579 people (about 86,549 households). A large population will benefit indirectly from the project, including landless farm laborers and temporary and permanent laborers in the construction and manufacturing sectors. The Project will also strengthen local private sector service providers (for land improvement) and input suppliers. This impact is characterized as Major adverse prior to mitigation and its residual significance after implementation is deemed extremely beneficial as given in Table 6-4.

6.8.2 Access to Improved Irrigation System and Improved Water Use Practices

Currently the area has an inadequate and underdeveloped irrigation system which severely limits crop production and livestock potential. In total, eight (8) irrigation schemes will be implemented, four (4) each in the Nari and Porali basins, spanning ~128,000 ha. Implementation of irrigation schemes will lead to Improvements in the irrigation system and improved water use practices will lead to a considerable increase in cultivatable land, thus increase crop production and improve income and livelihoods of farmers. The implementation of project will result in increased crop production, resulted by increase in cropping intensity from 2% to 100% and improvement in yield /acre. Productivity of crops is expected to double after project implementation. After project implementation, in the Porali River basin, total crop production is expected to increase from 184,235 tons to 450,627 tons (an increase of 266, 392 tons). In total, the irrigation sub-projects and on-farm water management practices are expected to benefit 544,490 people (68, 061 households). It is expected that by 2021, 77,000 ha of additional land will be under improved irrigation. This impact is characterized as Major adverse prior to mitigation and its residual significance after implementation is considered extremely beneficial as given in Table 6-4.

6.8.3 Damage of Command Areas by Flood Waters

Severe floods in 2007, 2010 and 2011 led to loss of life and destruction of settlements and irrigation infrastructure, significantly reducing the agricultural production base. The implementation of the flood works will improve the lives of people, protect agricultural areas and the livelihoods of people. These interventions will also reduce the likelihood of flooding to the command area as well as the devastating damage and the economic burden associated with recovery following these floods. Flood protection works are expected to directly benefit 81,760 people (10, 220 households) and protect 14, 557 ha of land. The estimated avoided damages/per year due to flood protection works are in USD $753,882, $462,271, $124,720 and $1,340,873 for infrastructure, livestock production, crop production, respectively. Erosion protection to the flood embankments on both sides of the river is also proposed to ensure the longevity of these defenses. Construction of flood water diversion structure would play a pivotal role in increasing the income of households at farm level. This will help in increasing the area under cultivation along with cultivation of improved varieties. Flood water diversion schemes in the province would definitely help in improving the family nutrition through availability of better and nutritious food and thus contribute to better health of households. This impact is characterized as Major adverse prior to mitigation and after implementation is deemed extremely beneficial as given in Table 6-4.

6.8.4 Loss of Opportunities for Women and Social Uplift

Without the project case, there would be a loss of opportunities for women. The Project will enhance opportunities for women to participate in profitable agriculture, by tailoring interventions to their specific needs and by promoting gender equity in rural communities. It is expected that 352,789 women will benefit directly from implementation of Irrigation Schemes, Potable Water, Flood Protection and Watershed and Rangeland Management. This impact is characterized as Major adverse prior to mitigation and its residual significance after implementation is considered Major beneficial as shown in Table 6-4.

6.8.5 Water Supply and Waterborne Disease in Project Area

Currently, less than 15% of the population of Balochistan has access to safe drinking water. The Project will provide consistent and regular water supply for households and livestock. In total, 16 potable water supply schemes will be implemented in 16 villages. Potable water supply sub-projects are expected to directly benefit 29,220 people (3, 653 households). Lifestyle in surrounding areas will be improved by ensuring sustained supply of potable water. Improvement in sanitation and reduction in water borne diseases are expected in the project area. Sustained water supply will contribute significantly on reduction to households spending on water borne diseases. Also there will be improvement in livestock quantity and composition due to the consistent availability of water, resulting economic income and food security of people. This impact is given as Major adverse prior to mitigation and its residual significance after implementation is considered extremely beneficial as shown in Table 6-4.

6.8.6 Loss of Nutrient Rich Sediments for Crop Production

Diversion schemes are designed to distribute nutrient rich sediments in the command area, which will work positively for cropland and increase crop production, without discharging them to the downstream water flow. This impact is given as Moderate adverse prior to mitigation and its residual significance after implementation is considered Moderate beneficial as shown in Table 6-4.

6.8.7 Social Impacts due to Watershed and Rangeland Management Plan

Rangeland degradation is occurring as a result of over grazing, removal of vegetation for fuel wood and no clear authority of rangeland ownership. Watershed and Rangeland Management will have a positive impact on the surrounding communities. About 280,161 people (32, 960 households) are expected to benefit from the implementation of the Watershed & rangeland Management plan practices. Watershed management activities will be undertaken in both Project river basins, including soil and water conservation measures, rainwater harvesting and plantations. The impacts are characterized as Major adverse before mitigation and after implementation they are deemed extremely beneficial as shown in Table 6-4. Rangeland Management will further provide the following enhancements for surrounding communities:

- Production of fuel wood for use by low income households
- Will create local jobs for harvesting timber and non-timber products
- Improvement in livestock (quantity and composition) due to more consistent food stock availability for grazing animals.
- Further develop livestock potential of the area through management of pasture lands.

6.8.8 Social Impacts on downstream and protected areas (Alteration of Ecological Flows)

Alteration of Ecological flows of the Porali River may have an effect on the fish and shrimp in Miani Hor and thus impact livelihoods of people which depend on these resources. The Porali River and its tributaries drain into the Miani Hor. Miani Hor serves as a natural fish and shrimp hatchery and thus supports fishing in the area and is therefore providing livelihood sources to the fishermen communities of Dam, Bhira, Sonmiani, Baloch Goth and other seasonal migrants from country. It provides livelihood to a coastal population of more than 100,000 people. This impact on the downstream flow is characterized as Major adverse Table 6-4.

Mitigation

- Environmental flow assessments are determined to maintain the hydrological regimes and provide protection of river flows and ecosystem characteristics.
- The entire scheme of analysis is developed on the baseline geospatial datasets and incorporating the basins water management evaluation approach (WEAP) and analyzed for Porali river basin.
- Assessments show that the minimum environmental flow required for Porali River is 0.111 BCM and that after diversion and consumption 0.582 BCM water will be released downstream, which is 5 times more than the minimum requirement, thus there should be no negative impact.

6.8.9 Social Impacts on Downstream/Protected Areas due to increased use of Pesticides & Fertilizers

The project will result in an increase in cultivated land, thus there will be an increase in the use of pesticides and fertilizers which may have a negative effect on fisheries and shrimp production in downstream areas, especially in the Miani Hor. In the Miani Hor, many surrounding communities depend on fish and shrimp production for their livelihoods. This impact is characterized as moderate adverse, as given in Table 6-4.

Mitigation

- Disseminate information regarding sustainable use of fertilizers and insecticides to keep the use at an optimal level.
- A comprehensive education and awareness programme for farmers; development of a biodiversity database; community-based sustainable use programmes.
- The EMP includes an Integrated Pest Management.

6.9 Environmental Impacts during Operation & Maintenance Stage

6.9.1 Ground Water Recharge

Due to the degradation of groundwater table, the principal watersheds have almost lost their capacity for intercepting rainfall and ground water recharge. Also, currently ground water provides a significant percentage of the irrigation water for crops in the areas. After project implementation there will be a reduced burden on ground water since there will be a reduced area under tube-well irrigation. Also improved watershed and rangeland management technologies will improve soil moisture retention, reducing erosion, and improving groundwater recharge. This impact is characterized as Major adverse prior to mitigation and after implementation is deemed major beneficial as given in Table 6-4.

6.9.2 River Morphology and Flood Protection

After Project implementation the regulated hydrology regime will be more beneficial for the overall ecosystem health, even with reduced total quantity of water, than the current erratic regime. Flood water diversion schemes will bring very positive impact on the environment through increased fodder and agriculture crop production, which will take off pressure from the rangelands of the area in terms of provision of fodder and fuelwood. Flood water diversion scheme will also help in increasing the productivity of ecosystems and will therefore attract more faunal species in the area. This will help in maintaining and increasing the biodiversity in the project/scheme area. This impact is characterized as major adverse prior to mitigation and after implementation of the mitigation measures is considered to be major beneficial as given in Table 6-4.

6.9.3 Impacts due to Watershed and Rangeland Management Plan (Highland Pastures and Biomass)

Rangeland degradation is occurring as a result of no grazing management plans, removal of vegetation for fuel wood and no clear authority of rangeland ownership. The implementation of the Watershed and Rangeland management will prevent grazing on degraded land and protect areas with good natural regeneration potential. Also, grazing management plans based on carrying capacities, and construction of watering ponds for livestock will be introduced. Planting of palatable shrubs and trees and reseeding of grass as well as introduction of stall feeding based on fodder production. Rotational grazing and stocking rate limits will be introduced. Rotationally controlled grazing will lead to less degradation of land, provide a chance for vegetation to grow and also provide erosion control. At the irrigation scheme level, watershed management will include drainage improvement, soil and water conservation measures and rehabilitation/protection of irrigable land degraded/endangered by erosion gullies. This impact is characterized as Major adverse prior to mitigation and after implementation is considered to be Major beneficial as given in Table 6-4.

6.9.4 Soil Erosion

Cutting of trees, removal of range shrubs for fuel wood and over grazing have caused denudation of the watersheds. As a result, the principal watersheds have almost lost their capacity for intercepting the rainfall. River basin level activities will include soil and water conservation measures (e.g., hillside drains, contour trenches, rainwater harvesting in micro-catchments and plantations). Construction of water conservation and erosion control works (e.g., loose and pack stone check structures, groundwater recharge ponds, gabions, Kareze rehabilitation, streambed ponds, ditches etc.). Improved watershed and rangeland management technologies will be introduced to improve soil moisture retention, reducing erosion and improving groundwater recharge. By 2021, it is expected that 70,000 ha of land area with high erosion risk will be treated. This impact is characterized as Major adverse prior to mitigation and after implementation is considered to be Major beneficial as given in Table 6-4.

6.9.5 Destruction of Ecosystem and De-forestation

The Watershed and Rangeland Management plan will also include conservation of two important ecosystems in Balochistan, namely the Juniper forest in the catchment areas of Nari river basin and the Mangroves forest in the delta of Porali river basins. The plan will include enlargement and conservation of protected juniper and mangrove forests. Reforestation efforts will also help in the recovery of the critically endangered Balochistan Black Bear. Rangeland and Watershed Management Plan impacts are characterized as Major beneficial, as given in Table 6.4. This impact is characterized as Major adverse prior to mitigation and after implementation is deemed Major beneficial as given in Table 6-4.

6.9.6 Enhanced/ Induced use of Fertilizers and Pesticides

The project will result in an increase in cultivated land, thus there will be an increase in the use of pesticides and fertilizers which may have a negative effect on ecosystems and downstream areas. There will also a negative effect on downstream areas, especially the Miani Hor (Ramsar site) and Hamal Lake. This impact is characterized as Major Adverse, as given in Table 6-4.

Mitigation

- An Integrated Pest Management (IPM) plan is being prepared as part of the EMP and will be implemented during project operation stage.
- Disseminate information regarding sustainable use of fertilizers and insecticides to keep the use at an optimal level.
- A comprehensive education and awareness programme on sustainable fertilizer use.
- Development of a biodiversity database; community-based sustainable use programmes; developing and strengthening the protected areas system; developing a policy for ex-situ conservation of biodiversity; developing an effective policy framework and enabling legislation; and developing institutional capacity to manage biodiversity.

6.9.7 High Residual Sodium Carbonate Levels in River Water

In the Loralai Sub-basin and Sehan River at Makhtar, Residual Sodium Carbonate (RSC) levels measured to be 5.86 and 3.70 meq/l, respectively. A RSC > 1.25 meq/l[8] is considered inappropriate for irrigation purposes, since it can cause crusting of seed beds, temporary saturation of the surface soil, high pH and the increased potential for diseases, weeds, soil erosion, lack of oxygen and inadequate nutrient availability. This impact is characterized as Major Adverse, as given in Table 6-4.

Mitigation

- Farmers will be educated on best practices to solve the RSC problem, which will include some of the following:
  - Injection of sulfuric acid to dissociate the bicarbonate ions (PH around 6.2) giving off carbon dioxide. It allows the calcium and magnesium to stay in solution in relation with the sodium content.
  - Add gypsum when soils have low free calcium plus leaching.
  - Add sulfur to soils with high lime content plus leaching

With the above mitigation measures, the adverse impacts with risk of water pollution have been assessed as minimal.

6.9.8 Diversion will Alter the Natural Flow Regime

The Porali River and its tributaries drain into the Miani Hor, a subtropical lagoon lying on the coast of Lasbela district of Balochistan. The area supports mangrove forests and is a designated Ramsar site located downstream of the Porali River basin. Loop-root mangrove (*Rhizophora Mucronata*) and Ceriops Tagal are endangered species of Miani Hor. There is also a resident population of Indo-Pacific humpback dolphin (*Sousa Chinensis*) which is considered near threatened according to IUCN Red List. The Nari River drains into Hamal Lake and then into Manchor Lake, both of which are important wetland areas downstream of the NRB. Hamal Lake serves as a nursey for freshwater fish and is a stopover for many migratory birds such as geese, flamingos, egrets, ducks, coots, gulls, shorebirds, terns, herons, cormorants, ibises. Manchor Lake is also an important stopover for migratory birds. Alteration of ecological flows of the Porali and Nari River may have a significant effect on the ecology of the Miani Hor, Hamal Lake and

[8] National Surface Water Criteria & Irrigation Water Quality Guidelines for Pakistan. (2007). WWF

Manchor Lake, including less nutrient rich sediment reaching these areas. Diversion may alter the natural flow rates and hydro period, degrade bank line and riparian habitats, and alter aquatic community structure and diversity in downstream areas. This impact is characterized as Major Adverse, as given in Table 6-4.

Mitigation

- Environmental flow assessments are determined to maintain the hydrological regimes and provide protection of river flows and ecosystem characteristics.
- The entire scheme of analysis is developed on the baseline geospatial datasets and incorporating the basins water management evaluation approach (WEAP) and analyzed for Nari and Porali river basins.
- Nari and Porali river basins hydrological studies at sub-basin levels were conducted and a comprehensive assessment undertaken for the quantification of runoff and availability of surface and ground water is assessed. In addition, demand assessments and water consumptive usage is also assessed in terms of population, livestock and population.
- Assessments show that the minimum environmental flow required for Nari River is 0.082 BCM and that after diversion and consumption, 1.005 BCM water will be released downstream, which is more than 12 times the minimum requirement, thus there should be no negative impact.
- Assessments show that the minimum environmental flow required for Porali River is 0.111 BCM and that after diversion and consumption, 0.582 BCM water will be released downstream, which is more than 5 times the minimum requirement, thus there should be no negative impact.

6.9.9 Pesticide Residue in Water Bodies

Due to high use of pesticides for agricultural activities there may be a high pesticide residue in water bodies that may negatively affect fish and other aquatic wildlife. This impact is characterized as Moderate adverse, as given in Table 6-4.

Mitigation

- Based on secondary information, organochlorine pesticide residue in water is low but high in sediments in Miani Hor.
- The concentrations of DDT, HCH, Aldrin, Dieldrin, Endrin and Heptachlor in marine biota of Miani Hor are very low than the limit of Carcinogenicity from fish consumption as set by United States Environmental Protection Agency.
- Monitoring of organochlorine pesticide residue is recommended to establish the baseline during the early stage of project implementation and follow-up monitoring to compare with the baseline.

6.10 Climate Change Impacts and Risks

Climate change is expected to have a negative impact on both surface and groundwater resources in Balochistan. According to climate change predictions of Pakistan Meteorological Department, temperatures in high Balochistan are expected to increase to 0.12-0.6 °C by 2050 and 0.27-1.35 °C by the end of century. On the other hand, for lower Balochistan, the numbers are 0.04-2 °C by 2050 and 0.09-4.5 °C by the end of century. Climate change is also expected to increase extreme precipitation events in high Balochistan and decrease in lower Balochistan. As agriculture is directly dependent on the availability of water, this sector will be one of the first to suffer from climate change. It is predicted that any further decline in water availability would prove catastrophic for local people’s food security and incomes. Local agricultural practices provide little scope for adaptation. The scarce and the mangrove forests provide a variety of ecosystem goods and services. These forests will continue to experience huge pressures, including demand for fuelwood, and degradation unless immediate measures for their resilience are taken. It should be noted that forests play a large role in sequestering carbon, therefore mitigating climate change. The consumption of groundwater is likely to become unsustainable in the semi-arid regions of Balochistan. Already, aquifer drawdown in some areas of Balochistan is such that future reliance cannot be placed on this resource.

The Project schemes reviewed and analyzed with respect to their potential for emission of GHGs and consequent impact on global warming/climate change. The emission of GHGs from the Project is likely to be almost negligible as there shall be little change from the baseline GHG emissions to the operational stage of the project. There will be emission of GHGs from construction machinery and vehicles to be used during construction period. However, the proposed interventions of BIWRMD Project will not contribute to global climate change since construction activity will last only 5 to 6 years and thus will produce a negligible amount of GHGs. Future climate change is expected to increase the variability in rainfall, increase temperatures and most likely reduce water availability. Hence, improved water management is thus critical for the future economic and social development of Balochistan.

7 Cumulative Impact Assessment

7.1 Objective

The Government of Balochistan is planning the IWRMD Project which will transform the existing water management from a narrow irrigation project focus, to an integrated multi-sectoral river basin planning and development approach. It will achieve this through institutional restructuring and strengthening, investments in hydro-meteorological data and water information systems, and priority infrastructure investments in irrigation, potable water supply, flood protection, watershed and rangeland management, and environmental protection of Juniper forest in the north, Hamal Lake in southeast, and Miani mangrove forest in the south. If the impacts arising from the construction and operation of the proposed intervention are considered individually for each scheme, they are mostly construction related and temporary in nature, but these impacts may be significant and long term when evaluated in the context of the combined effects of all the existing water resources project, proposed intervention under the project, and planned and future water resources management project.

The objective of the current cumulative impact assessment (CIA) is to evaluate these combined effects of all interventions.

The main focus of the cumulative impacts of the water resources project will lead to the impacts on the availability of water in downstream stretches in terms of the release of environmental flows for the survival of aquatic habitats. The environmental flows of River Basins of Balochistan on the downstream ecosystem are already well documented and recommendations for these impacts are also available considering the current water usage. These are explained in Section 7.2.

The most significant valued environmental components (VECs) related to this project are identified in the TOR of the independent ESIA study and they are: surface water, aquatic habitat and fish, and biodiversity and forests, and are considered for the current CIA study. Significance of these VECs is described in Section 7.3.2.

7.2 Background

ADB TA 4560: Supporting Implementation of IWRM Policy in Balochistan: The purpose of the study was to assess minimum environmental flows for downstream ecosystems of river basins. The specific objectives of the study included estimation of water balance at the basin level and minimum environmental flows for downstream ecosystems. The estimation of minimum environmental flows for the river basins was based on the following:

- Total surface water generated within the river basin was multiplied by a selected coefficient of minimum flow to estimate the minimum environmental flows;
- Minimum environmental flow is to be considered sufficient or acceptable, if its estimated value is less than the flow of surface water to the downstream basin, otherwise the current flow would be the available minimum environmental flow;
- Demand of ecosystem or habitat covering plants, fish species and birds was assumed to be ≤ 10% of the total generated water within the basin in an average year;
- Surface water available for development was considered equal to the difference between the flow of surface water to the downstream basin and minimum environmental flow; and
- Potential water available for recharge was estimated by adding surface water available for development and current recharge level (or direct recharge by groundwater).

Minimum environmental flows for river basins in Balochistan were estimated from the total internally generated water within the basins at 50% probability. The minimum environmental flows of 1.08 billion m^3 are estimated for the 18 river basins. And the minimum environmental flows of Nari and Porali basins are estimated as 82 million m^3 and 111 million m^3, respectively.

IUCN Management Plan for Ziarat Juniper Biosphere Reserve: International Union for Conservation of Nature prepared a management plan for the Ziarat Juniper forest with the following objectives for the next 5 years:

- Promote the sense of ownership amongst the communities for them to be custodians of the Biosphere Reserve.
- Build capacities for safer and more profitable skills, better management of disasters, and adaptations to climate changes.
- Control/regulate practices and traits that are harmful to the natural health of the Juniper forest Ecosystem and enhance connectivity in the landscape.
- Promote coordination for major stakeholders to jointly address the issues and challenges of the Biosphere Reserve in the fields of conservation, sustainable development and scientific research.
- Strengthen the knowledge base of the Biosphere Reserve for present and the future.
- Promote awareness and communication as basic tools for the proper understanding of the values of the Biosphere Reserve and urging support for maintaining it as a national and international asset.

Ziarat Juniper Forest Conservation under Balochistan Natural Resources Management Project: This project was funded by the World Bank, the objective of the sub-project of Ziarat Juniper Forest was to zone the forest for different uses, and establish community plantations around the Juniper areas as substitute sources for community fuelwood and timber. It also intended to test the operational feasibility of a management plan, and the technical, social and economic feasibility of growing community fuelwood plantations under such harsh conditions, undertake soil erosion control works in an area of about 10,000 ha, develop springs, produce and distribute 100,000 seedlings, construct offices and other buildings, and conduct research and trials on new species of fuelwood trees, shrubs, grasses and fodder, and on dwarf mistletoe disease (*Anceuthobium oxyce dri*) which attacks juniper. Its specific purpose was to complete and implement a forestry management plan to conserve the juniper forests in Ziarat in close collaboration with the communities of the area.

IUCN Mangrove of Pakistan – Status and Management: The services from Miani mangrove forests are decreasing due to: (a) Overall climate change impact, (b) Reduced flow of water and silt from the rivers, (c) Gradual sea level rise, (d) Over exploitation of mangroves for fuel wood and fodder, (e) Inflow of pollutants into the mangrove Eco-system, (f) Meandering and erosion of creeks, and (g) Indiscriminate grazing. This study planned the following activities for the management of mangrove in Pakistan, including Miani Hor:

- Better understanding of the dynamics of ecosystems;
- More efficient management technology;
- More effective utilization of mangrove resources without degradation of the environment; and
- Better understanding of possible environment impacts of pollution, scarcity of freshwater and utilization of mangrove resources.

7.3 CIA in Context of BIWRMD Project

7.3.1 Study Boundaries

The spatial boundaries of cumulative impact assessment (CIA) have been based on the jurisdiction of GoB. The spatial boundary is the Nari and Porali River basins and the projects considered for the assessment are BIWRMD, Delay Action Dam, 100 Dams, and other Water and Power Development Authority (WAPDA) Dam in the selected river basins in Balochistan in next 10 years. Locations of these river basins are shown in Figure 7.1.

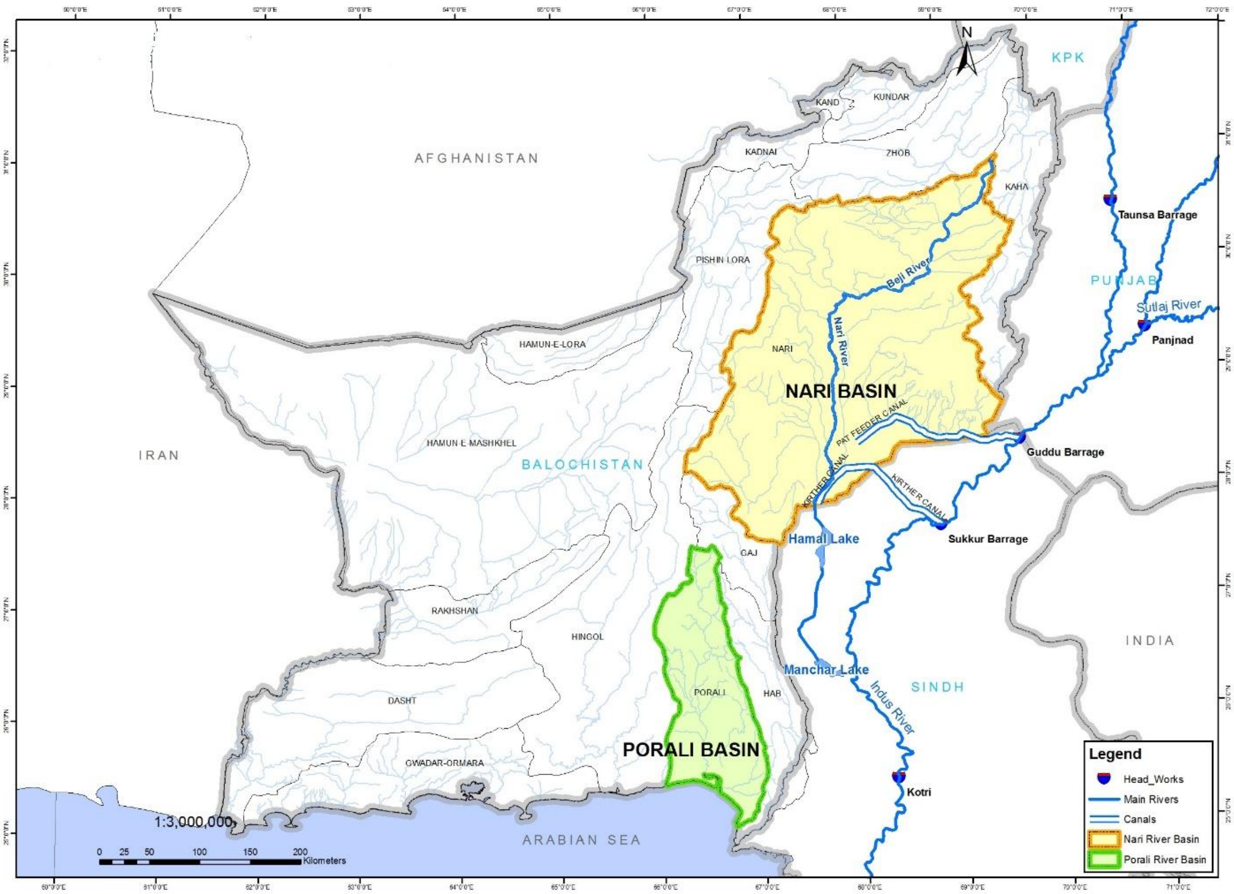

Figure 7-1: CIA boundary

7.3.2 Identification of Valued Environmental Components for the CIA

Based on consultations with various stakeholders, three valued environmental components are identified for the CIA study. These VECs and their significance are described below:

- **Surface Water**: Construction of upstream water resource infrastructures has major influence in water availability for irrigation and drinking water while affecting negatively in downstream water flow. Downstream water release is reduced during low flow season due to the improved water supply for irrigation, possible land conversion for agriculture due to increased water availability, and reduced water available for maintaining environmental flow.
- **Aquatic Habitat and Fish**: In perennial river system in both NRB and PRB, aquatic species, such as fish and Marsh Crocodile (*Crocodilus palustris*) is found in the lagoons and streams. The mangroves are fully dependent upon the freshwater discharges from the River. The average rainfall is very low (221 mm), and in some

years, there is virtually no rain at all. Historically, the abundant freshwater discharges and nutrients-rich sediment load was conducive to a highly productive coastal ecosystem, including mangrove stands and fish which form the livelihood basis of local communities around Miani mangrove forest. In 2003, the reported catch from Miani Hor area was 11,000 metric tons which is 9% of the total catch of Balochistan coast.[9] It is suspected that most severe environmental stress, which the mangroves are facing results from the reduction of freshwater flows down the Indus carrying with it reduced loads of silt and nutrients. Perennial rivers of Balochistan has little impact on the sediment discharge in Miani Hor.

- **Biodiversity and Forests**: The main drivers of biodiversity loss are converting natural areas to farming and irrigation, polluting or over-exploiting resources including water and soils and harvesting wild plants and animals at unsustainable levels. Project will divert water for irrigation by reducing flows and/or increased surges in low flow season, increase pressure on forests (illegal logging) by influx of workers, may convert forest land due to increased agricultural potential, release less water in downstream resulting in reduction or degradation of aquatic and forest habitats, may degrade rangeland by overgrazing, collect firewood, etc.

7.4 Surface Water Constraints and Availability

7.4.1 Downstream Water Releases

7.4.1.1 Proposed Project Scheme

Hydrological alteration of river flow regimes can cause significant environmental degradation. Feasibility study of the Project undertook water balance assessment to determine what components of the natural flow (amounts, timing) will be released in downstream. An ADB TA conducted in 2005 to estimate the environmental flow requirement of 18 river basins of Balochistan.[10] This assessment determined environmental flow requirements or environmental water allocations of a river, wetland or coastal zone necessary to maintain the biophysical, ecological processes and health of aquatic ecosystems, and associated ecological goods and services. Figure 7-2 and Figure 7-3 show schematics of the preliminary average annual basin water balances for the Nari and Porali basins including estimated consumptive demands for the proposed irrigation schemes. The water balances are based on estimates of the water demand for “nature” and do not directly consider flow regime characteristics and hence specific environmental flow requirements. Nonetheless, the water balances indicate that on average, the volumes of water for consumptive demands are relatively small and there is additional water that can be sustainably diverted in these basins to improve livelihoods of local inhabitants.

Based on the water balance analysis it is found that the net quantity of water available in downstream Nari basin is about 1.005 billion m^3 and in Porali basin it is 0.5818 billion m^3.

7.4.1.2 Delay Action Dam

(a) Background

Groundwater recharge is a process of gravity driven infiltration measure of the precipitation through surfaces (original ground) and river beds, whereas, the artificial recharge(s) measures are mainly through the recharge devices in the form of infiltration well and ponds. Gravity fed recharge is quantitatively less expected because of low rainfall intensity with precipitation in the range of around 65 to 263 mm in the average year, 25 to 153 in dry year and 155 to 481 mm in

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[9] Shah A.A. and Jusoff K. (2007). Mangroves conservation through community participation in Pakistan: the case of Sonmiani Bay. In International J. of Systems applications, Engineering & Development, issue 4, Volume1, pp. 75-81

[10] ADB TA 4560-PAK (2008); Supporting Implementation of IWRM Policy in Balochistan, Asian Development Bank, the Philippines.

the wet year per annum in the NRB and rainfall intensity in Porali River Basin at three probability levels (25%, 50%, and 75%) are 239.40 mm, 93.35 mm, and 93.98 mm, respectively. The rainfall in the wet year contributes for the groundwater recharge, whereas it hardly contributes in the dry year. River runoff does not generally contributes as sub-surface groundwater recharge due to its short duration (torrential), in addition severe surface erosion caused by floods devastates the groundwater conservation conditions in the drainage areas. Consequently Delay Action Dams (DADs), artificial recharge facilities, have been constructed in Balochistan to accelerate recharge of groundwater aquifer. Due to the rapid depletion of groundwater resources, the Government of Balochistan has constructed about 292 DADs with a gross storage capacity of 276 million m^3 (223,556 acre-ft) for recharging groundwater aquifers.

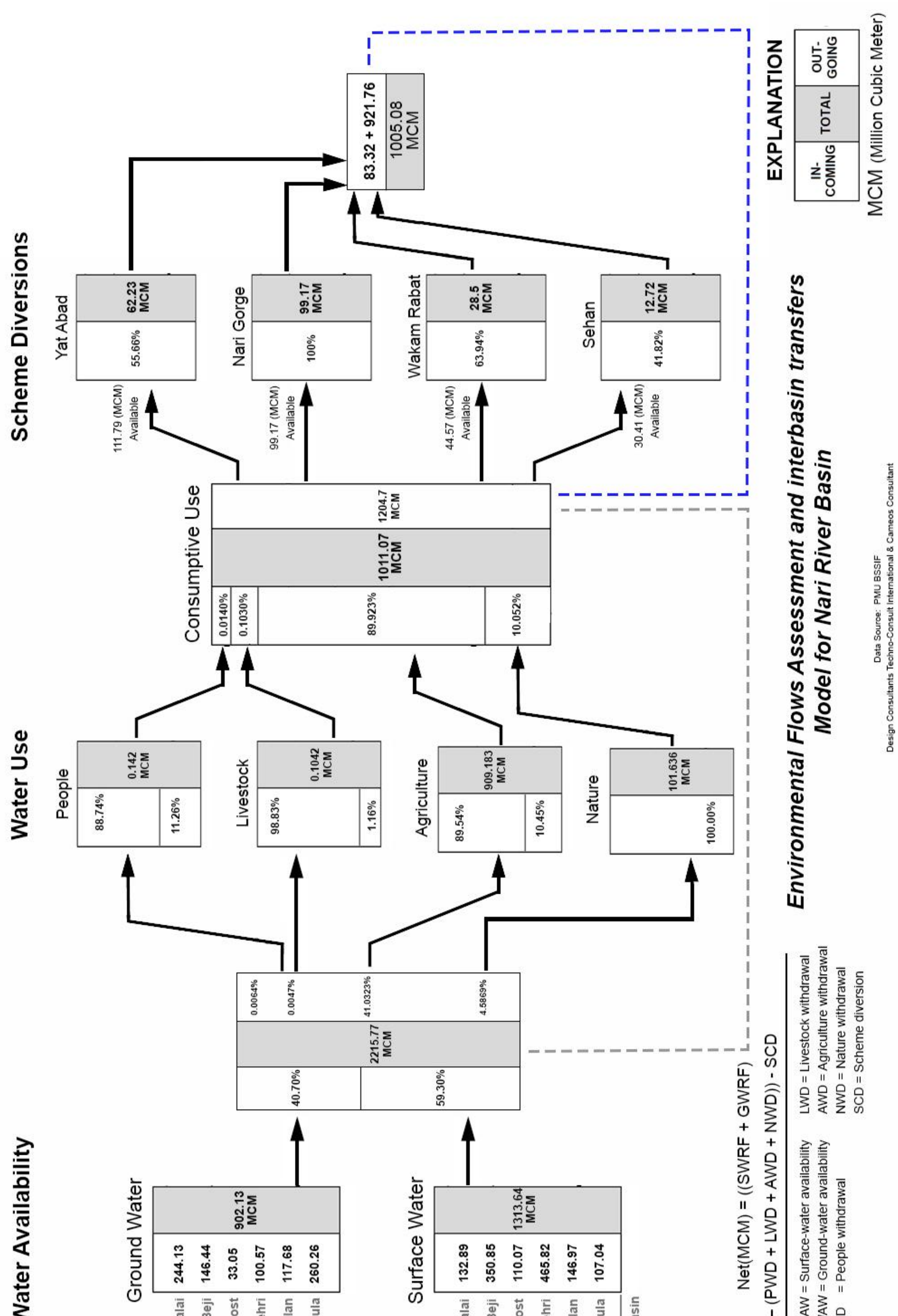

Figure 7-2: Nari Basin average annual water balance

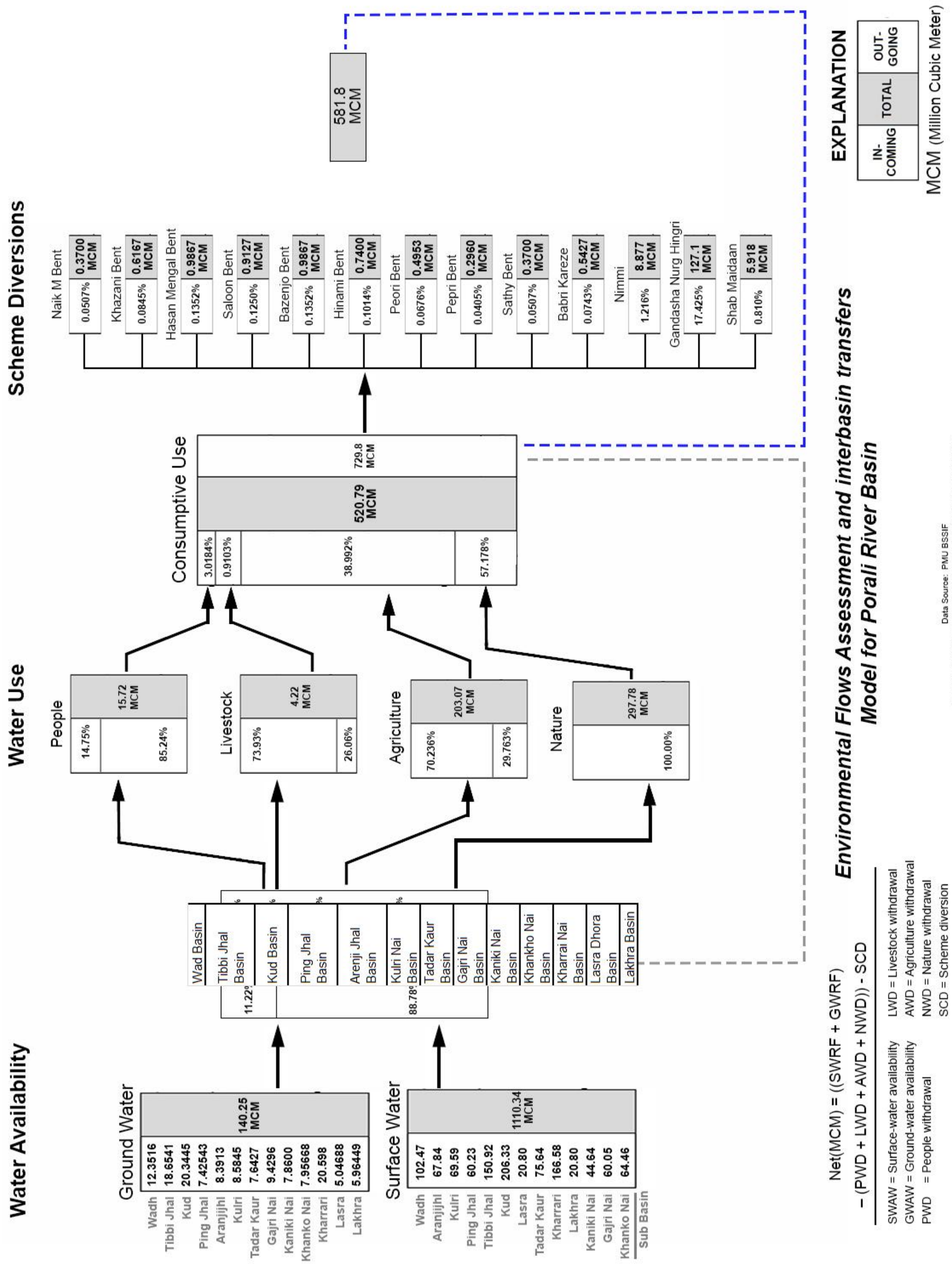

Figure 7-3: Porali Basin average annual water balance

(b) Objectives of DADs

The major objectives to construct the DADs are the following:

- Recharge of groundwater;
- Flood control and damage minimization;
- Control of sediment loads;
- Socio economic uplift of the population.

(c) Design and Salient features of DADs

The basic embankment configuration comprises of homogeneous and zoned earth fill sections depending on the availability of fill material with varying configuration as follows:

- Maximum height varying from 9.14m to 15.2m (30 ft. to 50 ft.);
- Top width is usually kept as 6m (20 ft);
- Upstream slopes vary from 2 to 3:1 and downstream slopes vary from 2 to 4:1;
- 0.46 to 1 m (1.5 to 3 ft) hand packed stone pitching provided on the upstream slopes to protect against wave action;
- 0.23m to 0.304m (0.75 to 1.0 ft) thick shingle/gravel layer provided on the top and downstream slope of the embankment for protection against erosion from wind or rain cuts.

Depending upon the site-specific topographic and geological conditions and discharge requirements, stepped and sloping gabion apron spillways are provided mostly without any stilling basin structures for energy dissipation. The spillway is usually sized (designed) to pass the 30-50 years return period inflow flood. Table 7-1 presents the list of the delay action dams.

Table 7-1: Summary of completed Delay Action/ Storage Dams in Balochistan

Basin	No. of Dams	Total Storage (million m^3)
Dasht	18	28
Gaj	3	6
Gawadar	4	76
Hamun-E-Lora	1	0
Hamun-E-Mashkhel	9	21
Hingol	5	4
Hub	7	8
Kachi Plain	11	3
Kadnai	--	0
Kaha	8	4
Kand		0
Kunder	4	0
Mula	5	5
Nari	44	22
Pishin Lora	127	43
Porali	13	16
Rakhshan	4	8
Zhob	29	30
Total	**292**	276

Source: Irrigation and Power Department, Government of Balochistan

7.4.1.3 The 100 Dams Project

Government of Balochistan planned 100 Dams project in 2008 to mitigate the sharply depleting groundwater table as well as to protect medium and high-level floods. Federal Government approved it for financing in 2010, and physical works began in 2011. This project has been building multipurpose dams across the province for full utilization of the huge potential of floodwater (about 63% of the water budget).

The construction of these 100 Dams is planned in three phases, with 20 dams to be completed as Package I, 26 dams in Package II while remaining 54 dams to be completed in Package III. To date, 18 Dams of Package I and 6 dams of Package II have been completed. Remaining dams of Package II are scheduled to be completed by June 2017.

Out of the completed 24 dams, only two are located in Nari and Porali River basins and they are:

- *Nari Basin*: Kumbri Dam in Bolan: This dam is a modified homogeneous earth fill dam constructed to cultivate 6,313 ha (15,600 acres) of land[11] with storage capacity of 24.03 million m^3 (19,481 acre-ft).
- *Porali Basin*: Lohi Dam in Khuzdar: 4.69 million m^3 (3,804 acre-ft).

In the remaining Packages, following are the dams planned for construction, across the two river basins. Although termed as dams, none of these structures is to serve as a water reservoir rather water is to flow out once its velocity has been achieved.

Table 7-2: Remaining dams to be constructed

Nari River Basin	Porali River Basin
Tor Kane, Killa Saifullah	Jodair, Awaran
Malgagi, Killa Saifullah	Sasool, Khuzdar
Surghund, Loralai	Harambo, Khuzdar
Dargai Zakhpail, Loralai	Hushtri, Khuzdar
Spezandai, Ziarat	Taigh, Khuzdar
Zawa, Ziarat	
Chapchal, Kalat	
Shashlok, Kalat	
Chiltan, Mustung	
Dulay Kanak, Mustung	
Asimabad, Mustung	
Naharkot, Barkhan	
Dhudar, Jhal Magsi	
Sharig, Sibi	

7.4.1.4 Dam Investment by Water and Power Development Authority

The Federal Water and Power Development Authority plans to construct medium sized (with storage capacity of less than 1 MAF) water storage dams across Balochistan. Currently, there are four operational water storage dams constructed by WAPDA in the province, out of which one is located in the Project study area and they are:

[11] Kumbri Dam in Bolan (2016); http://defence.pk/threads/balochistans-socioeconomic-development-updates-discussions.302433/page-2, website visited on January 8, 2016.

- Sabakzai Dam in Zhob[12] -The main objectives of the dam are to provide 21.5 km metalled access road upto Sabakzai, extension of 11 kV line upto dam site, irrigation supply of about 0.934 cumec of water for more than 2,782 ha of land round the year with an average cropping intensity of 123%. The dam is build on Sawar Rud a tributary of Zhob River. The live storage capacity of the dam is 18.13 Mm^3 (14,700 acre-ft) and stored water is meeting the drinking water requirements of about 15,000 people, helping to mitigate the flood and annual losses to property.

Dams that are under consideration for construction in the study area in the near future are as follows:

- *Nari Basin Area*: Naulong Dam in Jhal Magsi, 298.5 million m^3 or 242,000 acre-ft (gross),[13]
- *Porali Basin Area*: Winder Dam in Lasbela, 44.6 million m^3 or 36,167 acre-ft (live), [14]
- *Porali Basin Area*: Pilar Dam in Awaran, 111 million m^3 or 0.09 million acre-ft (live)[15]

These medium sized dams have been under consideration since more than seven years, and are still in the feasibility stage. Recently, WAPDA has launched another study titled, 'Feasibility of Medium Dams in Balochistan' under the Federal budget for Balochistan, which will take at least three years to complete.

7.4.2 Cumulative Effects

7.4.2.1 Downstream water releases

Based on the analysis above, the following conclusions can be made based on a conservative estimate:

- *Impacts of Project Schemes*: It is estimated that scheme diversion under the proposed Project in Nari River basin is 199.62 million m^3 and in Porali River basin it is 148 million m^3, respectively.
- *Impacts of Delay Action Dams*: In Nari River Basin, 44 dams were constructed with total storage capacity of 22 million m^3 and in Porali River Basin, 13 dams were constructed with total storage capacity of 16 million m^3. Therefore, total use of the water by the DADs in two river basins is 38 million m^3.
- *Impacts of 100 Dams*: Given the timeframe it took for the initial 24 dams to implement, not all of the dams mentioned above are likely to complete in the next 5 to 10 years. The funding is to come from Federal Government, in the form of packages, and its flow is dependent on physical progress achieved. With current security situation in Southern Balochistan, it is highly unlikely that the dams in at least Porali River basin will be completed in the timeframe being considered by this CEIA. As such, even if they do complete, there are minimal negative impacts of these multipurpose dams, as they will help reduce flash flooding, improve groundwater tables, as well as provide drinking water for animals, and in some cases human settlements. Since these are not diversion structures, nor are they reservoirs,

[12] NESPAK, Project Summary, www.nespak.com.pk/projects/pdf/4-1-0.pdf, visited on January 8, 2016

13 Wapda Website, http://www.wapda.gov.pk/index.php/projects/water-sector/future/naulong-dam, visted on January 8, 2016.

14 Wapda Website, http://www.wapda.gov.pk/index.php/projects/water-sector/future/winder-dam, visted on January 8, 2016.

15 http://siteresources.worldbank.org/PAKISTANEXTN/Resources/293051-1114424648263/Session-VII-Nadir.pdf, visted on January 8, 2016.

downstream water flows, for agriculture and/or domestic purposes, are likely to remain unaffected.

- *Impacts of WAPDA Dams*: As in the case of 100 Dams, it is highly unlikely that all of the above dams will be constructed in the timeframe being considered by this CIA. However, considering the worst case scenario the total live storage required for these dams is about 472.23 million m^3, 298.5 million m^3 in Nari Basin area and 155.6 million m^3 in Porali Basin area.

7.4.2.2 Consequence of upstream water use

The total amount of water produced in NRB and PRB are 2,215.77 million m^3 and 1,250.59 million m^3, respectively. Current water consumption by human, livestock, and agriculture in both NRB and PRB are 909.434 million m^3 and 223.01 million m^3, without the consideration of natural use, which also include the minimum environmental flow. The estimated amount of water utilized by the nature to sustain the ecosystem considered in NRB and PRB are 101.636 million m^3 and 297.78 million m^3, respectively. A study conducted by the Asian Development Bank in 2005 made an estimate for the minimum environmental flows in 18 river basins. This study concluded that the minimum environmental flows of Nari and Porali basins are 82 million m^3 and 111 million m^3, respectively. The hydrological assessments for both NRB and PRB estimated that the quantities of water available to release in downstream are 1,005.08 million m^3 and 581.8 million m^3, respectively. Considering the utilization of Delay Action Dams, 100 Dams, and WAPDA sponsored dams (both current and foreseeable future) in Balochistan, quantities of water available for downstream release are 684.58 million m^3 in Nari Basin and 410.2 million m^3 in Porali River Basin, respectively. The estimated quantities of water available for release are more than 8 times higher and 3.6 times higher than the estimated minimum environmental flow required for these basins.

7.4.3 Water Availability

Current agriculture water use in Nari and Porali basins are 909.183 million m^3 and 203.07 million m^3, which will be supplemented with 199.62 million m^3 and 148 million m^3 through the diversion weir. Additional lands will be irrigated under the schemes are 69,029 ha in Nari basin and 18,493 ha in Porali basins. The land has been identified in consultation with the communities and BID. Since, spate irrigation is the practice in both the river basins, planned irrigation schemes will positively improve the irrigation water supply. There is a potential for ecologically important land conversion for agriculture use, due to improved availability of water, this will remain a challenge during the Project operation.

7.4.4 Recommendations under the Project

The following recommendations are made to protect surface water:

- Install hydro meteorological stations at designated locations to monitor water flow of the rivers and distributaries. This is crucial to make any future investment in water resources. The hydrological data is needed to monitor future water availability and flow in the rivers and evaluate the performance of the schemes.
- Preserve aquatic biodiversity by river management focusing on restoring both the timing and duration of flood pulses, as well as on maintaining critical minimum flows in the dry season.
- The project will work closely with the local communities as well as Forest and Wildlife, and Revenue Departments to ensure that natural habitats including rangelands and forests remain unaltered as a result of this project. The areas of ecological important will be delineated as per land records using GIS and remote sensing support, with active community involvement. Since the project aims to work with farmer communities in the shape of farmer organizations as well as water user associations, a binding clause on

protection and non-conversion of natural habitats will be included into the terms of partnerships signed with the local/farmers' organizations.
- During operation stage of the project care will be taken to stop converting ecologically important land for irrigation.

7.5 Aquatic Habitat and Fish

Balochistan climate is categorized as arid. The rivers are active with perennial flow with high intensity of showers during monsoon and spring, causing seasonal flash floods. The rivers are mostly dry during other seasons.

7.5.1 Cumulative Effects

7.5.1.1 Impacts of diversion scheme

In the perennial river environment, the aquatic fauna mostly consists of fish species survive in streams and lagoons. In the Nari River Basin, in upstream Nari Gorge near Sibi, Marsh Crocodile (*Crocodilus palustris*) is found in the lagoons and streams. Besides, many migratory birds including cranes and ducks also station in these lagoons during the migration period. In the upper reaches of the Nari basin, such as, Sehan and Beji Sub-basin, Mahasheer is the common fish species in these lagoons and other water bodies. While in the lower reaches of Nari Gorge, in Mushkaf area, the fish species found include: Rohu, Palli, Palwar, and Mally. Diversion of flood water or diversion of sub-surface water through Perennial Irrigation Schemes, will not affect these fish species and Marsh Crocodile but enhance their habitats with additional water for a sustained period of time. Therefore, it is expected that the farmers of the area falling in the jurisdiction of Perennial Irrigation Schemes may be encouraged fish farming because it has become a lucrative business due to the high meat demand in the country/province. Mushkaf area especially suits for the fish farming in NRB. A similar situation exists for the Porali River Basin. The fish species present in the PRB include: Pari, Palli. Palwar, Pahari Rohu, Reba Schrogar, Perrrnada, Chidu, Mahaseer, Tengra, Taints, Molly, Mar Mahi, Mrbo, and Gallo. Due to the recent price escalation of fish and fish products, farmers in Khuzdar and Lasbela area having perennial water resources suitable for fish may switch to fish farming, as well. The Perennial Irrigation Schemes proposed under the Project will not affect the fish population, however enhance the sustainability of their habitats.

7.5.1.2 Impacts of sediments in Miani Hor

The dimensions of lagoon in Miani Hor change greatly between high and low tides twice a day due to tidal water fluctuation that enters into lagoon from single inlet connecting the lagoon with the sea. The rise and fall of the tide in the sea causes flow of water into and out of inlet that in turn causes fluctuation of water level of the lagoon. The steep mud banks are visible at low tide surrounded by numerous flat islets of mud covered with mangrove. As a result of occasional fresh water runoff into the lagoon, a small Porali delta has been developed which is enriching the mangrove forest in the vicinity. The Porali River runs over a stony course and has low banks as far as Mangia, where it passes through clay soil.

Analysis of sediment samples indicate that lagoon bed is consisted of silty clay with few sandy patches. [16] Beach material is composed of medium and fine sand with some stones. The soil of Lasbela up to Miani Hor Lagoon is alluvial, and is composed of light loose clay, mixed with fine sand with saline ingredients. The main minerals are shale, marble, lime stone, barite and

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[16] Syed, N. A. et. Al (2014); A Study of the Dynamics of Miani Hor Coastal Lagoon, Pakistan and Failure of Damb Fish Harbour, International Journal of Science and Technology Volume 3 No. 8.

serpentine while basalt and magnesium are also found in the district. There are numerous streams and watercourses at the head of the valley above Bela, which drain either into Lagoon or directly to the sea.

A small Porali delta has been developed with occasional fresh water runoff (especially during the monsoon) into the lagoon, enriching the mangrove forest in the vicinity. Porali is a perennial river with seasonal water flow and drains only when there is rain in its catchment area, so very seldom it makes any impact on the water quality of Miani Hor lagoon. Most of the time due to excessive rate of evaporation (3 m/year) the salinity of lagoon remains higher than the open sea to serve as negative estuary diluted by seawater mixing during flood tide. The depth at the inlet is relatively smaller than the average depth of lagoon, therefore, there is exchange of water during tidal fluctuation.

High energy waves off lagoon are dominant with 90% wave ranged between 1–2 m and period of 6 – 10 sec with wave direction from southwest. On the other hand, inside the lagoon as a result of single and 4 m deep inlet, these waves get attenuated with no significant height. The dominant force that keeps the bottom sediment of lagoon suspended is tidal driven circulation. Sediments are suspended and carried away during peak flood and ebb velocity and they are deposited during slack periods, as shown in Figure 7-4. The sediments brought form lagoon are deposited offshore keeping inlet open as a result of jet flow water.

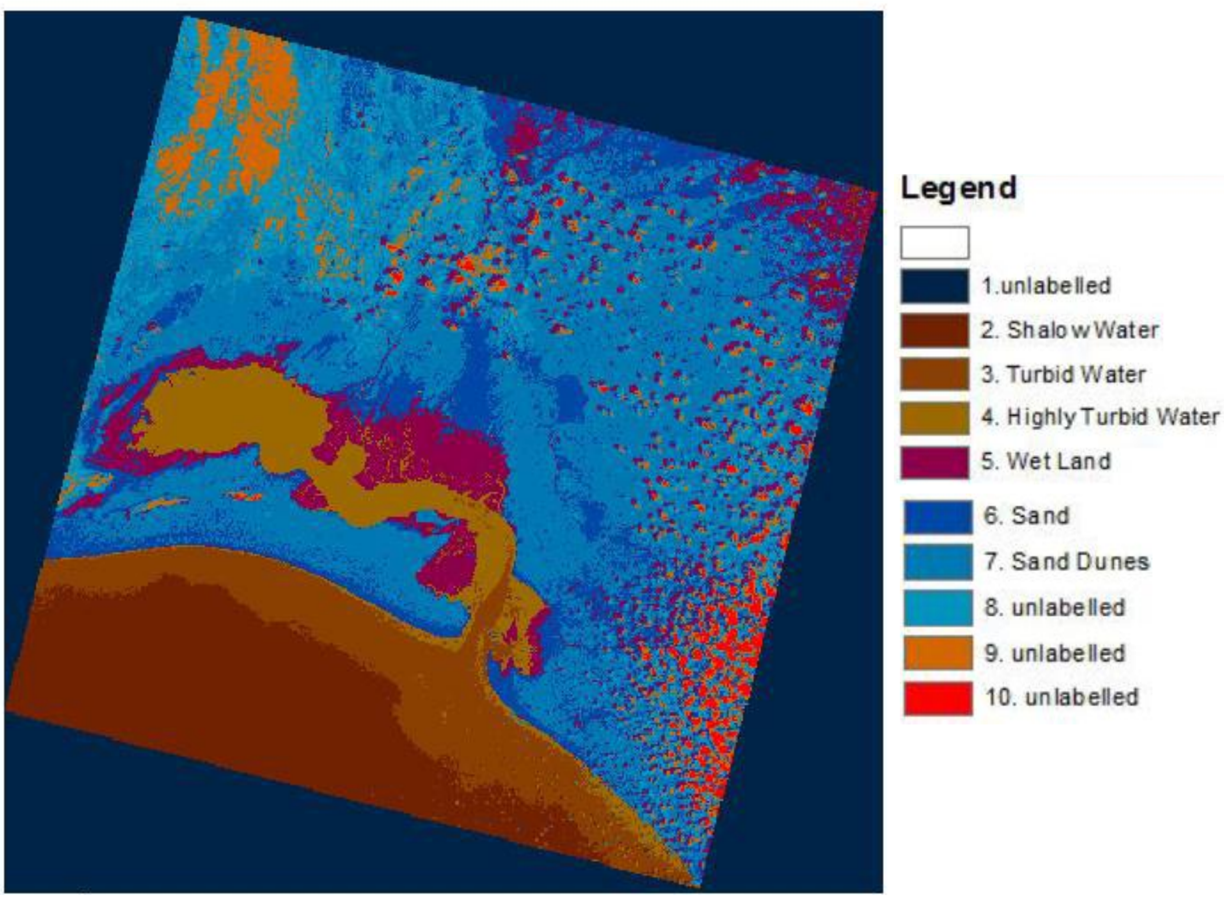

Figure 7-4: Sediment transport in and around Miani Hor lagoon (SPOT XS imagery of 03/09/2005)

7.5.2 Recommendations under the Project

- A study is recommended to assess the suitability of fish farming in Mashkaf in Nari Gorge subbasin, Sehan and Beji Sub-basin of Nari River basin, Khuzdar and Lasbela area in Porali

River basin. Based on the study outcome, fish farming support to the local community for their livelihood enhancement is recommended.

- Seasonal monitoring of water flow and quality is recommended at the discharge points of Miani Hor from Porali River and its distributaries.
- Since, there is a potential reduction of nutrient rich sediment and increased organochlorine pesticide discharge in Miani Hor due to the water diversion and irrigation scheme under the Project, some of the existing community management plan of Miani Hor will be supplemented under this Project to enhance the ecological diversity of the mangrove forest.
- Miani was declared a Ramsar site by the Ramsar Secretariat in 2001, which still remains its only protection status. Balochistan Forest Department took management control of approximately 200 ha of the area, while the remaining area is under Revenue Department and local communities. There has been a proposal by WWF and IUCN to declare it as the first marine protected area of Pakistan, and they have carried out many scientific research to validate the proposal. The Project can support this process and provide resources to ensure that it gets the desired protection status, also supplement some of the community based management within the project period. This will augment the development objective of the project, which aims to improve the resilience of the local people to climate change and natural disasters.

7.6 Biodiversity and Forest

7.6.1 Conversion of Rangeland and Forest

Rangeland degradation in the Project area is occurring as a result of no grazing management plans, removal of vegetation for fuel wood and no clear authority of rangeland ownership. The major indicators of rangelands degradation are shift in species composition, loss of range biodiversity, reduction in biomass production, less plant cover, low small ruminant productivity, and soil erosion.[17] Perennial grasses and palatable shrub species are confined to only in some protected Forest Areas. The degradation of rangeland is site specific and depends on the existing vegetation, grazing pressure, grazing accessibility, human population, availability of stock water, and tribal conflicts.[18] Major rangeland management issues include: open range areas, no clear land ownership, weak community participation, recurrence of drought, and lack of integrated range management approaches. Perennial grass like *Chrysopogon aucheri* a highly palatable species is gradually replacing by low palatable species of *Cymbopogon jwarancusa* and shrubs like Artemisia species or Haloxylon species. Even at many rangelands these shrub species have been replaced by unpalatable shrub species like *Peganum harmala* and *Othonophsis intermedia* with clear evidence of soil erosion. Pastoral communities have some realization about the rangeland degradation by assessing their livestock production or health, forage availability and traveling in search of forage. However, the impact of rangeland degradation on other services like carbon sequestration, conservation of plant and wildlife biodiversity, water harvesting and spreading, infiltration, and many other environmental services are either not monitored, documented or disseminated the information among the various sectors of the society.

7.6.2 Cumulative Effects

Livestock serve as a backbone of the rural economy of Balochistan (80% of all Pakistan's sheep and 40% of goats + sheep occur here). There is potential for careful application of indigenous

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[17] Ahmad, S.S. and H. Ehsan. 2012. Analyzing the herbaceous flora of Lohi Bher wildlife park under variable environmental stress. Pak. J. Bot., 44(1): 11-14.

[18] Ahmad, S. And M. Islam. 2011. Rangeland productivity and improvement potential in highlands of Balochistan, Pakistan. Biomass - Detection, Production and Usage, Darko Matovic (Ed.), ISBN: 978-953-307-492-4, In Tech, pp. 289-304.

and scientific knowledge to improve models of livestock and rangeland management, thereby yielding a number of improved goods and services, which in turn will help to relieve pressure on other natural resources. The rangelands, forestland, and watersheds of both river basins are already under severe stress from local population, livestock grazing/browsing, and fuelwood extraction. With the influx of construction activity, the pressure will increase considerably (as labor camps will be set up which typically use wood and shrubs for fuelwood). The project will need to work with the local communities as well as Forest and Wildlife, and Revenue Departments to ensure that natural habitats including rangelands and forests remain unaltered as a result of this project. The rangelands will need to be delineated as per land records using GIS and remote sensing support, with active community involvement.

7.6.3 Ziarat Juniper Biosphere Reserve

Prior to the British era the demand on forest produce was minimal. Life and property was unsafe and inter-tribal clashes were frequent. With low population and the demand of the tribesmen for timber, fuel wood and grazing was met easily by the forests. During British period, tree growth started disappearing from areas accessible by roads for supplying fire wood to Quetta. In order to save the forests from destruction, the Balochistan Forest Regulation was enacted in 1890. After that, certain areas have been declared as State forests, from time to time with the consent of the tribesmen till it was all in this category by 1960s. Since the progress of reservation was low, juniper was declared a reserved tree in 1901, to protect from uncontrolled cutting. Certain areas were declared as State Forests, prohibited grazing through the notifications. It has never been possible to enforce grazing protection effectively due to the intense pressure of grazing and the resultant shortage of fodder. Illicit cutting of sale in towns was stopped in 1960s, however, illicit cutting of green trees for use as fire wood and fencing continued in villages inside the forests.

The juniper forest ecosystem of Ziarat exhibits great values of biodiversity conservation and ecological significance which accrue local, regional, and global benefits. The proposed area of biosphere is habitat to the largest patch of Juniper forests (*Juniperus excelsa polycarpos*) in Pakistan. It is believed that the Junipers of Ziarat are the second largest Juniper forest of its kind in the world and measures about 110,000 ha. Figure 7-5 gives highlights of various zones of the juniper biosphere reserve. The Juniper forest ecosystem of Ziarat play an important roles in economic development and environmental stability. The largest direct value of the juniper ecosystem is the role it plays in watershed protection, ensuring the conservation of soil (fertility and erosion control) and the steady supply of water to lower lying areas. It recharges the underground water, increases water table as snowfall and rainfall percolate into the soil, reduce the aridity by transpiration, purify the air by addition of oxygen and improve microclimate of the area. Although, there is no component under the Project which lies within or the close proximity of Juniper forest, however, Nari River basin is connected with streams those are originated from Kawas Mountains of Juniper forest feeding water to the catchments. Therefore, it is important to consider some program for the sustainable watershed management in the mountain ranges and support the river systems with sufficient water flow.

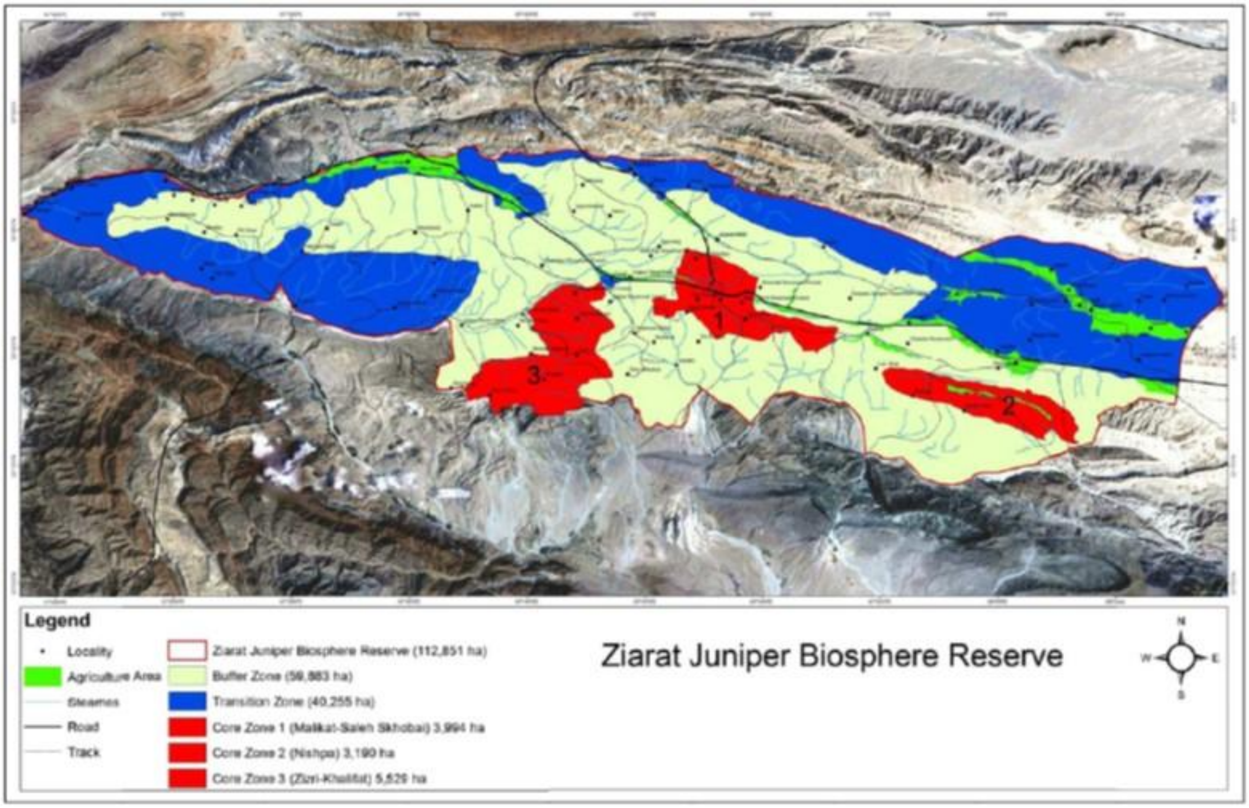

Figure 7-5: Ziarat Juniper Biosphere Reserve (Source: IUCN)

7.6.4 Cumulative Effects

A number of ecosystem products and services have been integral part of the communities living in and around the Juniper forests of Ziarat, such as, the water generated through recharge of groundwater aquifer supports agricultural production and human consumption. Most people inhabiting watershed areas are surviving just at the subsistence level due to the limited resources, and are gradually getting further impoverished due to overgrazing, removal of vegetation, fires and cultivation on steep slopes. They cannot improve their lot because they are uneducated, do not possess many skills and do not have enough money to invest. They are nevertheless sticking to their meagre holdings primarily due to sentimental (cultural) reasons and thus refuse to out-migrate. Human and livestock (cattle and sheep) populations are on the increase. As they are cultivating steep slopes using medieval technology, without any modern inputs, they continue to get minimal returns. But in the process they are destroying the existing land base, are carving out new agricultural land by removing trees, and accelerating soil disturbance and sedimentation. This results in reduced life of costly reservoirs, being choked with silt, sand and debris, and rises in river bed levels which aggravates flash flood damages, causing havoc to infrastructures, and destroying crops and fertile agricultural land. Forests have a bigger role in the rehabilitation and development of rangelands, water management, wildlife management, promotion of ecotourism, and soil conservation. In view of their multiple functions and the threats faced, there is dire need to protect and rehabilitate Juniper forests for the existence and survival of human populations.

7.6.5 Recommendations under the Project

The following initiatives will be taken by BID in the project area as a continuous process:

- Rangeland improvement can be achieved through proper grazing control, developed as a system by involving the people who live there. Scientific management of rangelands can go a long way in enhancing their productivity. Partial or complete closures in certain areas through rotational or deferred grazing reinforced with reseeding can be emphasized. Benefits of regulated grazing can be demonstrated effectively by developing model pastures either on state land or on the lands of some volunteers to achieve a make-believe effect. The concept of group grazing can also be introduced. The protection of forested land, which is an erstwhile resource of fodder, fuel and grazing, must go hand in hand with the protection and improvement of pastures. Some unproductive lands designated as forests can best be managed as pastures.
- At present, agricultural yields in watershed areas are very low because of the use of outdated and inefficient techniques and inadequate knowledge. Improvement measures for rangeland management under the Project will reduce soil exposure, improve surface storage, increase infiltration and reduce damage. The methods to achieve desired objectives include use of fertilizers and green manuring, preservation of stubble and crop residues, proper crop rotation, ploughing along the contours, bench terracing, and subsoiling.
- Since, the project aims to work with farmer communities in the shape of farmer organizations as well as water user associations, a binding clause on protection and non-conversion of natural habitats can be added into the terms of partnerships signed with these local organizations.
- Propose monitoring of land conversion and management plans in the EMP to improve rangelands in the Project area.
- The surrounding area of the Juniper forest has very limited water resources therefore watershed management is pivotal for sustainable development of the area and the downstream catchment dependent on this watershed. Mountainous terrain of the area provides some excellent opportunities for watershed development and management, which has intensive influence on agriculture, forestry and livestock sectors. Besides, the ecosystem provides valuable services of regulating aquifers by protecting the watersheds in the catchment areas that conserve and sustain provision of water resources for various production functions that support livelihoods of the local communities and the Nari River Basin.
- UNESCO has declared Juniper Forests of Ziarat, as Man and Biosphere Reserve, and Government of Balochistan is considering a PC-1 on declaring it a national park. The project will provide support to this cause and ensure that the national park is not only declared, but the existing community based management plan is supplemented, with pilot investment in its key interventions. This will help maintain the forest cover, which will assist in maintaining, and as a consequence, accelerate the groundwater recharge, availability of water resources to the communities dependent on the forest, and improving the water quality and quantity of Nari River basin.

8 Environmental Management Plan

8.1 Objectives of EMP

The basic objective of the EMP is to manage adverse impacts of project interventions in a way minimizing the negative impacts on the environment and people and compensate and enhance the environmental and social status of the Project area. The specific objectives of the EMP are to:

- Facilitate the implementation of the mitigation measures identified during the present EA and discussed earlier in the document.
- Maximize potential project benefits and control negative impacts;
- Draw responsibilities for project proponent, contractors, consultants, and other members of the Project team for the environmental and social management of the Project;
- Define a monitoring mechanism and identify monitoring parameters in order to:
- Ensure the complete implementation of all mitigation measures,
- Ensure the effectiveness of the mitigation measures;
- Maintain essential ecological process, preserving biodiversity and where possible restoring degraded natural resources; and
- Assess environmental training requirements for different stakeholders at various levels.

The EMP will be managed through a number of tasks and activities and project and site specific management plans. One purpose of the EMP is to record the procedure and methodology for management of mitigation identified for each negative impacts of the Project. The management will clearly delineate the responsibility of various participants and stakeholders involved in planning, implementation and operation of the Project.

8.2 Inclusion of EMP in contract documents

In order to make the Contractors fully aware of the implications of the EMP and responsible for ensuring compliance, technical specifications in the tender documents will include compliance with mitigation measures proposed in the EA 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.

8.3 Construction Environmental Action Plan

Contractors need to prepare site specific management plans to address various environmental issues, and to demonstrate the manner in which the Contractor will comply with the requirements of ECPs and EMP. It will be reviewed and approved by Project Supervision and Implementation Assistance Consultant (PSIAC) and PMU before implementation of construction works.

8.4 Institutional Arrangements

The existing organogram of BID and the proposed organizational structure under PMU for the implementation of the EMP is presented in Figure 7-6.

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8.4.1 BID Project Management Office (PMU)

Balochistan Irrigation Department is the project proponent. The PMU established under the secretary of the BID will monitor and coordinate all project implementation activities. PMU would be responsible for all aspects of project implementation including financial management, procurement, recruitment of staff, consultants and contractors, and overseeing the implementation of EMP.

8.4.2 Environmental and Social Safeguard Unit

It is proposed to create an Environmental and Social Safeguard Unit (ESSU) under PMU, consisting of the following staffs:

- Director, Environmental and Social Safeguard Unit at the executive engineer level.
- Deputy Director Environment at Sub divisional Engineer level,
- Deputy Director Social, and
- Deputy Director Communications.

The responsibilities of the ESSU are: (i) supervising, facilitating and coordinating implementation of environmental and social plans including EMP and SIAMP; (ii) ensuring that contractors follow Balochistan-EPA regulations, World Bank Safeguard Policies, and other requirements mentioned in the EMP; (iii) identifying any issues of non-compliance and report these; (iv) suggesting mechanisms to link contractor performance in relation to the EMP to the timing of financial payments, incentives or penalties; and (v) interacting with stakeholders for their concerns about the construction activities. The ESSU can be part of BID as permanent basis after the completion of the Project.

8.4.3 Project Steering Committee

A Project Steering Committee will be formed to provide strategic guidance and facilitate inter-agency coordination. The members of the committee will be the following:

- Secretary Balochistan Irrigation Department.
- Representative from the Department of Agriculture & Cooperatives
- Representative from the Department of Fisheries
- Representative from the Department of Forest & Wildlife
- Representative from the Department of Livestock & Dairy Development
- Balochistan Environment Protection Agency

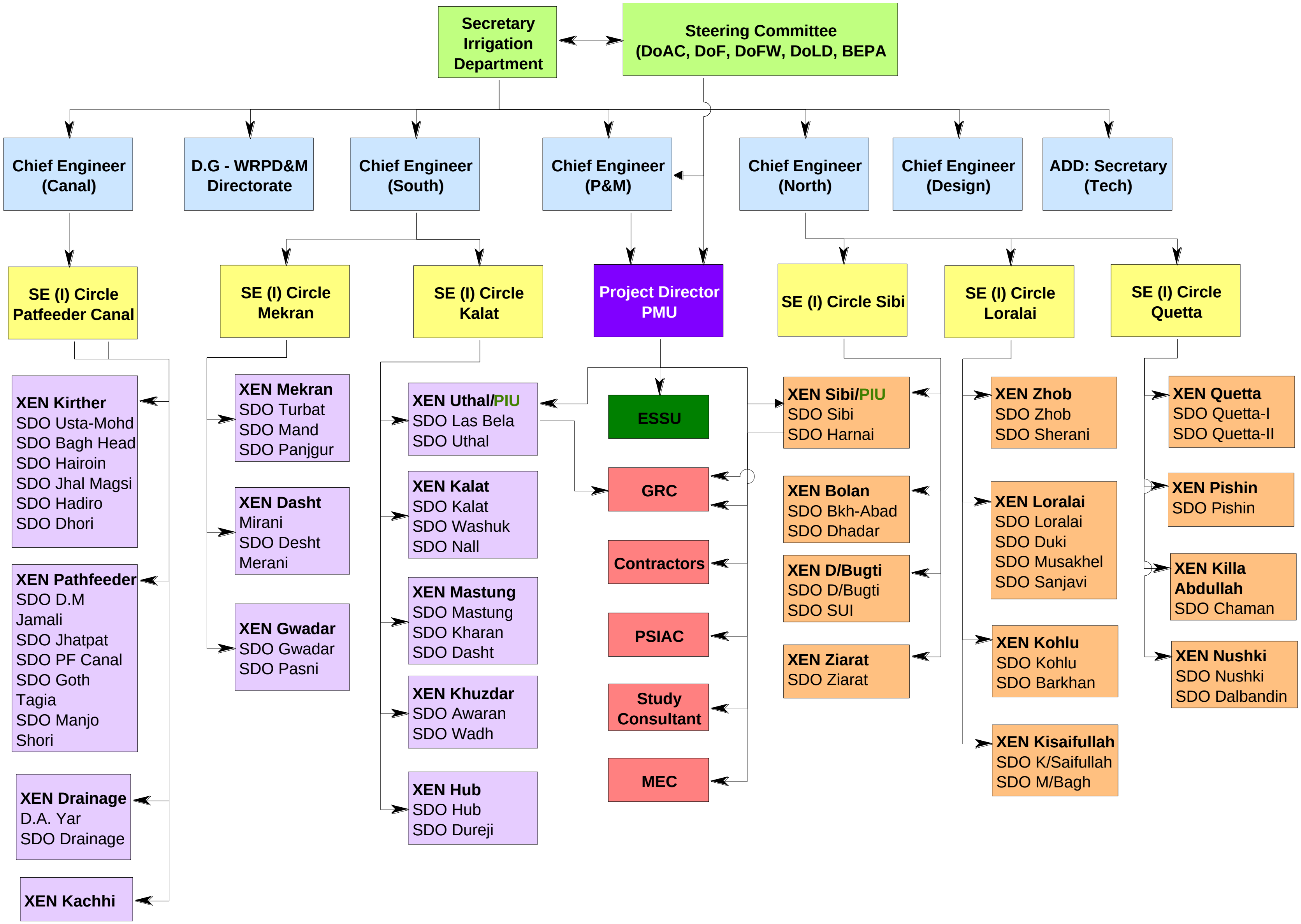

Figure 7-6: Proposed Institutional Structure for Implementation of EMP

8.4.4 Project Supervision and Implementation Assistance Consultant

The PSIAC will be responsible for supervising the contractors for the implementation of EMP and SIAMP. For this purpose, the PSIAC will appoint dedicated environment and social staff to ensure the implementation of environmental and social management plans during the project. They will supervise the contractor for the EMP implementation, particularly the mitigation measures. They will also be responsible for implementing the monitoring of effects of these measures.

PSIAC will have the following environmental staff:

- Environmental specialist
- Social Specialist
- Ecologist
- Occupational Health and Safety Specialist
- Environmental Surveyors

The environment staff of PSIAC will closely supervise the construction team to ensure that all environmental commitments are incorporated into the construction activities and work processes. Specific responsibilities include:

- Supervising and supporting contractors in achieving their responsibilities as outlined in the EMP;
- Issuing non-compliance notices to the contractors;
- Providing input, advice, and approval on activity specific work plans relating to EMP;
- Supervising the implementation of activity specific work plans;
- Regularly reviewing and assessing environmental risks throughout the construction phase;
- Identifying and preparing environmental induction and training materials;
- conducting environmental trainings;
- Assist ESSU in addressing and resolving environment-related complaints and grievances
- Responding to environmental incidents as required;
- Managing compliance reporting as it relates to the Project, and preparing monthly EMP compliance reports;
- Liaise with ESSU for effective environmental management at site;
- Liaise with the Resettlement Office and other relevant Project entities;
- Reviewing EMP and revising it if required on six-monthly basis.

8.4.5 Monitoring and Evaluation Consultant (MEC)

MEC will be recruited by PMU to carry out independent monitoring of implementation of EMP. The MEC will have environmental and social experts and shall carryout intermittent third party monitoring of the project. MEC will also carry out annual third party auditing of EMP and make further modifications if required.

8.4.6 Contractors

Contractors are also required to appoint the following environmental staff for the implementation of EMP in the field, particularly the mitigation measures.

- Environmental coordinator
- Ecologist (specifically to deal with the impacts on dolphins)
- Health and Safety Officer
- Community Liaison Officer
- Human Resources Officer

The contractor will develop various plans directed towards health, safety, the environment and social issues (discussed in Section 8.4.3), and get them approved by the PSIAC. The contractor will also be responsible for communicating with and training of its staff in the environmental/social aspects before the commencement of the physical works on site. Appropriate numbers of the following personnel are required in the contractor's environmental team:

- Environmental coordinator
- Ecologist
- Health and Safety Officer
- Community Liaison Officer
- Human Resources Officer

The construction contract will have appropriate clauses to bind the contractor for the above obligations.

8.4.7 Balochistan Irrigation Department

The Balochistan Irrigation Department (BID) will be the lead Implementing Agency supported by the departments of Agriculture, Forestry, Livestock, and Public Health Engineering. A central Project Management Unit (PMU) in Quetta will incorporate functions from the BID Planning and Monitoring wing and the BID Water Resource Management directorate, supplemented with additional suitably qualified staff. The PMU will be supported by Project Implementation Units (PIUs) in the Nari and Porali river basins, located in the towns of Sibi and Uthal respectively.

8.4.8 Project Director

Led by a Project Director, the PMU will have overall responsibility for project implementation including financial management, procurement, and recruitment of staff, consultants and contractors.

8.4.9 Project Implementation Unit

The PIUs in Sibi and Uthal, led by the Executing Engineers will be responsible for sub-project implementation and community liaison and participation through community and farmer organizations in their respective basins.

8.5 Environmental Management

8.5.1 Environmental Codes of Practice

A set of environmental codes of practice (ECPs) has been prepared for various environmental and social management aspects: ECP 1: Waste Management; ECP 2: Fuels and Hazardous Goods Management; ECP 3: Water Resources Management; ECP 4: Drainage Management; ECP 5: Soil Quality Management; ECP 6: Erosion and Sediment Control; ECP 7: Top Soil Management; ECP 8: Topography and Landscaping; ECP 9: Quarry Areas Development and Operation; ECP 10: Air Quality Management; ECP 11: Noise and Vibration Management; ECP 12: Protection of Flora; ECP 13: Protection of Fauna; ECP 14: Protection of Fisheries; ECP 15: Road Transport and Road Traffic Management; ECP 16: Construction Camp Management; ECP 17: Cultural and Religious Issues; ECP 18: Workers Health and Safety, and ECP 19: Construction and Operation Phase Security. The Contractors will be contractually obligated to comply with these ECPs, presented in Annex B: Checklist of Procedures for Cultural Heritage Finds (archaeological and others).

8.5.2 Mitigation Plans

These mitigation plans have been prepared on the basis of the detailed impact assessment covered under Chapter 6. These plans (Table 8.1) are project-specific, and to the extent possible, site-specific, however contractors will be required to carry out further detailing of the key aspects, to prepare site-specific management plans discussed below.

8.5.3 Project and Site specific Management Plans

These plans are site-specific and where applicable, contract-specific and will be prepared by various contractors prior to the commencement of construction activities. The Plans to be prepared by the contractors for various aspects of the environmental management will mostly include the detailing of the measures included in the ECPs and Mitigation Plans respectively discussed in Sections 8.4.1 and 8.4.2, providing where applicable, location details, layouts and drawings, timelines, roles and responsibilities, methodologies and procedures, and key performance indicators. A brief description of each of these plans is provided below:

Erosion, sediment and drainage control plan will be prepared by the contractor on the basis of ECP 4, 6 and 8, and the mitigation measures given in EA and ESIA. The Plan will be submitted to the PSIAC for review and approval before contractor mobilization.

Pollution Prevention Plan will be prepared and implemented by the Contractor on the basis of ECPs 1, 2, 10, 11, and WBG EHS Guidelines (2007), as well as the mitigation plans given in EA and ESIA. The Plan will be submitted to the PSIAC for review and approval before contractor mobilization.

Waste Disposal and Effluent Management Plan will be prepared and implemented by the Contractor on the basis of ECPs 1, 2, 16 and WBG EHS Guidelines (2007), as well as the mitigation plans given in the EA and ESIA. The Plan will be submitted to the PSIAC for review and approval before contractor mobilization.

Traffic Management Plan will be prepared by the Contractor on the basis of ECP 15 and also the mitigation plans given in EA and ESIA, after discussion with BID and authorities responsible for roads and traffic. The Plan will be submitted to the PSIAC for their review and approval before contractor mobilization. PSIAC will facilitate the integration and coordination of the plans prepared by various contractors to prepare an overall Plan.

Borrow Area Management and Restoration Plan for management and restoration of borrow areas will be prepared by the Contractor on the basis of ECPs 5, 6, 8, 9 and 10 and other requirements described in the mitigation plans. This Plan will aim at minimizing the environmental and social impacts during borrowing activities and restoring as much as possible the original natural situation of these sites by various measures (refill, leveling or smoothening). Restoration methodologies will be included in the Plan. The Plan will be approved by the PSIAC and PMU.

Occupational Health and Safety Plan will be prepared and implemented by the Contractor on the basis of the WBG EHS Guidelines (2007), ECP 18, and other relevant standards. The Plan will be submitted to the PSIAC for review and approval before contractor mobilization.

Drinking Water Supply and Sanitation Plan: Separate water supply and sanitation provisions will be needed for the temporary facilities, labor camp and workshops, in order not to cause shortages and/or contamination. A Plan will be prepared by the Contractor on the basis of ECP 3. The Plan will be submitted to the PSIAC for review and approval before contractor mobilization.

Management Plan for protection of flora and fauna will be prepared by the Contractor on the basis of ECPs 12, 13 and 14 and mitigation measures proposed to address impacts on dolphins. The Plan will be submitted to the PSIAC for review and approval before contractor mobilization.

Construction Camp Management Plan will be prepared by the Contractor on the basis of ECP 16 and also the mitigation plans given in EA and ESIA. The Plan will include the camp layout, details of various facilities including supplies, storage, and disposal. The Plan will be submitted to the PSIAC for review and approval before camp establishment.

Fuel and Hazardous Substances Management Plan will be prepared by the Contractor on the basis of ECP 2 as well as the mitigation plans given in EA and ESIA and in accordance with the standard operating procedures, relevant guidelines, and where applicable, material safety data sheets. The Plan will include the procedures for handling oils and chemical spills. The Plan will be submitted to the PSIAC for review and approval before contractor mobilization.

Emergency Preparedness Plan will be prepared by the Contractor after assessing potential risks and hazards that could be encountered during construction in the Indus and in the floods. The Plan will be submitted to the PSIAC for review and approval before contractor mobilization.

Communication Plan will be prepared by the contractor to demonstrate how they will communicate with local community leaders, provide details regarding employment opportunities at mobilization, and traffic management throughout the construction period. The contractor's communication plan should define a process for receiving, recording and responding to complaints and also monitoring of the success of any responsive action taken to prevent the escalation of any conflicts. The plan will be prepared in compliance with communication strategy provided in the Social Management Framework and Section 9.1.

8.5.4 Integrated Pest Management Plan

An Integrated Pest Management Plan is recommended in the EMP and presented in Annex D of this EA. Integrated pest management (IPM), also known as Integrated Pest Control (IPC) is a broad-based approach that integrates practices for economic control of pests. IPM aims to suppress pest populations below the economic injury level. The PSIAC will review the proposed IPM plan and finalize the plan in consultation with BID and Department of Agriculture.

8.5.5 Cultural Heritage Management Plan

Physical and cultural resources (PCR) are widespread in the Project area. Although, site visits and field surveys carried out the feasibility study concluded that no PCR will be affected by the Project schemes. However, there are potential likelihood of impacts due to the expansion of command area, strengthening of groundwater recharge, and development of improved rangeland. Therefore, it been recommended under this EMP to develop a Cultural Heritage Management Plan (CHMP) during the first year of project implementation. In addition to outlining the management actions to be taken for cultural heritage likely to be affected by the project, the CHMP will also contribute to developing awareness and the knowledge base of cultural heritage in Balochistan. The terms of reference for the CHMP is presented in Annex C.

8.5.6 Social Management

8.5.6.1 Resettlement Policy Framework

The project doesn't require any land acquisition. However, as a part of Social Impact Assessment and Mitigation Plan, a Resettlement Policy Framework (RPF) has been prepared by BID in case of any unforeseen land acquisition is required for the project and also to guide temporary land acquisition by the contractors. The RPF presents (a) principles and legal framework applicable for mitigation of these losses; (b) eligibility and entitlement criteria, (c) valuation methods; and (d) process of preparation of resettlement action plan.

8.5.6.2 Communication Strategy

A formal communication strategy is prepared for the project to lay out various communication needs and outreach tools and explain the responsibility of PMU to convey the awareness of the project impacts and its impacts to various stakeholders. A key aspect of this strategy shall be the communication of any project related impacts

8.5.7 Plans to Address Cumulative Impacts

8.5.7.1 Fish Farming Enhancement Plan

Inland fishery activity is non-commercialized in most of the project area, therefore, no industry related to fisheries has been developed. The only source of fish production in the project area is lagoon and streams of Nari and Porali River. Establishing designated fish ponds in these lagoons under private sector can promote the fish farming. Some private fish ponds were reported to be available in some of the district (such as Sibi),[19] though at a very small scale. Inland fishery in Balochistan is not common primarily due to scarcity of water and lack of awareness among people to use inland fisheries, wherever possible, as means of income. There is a potential of small scale fisheries development in Sibi along Nari River and Lasbela in Porali River but it requires coordinated support and capacity building of the rural population. Under this project, in coordination with the Fisheries department one or two model farm can be established and introduced this potential avenue by campaigning. Provision of free fish fingerlings, soft loans, and construction of farm to market road can induce the small landowners to this source of livelihood. A study is recommended to introduce fish farming (TOR is included in Annex F) with necessary capacity building to enhance fish cultivation in the project area, which includes, (i) Selection of proper location with water availability and quality, (ii) Selection of species suitable for the location identified, since fish is very sensitive to temperature and other climate conditions, (iii) Identify the source of seedlings and the transportation and management, as healthy seedlings must be procured from reliable/reputed dealers, for their survival and growth, (iv) Assess the risk of diseases, monitoring mechanism, and mitigation measures, (v) Identify the capacity of the farmer and recommend the training needs including the women, (vi) Design fishing courses for the community youth emphasizing on small-scale entrepreneurship, and (vii) Identify instruments for strong market linkages for effective disposal of produce.

8.5.7.2 Miani Hor Management Plan

There is a potential in reduction in inflow of freshwater from Porali River and nutrient rich sediments on account of diversion of water under the Project, inflow of pollutants due to higher fertilizer and pesticide use, and human and livestock population pressure for fuelwood and fodder collection have exposed Miani Hor ecosystem to severe environmental and social stress in the form of loss of habitat and biodiversity, decline in fish productivity and social problems for coastal communities. The EA study did not find any management plan for this important site. However, a 2005 IUCN report into the State of Pakistan Mangroves made several recommendations, some of which will form the thrust for the development of management plan for the cumulative impacts. It is recommended to conduct a biodiversity conservation study (TOR is included in Annex F) under the Project to: (i) Carry out extensive studies on the biodiversity of Miani Hor, (ii) Assess the potential of the mangrove ecosystem, its functioning and its relationship with other coastal ecosystems by considering traditional empirical knowledge on mangroves and transfer them to present knowledge, (iii) Develop scientific data on the biodiversity in the area, (iv) Support the preparation of a ten year management plan for Miani Hor in the first year of implementation along with implementation budget (v) Support the implementation of the Miani Hor management plan during the implementation of the Project, and (vi) Involve young and women groups in conservation work by developing culturally sensitive activities.

8.5.7.3 Ziarat Biosphere Reserve Conservation Plan

The linkage of economic benefits of horticulture (mainly from apple and cherry orchards) with water production from the catchments covered with Juniper forests has not been established

[19] GoB (2011); District Development Profile of Sibi District-2011.

properly and as a result the importance of these forests is mainly quoted for biodiversity reasons, only. The failure of this understanding at policy level and lack of awareness among masses may fail any effort to conserve these forests from disappearing. The IUCN prepared a management plan for the Ziarat Juniper Biosphere Reserve in 2013. The plan presents management strategies and prescriptions to encourage community conservation practices and inter-agency cooperation to protect this ecosystem. It is recommended that the project will conduct a biodiversity conservation study (TOR is included in Annex F) of Juniper forest and support the implementation of the 2013 management plan through the following actions: (i) Facilitate access of the local communities to obtain fuel efficient technologies in order to reduce the felling of trees for fuel; (ii) Support forest regeneration activities, (iii) Develop and implement strategies for grazing control in the core zone of the forest, (iv) Identify and implement sustainable livelihood activities for identified communities, while ensuring equitable representation of the various tribes, and (v) Involve young people and women in conservation work by developing culturally sensitive activities in this respect.

8.6 Mitigation Plan

The mitigation plan given in **Table 7-3** is organized around various project activities and includes various actions identified under the mitigation measures discussed in Chapter 6, define responsibilities for implementation as well as monitoring of each action, and also indicate the timing of these actions. Should any changes to the Project design or methods of construction and operation take place post this assessment stage, the impacts and monitoring/mitigation measures discussed may need to be revised to reflect such changes to allow the environmental and social implications of these changes to be addressed.

Table 7-3: Mitigation Plan

Project Activities	Environmental Impacts	Mitigation/Compensation/ Enhancement Measures	Institutional Responsibilities	
			Implementation	Supervision
A. ENVIRONMENTAL AND SOCIAL IMPACTS DURING PRE-CONSTRUCTION STAGE				
Negative Impacts				
A.1 General Design Considerations	Failure of previous similar interventions/ projects and schemes.	• The causes of failure of previous interventions in terms of design and / or construction faults will be studied and incorporated into the detailed designs.	Design Consultant	PMU
	Schemes will only benefit some influential people of the area and not benefit the poor and vulnerable peoples most in need.	• Location of the proposed schemes is identified based on field survey, need assessment, and consultations with local community to have a proper geographical dispersion of interventions to ensure equitable distribution of benefits. • The project intervenes in both basins in a manner that ensures that there are many individual beneficiaries from project activities.	Design Consultant	PMU
A.2 Land Acquisition	About four acres of land may be required on temporary basis for contractor' camp.	• Only government land to be used; no private or community land to be used. • In extreme case where private land acquisition is unavoidable, it will be compensated under the guidelines presented in the resettlement policy framework included in the Social Impacts Assessment and Mitigation Plan.	Design Consultant	PMU
A.3 Design Considerations: Impacts on Ecology, Soil and Land	Sub-basin / Watershed and Scheme site location. Improper selection with reference to site ecology (i.e. improper project siting) may lead to erosion and loss of useful agricultural land.	• Appropriate site selection and design were conducted according to national and the WB guidelines in order to entail no or minimal disturbance to local ecology, soil and land.	Design Consultant	PMU
	Improper site selection and design can lead to removal of vegetation and cutting of trees.	• Schemes located in ecologically sensitive areas not approved, in order to avoid impact on flora /fauna.	Design Consultant	PMU
	Sub-basin / Watershed and Scheme site location may lead to deforestation in the sub-basins.	• Plantation plan / forest / rangeland management consideration during design phase.	Design Consultant	PMU
A.4 Design	Watershed / Scheme	• During design stage, watershed hydrological modelling is being conducted at the	Design	PMU

Project Activities	Environmental Impacts	Mitigation/Compensation/ Enhancement Measures	Institutional Responsibilities	
			Implementation	Supervision
Considerations: Impacts on Surface Water	Site interventions may affect natural drainage / run-off. This can stress local natural stream flow –which may cause surface water quality degradation and contamination of water resources and affect downstream ecology.	scheme site to account for effects on natural drainage and surface water quality.	Consultant	
	Improper design considerations for suspended silt / maintenance of minimum flows may degrade downstream ecology.	• Designs to consider flow regulatory structures / schemes and minimum flow requirements.	Design Consultant	PMU
	Excessive diversion/use of surface water resources may lead to depletion of natural surface water resources.	• Design to consider proper water utilization rates under schemes as not to deplete water resources.	Design Consultant	PMU
A.5 Design Considerations: Impacts on Groundwater	Improper assessment of sub-surface ground water levels prior to design stage for Non-perennial schemes may lead to depletion of ground water resources.	• Extensive ground water table studies have been carried out during feasibility stage. • Schemes are designed according to Ground water recharge/ pumping regulations.	Design Consultant	PMU
	Improper capacity lead to inappropriate fertilizer and pesticide use in irrigation may lead to degradation of sub-surface water	• An integrated pest management plan is prepared under the national regulatory guidance. • Extensive training is designed under the On Farm Water Management Program for the proper use of pesticide.	EA Consultant	PMU

Project Activities	Environmental Impacts	Mitigation/Compensation/ Enhancement Measures	Institutional Responsibilities	
			Implementation	Supervision
	quality and contamination.			
A.6 Contractors' mobilization	If contractors are not made responsible to comply with ESMP, there will be several construction 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 ESA 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 needs to prepare the following site specific management plans to manage and mitigate/reverse potential adverse environmental impacts in compliance with ECPs and mitigation measures proposed in the EA. All these plans are to be reviewed and approved by PSIAC and PMU • Erosion, sediment and drainage control plan • Pollution Prevention Plan • Waste Disposal and Effluent Management Plan • Traffic Management Plan • Borrow Area Management and Restoration Plan • Occupational Health and Safety Plan • Drinking Water Supply and Sanitation Plan • Management Plan for Protection of Flora and Fauna • Construction Camp Management Plan • Fuel and Hazardous Substances Management Plan • Emergency Preparedness Plan • Communication Plan • Construction and Operation Phase Security	Contractor	PSIAC, PMU
B. SOCIAL IMPACTS DURING CONSTRUCTION STAGE				
Positive Impacts				
B.1 Hiring of Workers	Generation of employment.	• Temporary employment for local workers and technicians, local unskilled labors. Also, employment of locals during surveys.	Contractor	PSIAC, PIU
	Increased economic activity.	• Establishment of new businesses and commercial enterprises; local employment. • New market for local produces, more sale and revenue generation. • As a result of the influx of a workforce, there shall be a higher demand for locally produced food, goods and services benefiting local farmers, producers, traders including small shops within project area.	Contractor	PSIAC, PIU
Negative Impacts				
B.2 Land Acquisition	Temporary land acquisition by the	• Only government land to be used; no private or community land to be used.	Contractor	PSIAC, PIU

Project Activities	Environmental Impacts	Mitigation/Compensation/ Enhancement Measures	Institutional Responsibilities	
			Implementation	Supervision
	contractor during construction.	• In extreme case where private land acquisition is unavoidable, it will be compensated under the guidelines presented in the resettlement policy framework included in the Social Impacts Assessment and Mitigation Plan.		
B.3 Increased Traffic	Safety hazards due to increased traffic especially for children and elderly people.	• Traffic Management Plan addressing general access to be implemented. • Safety and security actions and procedures to protect local community during construction phase.	Contractor	PSIAC, PIU
B.4 Occupational Health & Safety	Risk of accidents and unsafe working conditions for workforce.	• Occupational Health and Safety Plan to be implemented. • Emergency Preparedness Plan to be implemented. • Contractor follows IFC Performance; Standards on Labor and Working Conditions; • Safety training for all workers.	Contractor	PSIAC, PIU
B.5 Safety, security, and vandalism	Security risks for workers and project staffs, especially in Porali River basin area.	• Continued consultations with the tribal leaders and local community leaders on security matters. • Security at the work sites and camps. • Identification cards to workers. • Access to the camps must be controlled through gated entrances and entrance and exit logs shall be maintained at each gate. • Preparation and implementation of the contractor's Communication plan to engage local leaders and community. • Implement ECP 19: Construction and Operation Phase Security	Contractor	PSIAC, PIU
	Inadequate construction site security poses a significant risk to assets, construction materials and property. Theft/vandalism of assets, materials and property would increase construction costs and cause delays in project completion.	• Ensure security at the work sites and camps. • Employ night watchman for periods of significant on-site storage or when the area necessitates. • Ensure there is proper fencing around construction site perimeter, chain-link at least 2.4 m high and secured with a steel chain and lock. • Pre-employment screening investigations should be used to verify the applicants relating to their employment, education and criminal history background. • Identification cards to workers • Implement ECP 19: Construction and Operation Phase Security	Contractor	PSIAC, PIU
B.6 Migrant Workers	Possible cultural conflicts between communities and workers.	• Awareness campaign; • Code of conduct for workers. • Grievance mechanism. • Develop and implement strong community participation plan.	Contractor	PSIAC, PIU

Project Activities	Environmental Impacts	Mitigation/Compensation/ Enhancement Measures	Institutional Responsibilities	
			Implementation	Supervision
	Risks of HIV/AIDS and STI due to the flow of migrant workers.	• Awareness creation on HIV/AIDS infection and diseases through a well-designed campaign implementation plan targeting all risk-prone groups. • Empowering women through employment in the construction work.	Contractor	PSIAC, PIU
	Increased pressures on local facilities (i.e., mosques, health care facilities) due to in-flux of migrant labors.	• Construction contractors will provide all required facilities for workers, so workers will not put pressure on local facilities.	Contractor	PSIAC, PIU
B.7 Storage of Materials	Health and safety risk of the community due to the existence of a construction site(s) and the storage and use of hazardous chemicals.	• The Contractor shall follow IFC EHS guidelines. • If there are any hazardous materials, they shall be safely stored on construction site locations under lock and key.	Contractor	PSIAC, PIU
B.8 Construction Activates	Temporary interruption of irrigation water supply during construction works.	• Prepare construction schedule to avoid farming seasons. • For longer construction scheme, the contractor shall be prohibited from interrupting the water supply to any canal or reducing it below the allocated discharge of these canals by proving diversion canals on the section where work is planned on priority basis. • The Contractor shall programme the Works to utilize the low water demand periods in the command area. • The Contractor shall submit a construction schedule to the Engineer for approval on mobilization. If in case, the closure of water supply is unavoidable, the Contractor needs to share his plan with the farmers and get their consensus.	Contractor	PSIAC, PIU
C. ENVIRONMENTAL IMPACTS DURING CONSTRUCTION STAGE				
Negative Impacts				
C.1 Air Pollution	Emissions of dust and air pollution will be generated from excavation works, operation of construction equipment and vehicles, material transport, and site clearance	• Water the soil surface and any non-asphalted roads, especially in the dry season. • Water the soil before starting excavating. • The storage and handling of spoil, subsoil, topsoil and materials should be carefully managed to minimize the risk of wind-blown material and dust. • Cover hauling vehicles carrying dusty materials moving outside the construction site. • Fit vehicles with appropriate exhaust systems and emission control devices. • Limit the idling time of vehicles not more than 2 minutes. • Implement ECP 10: Air Quality Management.	Contractor	PSIAC, PIU

Project Activities	Environmental Impacts	Mitigation/Compensation/ Enhancement Measures	Institutional Responsibilities	
			Implementation	Supervision
C.2 Clearing of Vegetation and Trees	Clearing of natural vegetation and trees in project areas. There may also be pressure on forests (illegal logging) by influx of workers.	• Vegetation clearance shall be limited to the extent required for execution of works. • Avoid cutting down of tree species of conservation significance and those that are protected, even those that act as nesting and breeding sites. • Tree planation will be carried out in and other suitable areas near the river training works at a ratio of 5 new trees per each tree cut. • Contractor will follow ECPs 12 and 13 on Protection of Flora and Fauna while tree cutting. • Include environmental management and awareness as part of training for employees during construction.	Contractor	PSIAC, PIU
C.3 Creation of Access Routes	Access routes will damage the land quality as well as standing crops.	• Construction Contractors will be prohibited from using agricultural lands for access routes.	Contractor	PSIAC, PIU
C.4 Earthworks	Fertile top soils that are enriched with nutrients required for plant growth or agricultural development will be impacted	• Strip the top soil to a depth of 35 cm and store in stock piles of height not exceeding 2m. • Remove unwanted materials from top soil like grass, roots of trees and others. • Spread the topsoil to maintain the physico-chemical and biological activity of the soil. The stored top soil will be utilized for covering all disturbed area and along the proposed plantation sites. • Implement ECP 7: Top Soil Management	Contractor	PSIAC, PIU
C.5 Excavation Works	Excavation works will impact on the loss of habitats especially the terrestrial invertebrates that live in the ground.	• Avoid construction during the rainy season • Minimize digging of trenches and vegetation clearance to minimum required level.	Contractor	PSIAC, PIU
C.6 Noise and Vibration Pollution	Operation of piling activities, excavation, operation of heavy equipment and transport vehicles, and blasting operation will cause noise and vibration affecting workers and the nearby population.	• Construction activities near settlements will be limited to day time only (8AM – 6PM). • High noise producing equipment will be provided with mufflers or acoustic enclosures. • Install acoustic enclosures around generators and install temporary noise control barriers where appropriate to reduce noise levels. • Fit high efficiency mufflers to appropriate construction equipment. • Notify affected communities in advance regarding major noisy operation, e.g. blasting. • Implement ECP: 11 Noise and Vibration Management	Contractor	PSIAC, PIU
C.7 Construction	Impact on surrounding environment and	• During construction phase the contractor site camps should be properly managed. Water usage, fuelwood cutting, deforestation, trees injury should be avoided.	Contractor	PSIAC, PIU

Project Activities	Environmental Impacts	Mitigation/Compensation/ Enhancement Measures	Institutional Responsibilities	
			Implementation	Supervision
Camps	communities from Construction Camps	Community of the area should not be affected. Proper sanitation and construction machinery should be maintained according to environmental standards. • The Contractor needs to establish main and site camps. The main camp may be a rented building in the Lasbela city and will be for the Contractor project management staff while site camps shall be for the labour and Contractor's machinery operators. The site camps shall be located where the construction works are in progress.		
C.8 Increased movement of traffic	Increased Traffic on local roads will affect access to the trading centre and, houses close to the road, deteriorate safety (especially the school children), spillage of fuels and chemicals, and damage to infrastructures and properties due to vibration	• Contractor will implement traffic management plan to ensure uninterrupted traffic movement during construction. • Restrict truck deliveries, where practicable, to day time working hours. • Restrict the transport of oversize loads. • Enforce on-site speed limit, especially close to the sensitive receptors, schools, health centres, etc. • Implement ECP 15: Road Transport and Road Traffic Management • Inspect structures within the close proximity of construction site for damages.	Contractor	PSIAC, PIU
C.9 Contamination and Effluents	Contamination of soil and water due to the accidental spills and leakage of fuels and chemicals.	• Contractor will prepare and implement Pollution Prevention Plan and ECP. • Implement ECP 2: Fuels and Hazardous Goods Management • Contractor to confine the contaminants immediately after such accidental spillage • Contractor to collect contaminated soils and washouts containing petroleum products treat and dispose them in environment friendly manner • All areas intended for storage of hazardous materials to be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation	Contractor	PSIAC, PIU
	Impact of spoils, solid waste, and waste effluents.	• Implement ECP 1 Waste Management and ECP 2 Fuels and Hazardous Goods Management. • Siting of fuel and hazardous material storage sites, including refuelling facilities, batching plants and construction yards are to be located outside the flood embankments and at least 500 m away from any residential areas. • Hazardous waste will be disposed of by designated contractors.	Contractor	PSIAC, PIU
C.10 Impact of borrow and quarry activities	Impact of borrow and quarry activities.	• Borrow/quarry areas will be developed close to the project area for extraction of earth material and aggregates for river protection works. • No private lands or agriculture lands will be used for borrowing. • Minimize volume of borrow material by using dredged material generated from the	Contractor	PSIAC, PIU

Project Activities	Environmental Impacts	Mitigation/Compensation/ Enhancement Measures	Institutional Responsibilities	
			Implementation	Supervision
		project. • The use of explosive should be used as low as possible to reduce noise, vibration, and dust. • Control dust and air pollution by application of watering. • Photographs recorded of each borrow area showing pre-construction baseline for comparison with after rehabilitation • Implement ECP 9: Quarry Areas Development and Management.		
C.11 Archaeological and Religious Sites	Disturbance/damage to unidentified archaeological asset or graveyard.	• No archaeological sites are reported with in the construction areas. However, in case any artefact or site of archaeological, cultural, historical, or religious significance are discovered during construction activities, the works will be stopped in that area, and the appropriate department will be informed.	Contractor	PSIAC, PIU
	Disturbance to sites of religious importance	• Location of all schemes at a safe distance from sites of religious importance, however, if sites of religious significance are encountered during construction activities, the works will be stopped in that area, and the appropriate department will be informed, as outlined in the chance finds procedure (Annex B).	Contractor	PSIAC, PIU
	Likely impacts on Physical and Cultural Resources	• An additional study to develop a cultural heritage management plan will be carried out in the first six months of the project. Terms of Reference are provided in Annex C.	Consultant	ESSU/PMU
C.12 Construction Activities: Impacts on Ecology, Wildlife and habitats	Loss of faunal habitat at locations of construction works, camp, staff quarters and on access/haul routes due to the felling of trees. Fragment and lead to loss of critical habitats for resident and migratory birds.	• Minimize construction in the critical habitats of birds. • Care should be taken to make sure bird nests are not destroyed. If there is no option available, rehabilitate them in other neighbouring trees. Also protect and rehabilitate injured or orphaned birds. • Use of existing access road and limit the width of new access roads. • Implement ECP 13 Protection of Fauna for species with conservation significance especially endangered and near threatened.	Contractor	PSIAC, PIU
	Deforestation and loss of habitat may affect the Balochistan black bear (found in Ziarat, Kalat and Khuzdar), which is a critically endangered species.	• Tree clearance shall be limited to the extent required for execution of works. • Contractor will follow ECP 12: Protection of Flora while tree cutting • Implement ECP 13: Protection of Fauna for species with conservation significance especially endangered and near threatened. • Include environmental management and awareness as part of training for employees during construction	Contractor	PSIAC, PIU
	Impact on river habitats (i.e., breeding	• Control of sediment flow from the construction activities • Silt curtains along river training works to control sediment runoff.	Contractor	PSIAC, PIU

Project Activities	Environmental Impacts	Mitigation/Compensation/ Enhancement Measures	Institutional Responsibilities	
			Implementation	Supervision
	and nesting sites)	• Minimize and restrict clearing of riverine vegetation as much as possible. • Implement ECP 13 Protection of Fauna for species with conservation significance especially endangered and near threatened. • Project activities are mostly confined to the diversion of flood water or diversion sub-surface water through Perennial Irrigation Schemes, so are not expected to affect the fish and marsh crocodile, which mostly reside in lagoon areas.		
	Loss of temporary breeding pools and pans due to refilling by construction soil or gravel.	• Schedule construction during the dry season to reduce impact since the amphibian populations will be low during non-breeding season • Fence off the trenches with nets to prevent amphibians falling into the trap. • Implement ECP 13 Protection of Fauna for species with conservation significance especially endangered and near threatened.	Contractor	PSIAC, PIU
C.13 Construction Activities: Impacts on Downstream and Protected Areas	Impact on downstream river habitats from construction activities, such as construction of flood protection and river training works. The Porali River and its tributaries drain into the Miani Hor, a designated Ramsar site.	• Control of sediment flow from the construction activities. • Implementation of ECPs, including ECP 1 Waste Management and ECP 2 Fuels and Hazardous Goods Management. • Silt curtains along river training works to control sediment runoff.	Contractor	PSIAC, PIU
D. SOCIAL IMPACTS DURING OPERATION & MAINTENANCE STAGE				
Positive Impacts				
D.1 Overall Project Implementation	Access to irrigation water, farming capacity and technology, flood protection, potable water supply, watershed and rangeland management, and environmental protection.	• Benefit 705,579 people (about 86,549 households) by 8 Irrigation, 16 Potable Water, and 2 Flood Protection schemes; improved Watershed and Rangeland Management, and environmental protection of protected and wetland areas.	MEC	PMU
D.2 Improvement of Irrigation	Access to improved irrigation system and improved water use	• Improved irrigation system and improved water use practices will lead to a considerable increase in cultivatable land, thus increase crop production and improve income and livelihoods of farmers.	MEC	PMU

Project Activities	Environmental Impacts	Mitigation/Compensation/ Enhancement Measures	Institutional Responsibilities	
			Implementation	Supervision
System and Water use Practices	practices	• The implementation of project will result in increased crop production, resulted by increase in cropping intensity from 20% to 100% and improvement in yield /acre. • Productivity of crops is expected to more than double after project implementation. • After project implementation, in the Porali River basin, total crop production is expected to increase from 184,235 tons to 450,627 tons (an increase of 266, 392 tons). • The irrigation sub-projects and on-farm water management practices are expected to benefit 544,490 people (68, 061 households). • It is expected that by 2021, 77,000 ha of additional land will be under improved irrigation.		
D.3 Flood Protection Works	Damage of command areas by flood waters	• Prevention of floods from entering into the command area by constructing flood protection works, will improve the livelihood of the population and protect crops, • Flood schemes will reduce the likelihood of devastating damage and the economic burden associated with recovery following the flood. • Flood protection works are expected to directly benefit 81,760 people (10, 220 households) and protect 14, 557 ha of land. • The estimated avoided damages/year due to flood protection works are in USD $753,882, $462,271, $124,720 and $1,340,873 for infrastructure, livestock production, crop production, respectively. • Construction of flood water diversion structure will play a pivotal role in increasing the income of households at farm level. This will help in increasing the area under cultivation along with cultivation of improved varieties. • Flood water diversion schemes in the province will help in improving the family nutrition through availability of better and nutritious food and thus contribute to better health of households.	MEC	PMU
D.4 Opportunities for Women	Loss of opportunities for women and social uplift	• Project will enhance opportunities for women to participate in profitable agriculture, by tailoring interventions to their specific needs and by promoting gender equity in rural communities. • It is expected that 352,789 women will benefit directly from implementation of Irrigation Schemes, Potable Water, Flood Protection and Watershed and Rangeland Management.	MEC	PMU
D.5 Water Supply to Communities	Water supply and waterborne disease in the Project area.	• Potable water supply sub-projects are expected to directly benefit 29,220 people (3, 653 households). • Lifestyle in surrounding areas will be improved by ensuring sustained supply of potable water. • Sanitation and water borne diseases in the area will be improved. • Sustained water supply will contribute significantly on reduction to households spending on water borne diseases.	MEC	PMU

<table>
<tr><th rowspan="2">Project Activities</th><th rowspan="2">Environmental Impacts</th><th rowspan="2">Mitigation/Compensation/ Enhancement Measures</th><th colspan="2">Institutional Responsibilities</th></tr>
<tr><th>Implementation</th><th>Supervision</th></tr>
<tr><td></td><td></td><td>• Improvement in livestock quantity and composition due to consistent availability of water will improve economic income and food security of people.</td><td></td><td></td></tr>
<tr><td rowspan="4">D.6 Social Implications due to improved watershed and rangeland management:</td><td>Poor Watershed and Rangeland Management.</td><td>• Watershed management activities will be undertaken in both Project river basins, including soil and water conservation measures, rainwater harvesting and plantations.
• About 280,161 people (32,960 households) are expected to benefit from the implementation of the improved Watershed and Rangeland Management practices.</td><td>MEC</td><td>PMU</td></tr>
<tr><td>Biomass productivity for sustenance.</td><td>• Production of fuel wood for use by low income households.</td><td>MEC</td><td>PMU</td></tr>
<tr><td>Social forestry jobs</td><td>• Will create local jobs for harvesting timber and non-timber products.</td><td>MEC</td><td>PMU</td></tr>
<tr><td>Grazing area and food stock for livestock.</td><td>• Improvement in livestock (quantity and composition) due to more consistent food stock availability for grazing animals.
• Develop livestock potential of the area through management of pasture lands</td><td>MEC</td><td>PMU</td></tr>
<tr><td colspan="3">Negative Impacts</td><td></td><td></td></tr>
<tr><td rowspan="2">D.7 Management and Maintenance of Project</td><td>Social disturbance due to poor expectation management of the project.</td><td>• Make formal arrangement for continued communication and engagement with local stakeholders, in the form of a community engagement cell.
• Hire an independent monitoring consultant, for regular monitoring of the project.
• Ensure consistent communication with local communities, even if there are hurdles in project implementation</td><td>MEC</td><td>PMU</td></tr>
<tr><td>Low system efficiency due to poor maintenance.</td><td>• Development and implementation of a proactive maintenance plan for the proposed project/site with predefined periodicity.
• Monitoring on regular basis at each project /site location and reporting maintenance status.</td><td>MEC</td><td>PMU</td></tr>
<tr><td>D.8 Restriction on Open-access Grazing</td><td>Restriction on open-access grazing may affect livelihoods of farmers.</td><td>• Development of comprehensive and fair rotational grazing plan.
• All users of grazing land will be given equal rights and access.</td><td>MEC</td><td>PMU</td></tr>
<tr><td rowspan="2">D.9 Downstream and Protected Areas</td><td>Alteration of Ecological flows of the Porali River may have an effect on the fish and shrimp in Miani Hor and thus impact livelihoods' of people which depend on these resources.</td><td>• Environmental flow assessments are determined to maintain the hydrological regimes and provide protection of river flows and ecosystem characteristics.
• Assessments show that the minimum environmental flow required for Porali River is 0.111 BCM and after diversion and consumption 0.582 BCM water will be released downstream, which is more than 5 times minimum requirements. Thus, there should be no negative impact.</td><td>MEC</td><td>PMU</td></tr>
<tr><td>More cultivated land will lead to increased</td><td>• Disseminate information regarding sustainable use of fertilizers and insecticides to keep the use at an optimal level.</td><td>MEC</td><td>PMU</td></tr>
</table>

Project Activities	Environmental Impacts	Mitigation/Compensation/ Enhancement Measures	Institutional Responsibilities	
			Implementation	Supervision
	usage of pesticides and fertilizers, which have negative effect on downstream areas, especially the Miani Hor and eventually impact the livelihoods of people.	• A comprehensive education and awareness programme for farmers; development of a biodiversity database; community-based sustainable use programmes. • The ESMP included an Integrated Pest Management plan.		
E. ENVIRONMENTAL IMPACTS DURING OPERATION & MAINTENANCE STAGE				
Positive Impacts				
E.1 Protection and Conservation	Groundwater recharge	• Improved recharge of ground water tables in the project area by water storing techniques and plantation. • Improved watershed and rangeland management technologies to improve soil moisture retention, reducing erosion and improving groundwater recharge.	MEC	PMU/BID
	River morphology and flood protection.	• The regulated hydrology regime will be more beneficial for the overall ecosystem health, even with reduced total quantity of water, than the current erratic regime. • Flood water diversion schemes will bring very positive impact on the environment through increased fodder and agriculture crop production, which would take off pressure from the rangelands of the area in terms of provision of fodder and fuelwood. • Flood water diversion scheme will also help in increasing the productivity of ecosystems and will therefore attract more faunal species in the area. This will help in maintaining and increasing the biodiversity in the project/scheme area.	MEC	PMU/BID
E.2 Watershed and Rangeland Management: Environmental Implications	Highland pastures and biomass	• Prevent grazing on degraded land, protect areas with good natural regeneration potential, reseeding/sowing rangelands with palatable species, • Establish grazing management plans based on carrying capacities, and construction of watering ponds for livestock. • Planting of palatable shrubs and trees and reseeding of grass as well as introduction of stall feeding based on fodder production • Rangeland management will introduce rotational grazing and stocking rate limits. • At the irrigation scheme level, watershed management will include drainage improvement, soil and water conservation measures and rehabilitation/protection of irrigable land degraded/endangered by erosion gullies.	MEC	PMU/BID
	Soil erosion	• River basin level activities will include soil and water conservation measures (e.g., hillside drains, contour trenches, rainwater harvesting in micro-catchments and plantations). • Construction of water conservation and erosion control works (e.g., loose and pack	MEC	PMU/BID

<table>
<tr><th rowspan="2">Project Activities</th><th rowspan="2">Environmental Impacts</th><th rowspan="2">Mitigation/Compensation/ Enhancement Measures</th><th colspan="2">Institutional Responsibilities</th></tr>
<tr><th>Implementation</th><th>Supervision</th></tr>
<tr><td></td><td></td><td>stone check structures, groundwater recharge ponds, gabions, Kareze rehabilitation, streambed ponds, ditches etc.).
• Improved watershed and rangeland management technologies to improve soil moisture retention, reducing erosion and improving groundwater recharge.
• By 2021, it is expected that 70,000 ha of land area with high erosion risk will be treated.</td><td></td><td></td></tr>
<tr><td></td><td>Destruction of ecosystem and deforestation.</td><td>• Conservation of two important ecosystems in Balochistan, namely the Juniper forest in the catchment areas of Nari river basin and the Mangroves forest in the delta of Porali river basins.
• The Project will supplement existing environmental protection and conservation of juniper and mangrove forests.
• Reforestation efforts will also help in the recovery of the critically endangered Balochistan Black Bear.</td><td>MEC</td><td>PMU/BID</td></tr>
<tr><td colspan="3">Negative Impacts</td><td></td><td></td></tr>
<tr><td>E.3 Fertilizers and Pesticides</td><td>Enhanced/ induced use of fertilizers and pesticides due to increased cultivation.</td><td>• An Integrated Pest Management (IPM) plan (Annex E) is being prepared as part of the EMP and will be implemented during project operation stage.
• Disseminate information regarding sustainable use of fertilizers and insecticides to keep the use at an optimal level.
• A comprehensive education and awareness program on sustainable fertilizer use is planned under On Farm Water Management component.
• Development of a biodiversity database; community-based sustainable use programmes; developing and strengthening the protected areas system; developing a policy for ex-situ conservation of biodiversity; developing an effective policy framework and enabling legislation; and developing institutional capacity to manage biodiversity.</td><td>MEC</td><td>PMU/BID</td></tr>
<tr><td>E.4 River Water use for Agriculture</td><td>High Residual Sodium Carbonate levels in river water can cause crusting of seed beds, temporary saturation of the surface soil, high pH and the increased potential for diseases, weeds, soil erosion, lack of oxygen and inadequate nutrient availability.</td><td>• Farmers will be educated on best practices to solve the RSC problem, which will include some of the following:
– Injection of sulfuric acid to dissociate the bicarbonate ions (PH around 6.2) giving off carbon dioxide. It allows the calcium and magnesium to stay in solution in relation with the sodium content.
– Add gypsum when soils have low free calcium plus leaching.
– Add sulfur to soils with high lime content plus leaching</td><td>MEC</td><td>PMU/BID</td></tr>
</table>

Project Activities	Environmental Impacts	Mitigation/Compensation/ Enhancement Measures	Institutional Responsibilities	
			Implementation	Supervision
E.5 Downstream, Mangrove Forest and Wetlands	Diversion will alter the natural flow rates and hydro period, degrade bankline and riparian habitats, and alter aquatic community structure and diversity in downstream areas. This may have a negative effect on the ecosystems in the Miani Hor.	• At the feasibility level, Porali and Nari flows are not assessed to be negatively impacted by the project in terms of their vitality for Miani Hor. • Assessments show that the minimum environmental flow required for Nari and Porali Rivers are 0.082 BCM and 0.111 BCM[20] and that after diversion and consumption, 1.005 BCM and 0.582 BCM water will be released downstream, which is 12 times and 5 times more than the minimum requirements of these rivers.	MEC	PMU/BID
	Pesticide residue in water bodies	• Based on secondary information organochlorine pesticide residue in water is low but high in sediments in Miani Hor. • Monitoring of organochlorine pesticide residue is recommended to establish the baseline during the early stage of project implementation and follow-up monitoring to compare with the baseline. • The concentrations of DDT, HCH, Aldrin, Dieldrin, Endrin and Heptachlor in marine biota of Miani Hor are very low than the limit of Carcinogenicity from fish consumption as set by United States Environmental Protection Agency.	MEC	PMU/BID
	Limited sediment discharge in Maini Hor	• Porali is a seasonal river that drains only when there is rain in its catchment area so very seldom it makes any impact on the water quality of Miani Hor.[21] • Sediment will be evenly distributed both in project schemes and downstream stretches.	MEC	PMU/BID

[20] ADB TA 4560-PAK (2008); Supporting Implementation of IWRM Policy in Balochistan, Asian Development Bank, the Philippines.
[21] Syed, N. A. et. Al (2014); A Study of the Dynamics of Miani Hor Coastal Lagoon, Pakistan and Failure of Damb Fish Harbour, International Journal of Science and Technology Volume 3 No. 8.

8.7 Monitoring Plan

During feasibility study the baseline monitoring was limited. It is proposed that during the early stage of implementation additional extensive monitoring is conducted to set-up an appropriate baseline condition. Proposed monitoring plan to be carried out during pre-implementation, implementation and operation stages of the project to establish the baseline condition and ensure contractors compliance with the mitigation measures and evaluation of the Project impact on post-completion is given in Table 7-4 along with the monitoring indicators and frequency. The PSIAC will be responsible for supervision of implementation of the plan. The total cost of monitoring has been estimated at USD 0.65 million.

Table 7-4: Environmental Monitoring Plan

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implementation	Supervision
Surface water flow and quality	10 locations (8 at the scheme level and two in the downstream discharge points (one before Hamal lake and one before Miani Hor discharge points)	Sampling and analysis of river water quality and waste water discharges for the parameters given in NEQS 2000 and Organochlorine Pesticides	Monthly during monsoon	Contractor	PSIAC, PMU
			Quarterly	Contractor	PSIAC, PMU
			Annually	External Monitor (PMU through a nationally recognized laboratory)	PSIAC, PMU
		Spot measurements of pH, conductivity, turbidity; visual inspection of presence of petroleum products	Monthly	PSIAC	PSIAC, PMU
Sediment quality	2 samples from downstream locations at Hamal Lake and Miani Hor	Laboratory measurements of organochlorine pesticide residue	Quarterly	External Monitor (PMU through a nationally recognized laboratory)	PSIAC, PMU
			Annually		MEC, PMU
Marine biota	Miani Hor	DDT, HCH, Aldrin, Dieldrin, Endrin and Heptachlor in marine biota of Miani Hor	Quarterly	External Monitor (PMU through a nationally recognized laboratory)	PSIAC, PMU
			Annually		MEC, PMU
Groundwater quality	16 samples, one from each water supply schemes	Sampling and analysis of groundwater quality for drinking water	Quarterly	Contractor	PSIAC, PMU
			Annually	External Monitor (PMU through a nationally recognized laboratory)	PSIAC, PMU
Air Quality (dust, smoke)	Along the access and haul road	Visual inspection to ensure good standard equipment is in use and dust suppression measures (sprinkling) are in place	Daily	Contractor	PSIAC, PMU
	Along the access and haul road	Visual inspection to ensure dust suppression work plan is being implemented	Daily	Contractor	PSIAC, PMU
Air Quality	Along the access	Air quality monitoring	Quarterly	Contractor	PSIAC, PMU

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implementation	Supervision
(PM_{10}, NO_2, SO2, CO_2, CO)	and haul road	for 24 hours for the parameters specified in NEQS 2000	Annually	External Monitor (PMU through a nationally recognized laboratory)	PSIAC, PMU
Emissions from plant and equipment	Close to construction area	Visual inspection	Monthly	Contractor	PSIAC, PMU
Noise and vibration	Close to noise generating equipment and road	24 hour noise monitoring	Quarterly	Contractor	PSIAC, PMU
		24 hour noise monitoring	Annually	External Monitor (through a nationally recognized laboratory)	PSIAC, PMU
		Spot measurements	Monthly	PSIAC	PSIAC, PMU
Waste Management	Storage and camp area	Visual inspection that solid waste is disposed of at designated sites	Monthly	Contractor	PSIAC, PMU
Spills from hydrocarbon and chemical storage	Storage area	Visual inspection for leaks and spills	Monthly	Contractor	PSIAC, PMU
Operation of borrow sites	Borrow and quarry areas	Visual inspection of quarry sites	Monthly	Contractor	PSIAC, PMU
Biodiversity monitoring	Miani Hor	Collection of information on presence, seasonal behavior and biotope characteristics of aquatic species and flora in selected locations	Half yearly	PMU through Study Consultant	PSIAC, PMU
Traffic safety		Visual inspection to ensure Traffic Management Plan is implemented	Monthly	Contractor	PSIAC, PMU
Local roads		Visual inspection to ensure local roads are not damaged	Monthly	Contractor	PSIAC, PMU
Drinking water and sanitation		Ensuring construction workers are provided with safe water and sanitation facilities on site	Weekly	Contractor	PSIAC, PMU
Safety of workers		Usage of personal protective equipment	Monthly	Contractor	PSIAC, PMU
Erosion		Visual inspection in all areas where run-off leaves bare and at important drainage features (ditches, gullies, etc.) after major rainfall events	Weekly	Contractor	PSIAC, PMU
Reinstatement of work sites		Visual Inspection	After completion of all works	Contractor	PSIAC, PMU
Plantation		Visual inspection to	Monthly	Contractor	PSIAC, PMU,

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implementation	Supervision
		ensure plantations are growing well			External Monitor

8.8 Capacity Building and Training

The environmental and social trainings will help to ensure that the requirements of the EMP are clearly understood and followed by all project personnel. The primary responsibility of providing these trainings to all project personnel will be that of the contractor and PSIAC. The trainings will be provided to different professional groups separately such as managers, skilled personnel, unskilled labors, and camp staff. Capacity building will be aimed at strengthening the PMU, PIU, and operational staff in the field of environmental management and social development. Members of the ESSU responsible for supervision of environmental and social mitigation measures would be trained in environmental management, environmental quality control, ecology, environmental awareness, participatory approach and social development. The contractor will also be required to provide environmental and social trainings to its staff, to ensure effective implementation of the EMP. A budget of USD 0.25 million has been earmarked for capacity building. The training plan shall include a program for the delivery of intermittent training, to cover the subjects included in Table 7-5. Training should be carried out initially at induction of staff and repeated throughout the project.

Table 7-5: Training Subjects for Inclusion in Contractors Training Plan

Training Subject	Target Audience
Environmental Code of Practices	All staff
Handling, use & disposal of hazardous material	Construction workers with authorised access to hazardous material storage areas and required to use hazardous material during their works
Waste Management	All staff (construction and camp staff)
Efficient& safe driving practices, including road & vehicle restrictions	Drivers & mobile plant operators
Actions to be taken in the event of major or minor pollution event on land	All construction staff
Use of flexible booms and surface skimmers in event of pollution event in water	All construction staff working on diversion weir, headwork structure and canals
Pollution prevention: Best practice	All staff
Health & Safety: Safe way to work & hazard awareness	All construction staff and O&M Staff
Health & Safety: Safe use of plant & equipment	Operators of plant & equipment
Health & Safety: Working at height	Staff colony and regulator construction staff
Health & Safety: Working near/on water	All construction staff working on diversion weir, headwork structure and canals
Health & Safety: Working near/on water	All construction staff working on barges
Health & Safety: Use of PPE	All construction staff
Occupational Health and Safety	To all persons entering the construction site
Emergency procedures and evacuation	All staff
Diver training	All divers
Spill clean-up training	Contractor's spill management staff
Fire fighting	All staff
Site inductions, including requirements under the Environmental Management Plan & details of environmentally sensitive areas of the site	All staff
Culturally sensitive awareness rising on HIV/AIDS and the spread of sexually transmitted diseases.	All staff

Training Subject	Target Audience
Awareness raising on risks, prevention and available treatment of vector-borne diseases	
Cultural sensitivities of the local population	On induction of all non-local staff

8.9 Audits and Annual Review of EMP

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

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

8.10 Grievances

Grievance Redress Mechanism (GRM) & Grievance Redress Committee (GRC) to deter fraud and corruption, mitigate risks, provide practical suggestions to project staff (on accountability, transparency and responsiveness), assess effectiveness of internal processes and increase stakeholder involvement in the project. The GRM will include an independent Grievance Redress Committee (GRC) to resolve complaints chaired by a retired Judge of High or Civil Court. The chairperson will act as an independent third party on the GRC. Any complaints not resolved by GRC will be passed on to the PSC for resolution. The PSC will act as a higher level GRC to resolve major and complex grievances; a copy of any such complaints will be sent to the Bank. The recommended members of the Grievance Redress Committee are shown in **Table 7-6**. More detailed information on GRM is presented in SIAMP.

Table 7-6: Grievance Redress Committee

Representative	Position
Retired Judge	Chairman
Head of PMU	Secretary
ESSU Representative	Member
Project Implementation Unit	Member
Community Representative(s) or GFP[22]	Member(s)
Project Supervision and Implementation Assistance Consultants Representative	Member
Contractors Representative	Member
Agriculture Department Representative	Member

8.10.1 Mechanism for Grievance Redress under the Project

It is proposed to follow the procedure listed below, prior to commencing the Project implementation activities including pre-construction:

- Establish a Public Complaints Centre (PCC) in the project office, which will be responsible to receive, log, and resolve complaints;
- Establish a Grievance Redress Committee (GRC) in the PMU office, to oversee the functioning of the PCC.

[22] The Grievance Focal Points (GFPs) will be literate people from each community that will assist and facilitate the community members in reporting grievances resulting from project activities.

- Form a non-judicial decision-making authority, e.g., Project Steering Committee, for resolving grievances that cannot be resolved by GRC.
- Form Grievance Focal Points (GFPs), which will create awareness among the population in each community. The GFPs will be community members who easily approached by the community. The GFPs will be provided training by the ESSU staffs of PMU.

8.10.2 GRM Steps and Timeframe

The following are the procedures (**Figure 7-7**) and timeframes of the grievance redress mechanism:

- *Stage 1*: When a grievance arises, the affected person may contact directly with the contractor/operator and the project manager to resolve the issue of concern. If the issue is successfully resolved, no further follow-up is required;
- *Stage 2*: If no ad hoc solution can be found, the affected person/s will submit an oral or written complaint to the PCC by themselves or through GRC entry points (the CFP, PIU, Contractor/Operator). For an oral complaint the GRC must make a written record. For each complaint, the GRC must investigate the complaint, assess its eligibility, and identify an appropriate solution. It will provide a clear response within five (5) working days to the complainant received by GRC/PIU/Contractor. The GRC will, as necessary, through PIU; instruct the Contractor to take corrective actions. The GRC will review the Contractor's response and undertake additional monitoring. During the complaint investigation, the GRC will work in close consultation with the Contractors, and the PSIAC (during construction) and with the PMU representatives (during operation). The contractors during the construction and the PIC during operation should implement the redress solution and convey the outcome to the PCC within seven (7) working days;
- *Stage 3*: If no solution can be identified by the GRC or if the complainant is not satisfied with the suggested solution under Stage 2, the GRC will organize, within two (2) weeks, a multi-stakeholder meeting under the auspices of the PD-PMU, where all relevant stakeholders (i.e., the complainant, PIU, contractor/operator, relevant local government offices) will be invited. The meeting should result in a solution acceptable to all, and identify responsibilities and an action plan. The contractors during construction and the PIU/field office during operation should implement the agreed-upon redress solution and convey the outcome to the GRC within seven (7) working days;
- *Stage 4*: If the multi-stakeholder hearing process is not successful, the GRC will inform Project Steering Committee (PSC) accordingly, and the PSC will organize a special meeting to address the problem and identify a solution; and
- *Stage 5*: If the affected people are still not satisfied with the reply in Stage 4, he or she can go through to local judicial proceedings (Court of Law).

8.10.3 Grievance Reporting

The GRC will record the grievance, investigate, and after subsequent actions, the results will be included in the monthly project progress reports. In the construction period and the initial operation and maintenance period covered by loan covenants, the project proponent will periodically report progress to the World Bank. This will include reporting of complaints and their resolution.

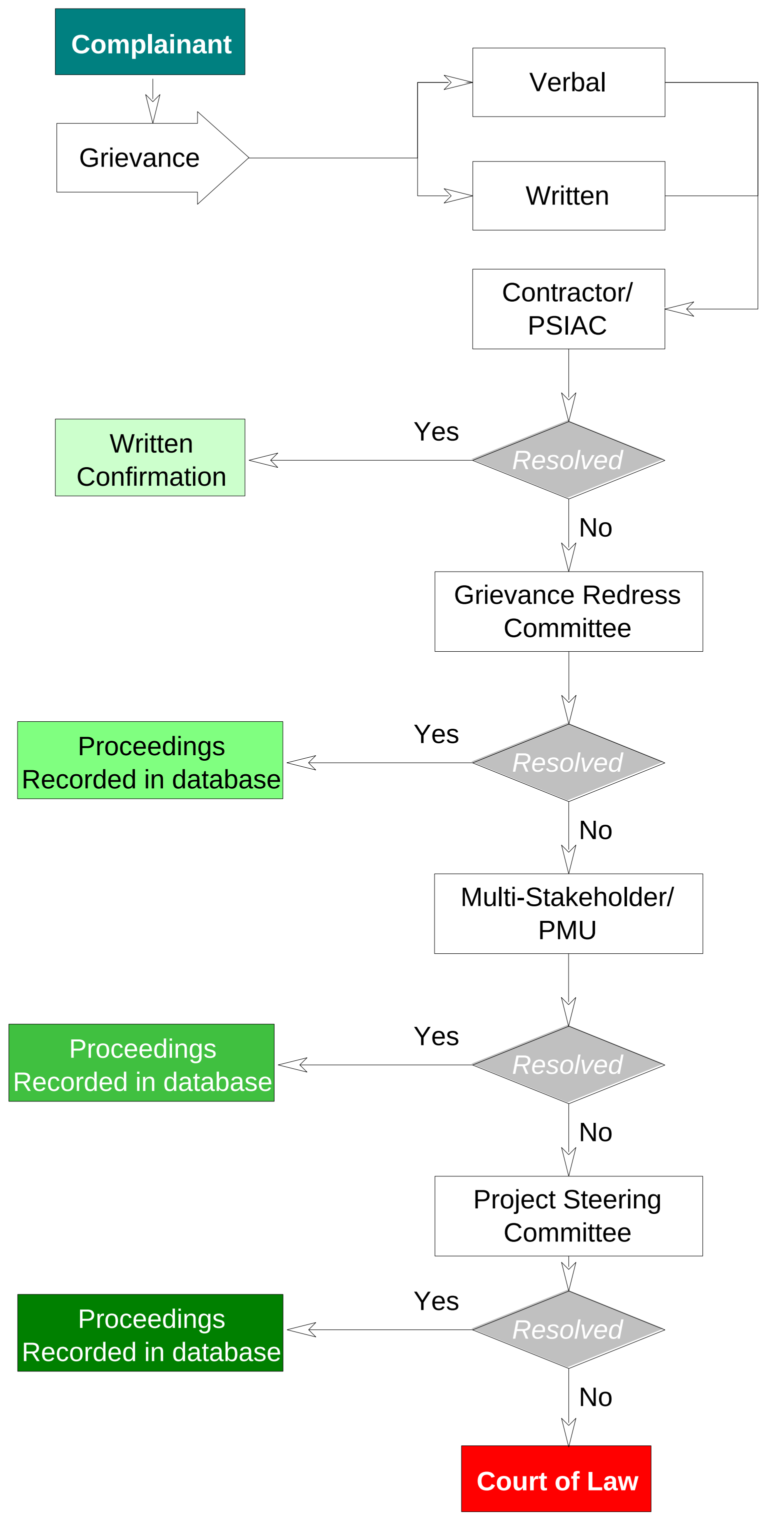

Figure 7-7: Grievance Redress Mechanism

8.11 Reporting

Proper arrangements are necessary for recording, disseminating and responding to information that emerges from the various environmental monitoring and management programs. They are also necessary for rendering the environmental management systems “auditable.” The PSIAC will prepare monthly reports covering various aspects of the EMP implementation including compliance and effects monitoring, capacity building, and grievance redressal during project implementation. MEC will prepare reports during post-completion. List of reports to be prepared during implementation and operation stages are presented in **Table 7-7**.

Table 7-7: Reporting during implementation and operation stages

Report	Contents	Prepared by	Distribution
Monthly	Non-Compliances observed on sites and actions required	Environmental/Social team of the Engineer (PSIAC)	ESSU – PMU; MEC; BID, Contractor
Monthly	Actions taken on site in response to PSIAC Monthly report Project progress and works to be undertaken in the coming three months Details of training delivered Details of accidents reported and actions taken	Contractor	PSIAC ESSU – PMU; MEC
Quarterly	Quarterly review on implementation of EMP including compliance and effects monitoring, capacity building, and grievance redressal	ESSU – PMU	PMU, PEPA; BID, DoAC, World Bank, PSIAC, Contractor
Semi-Annual	Semi-annual reporting for OHS, including workhours, number of lost-time accidents/incidents, serious injuries and fatalities, amount of lost time, root cause investigations, etc. There should also be some incident reporting requirements, such as for major spills, fatalities, local unrest, etc.	ESSU – PMU	PMU, PEPA; BID, DoAC, World Bank, PSIAC, Contractor
Annual	Results of effects monitoring Independent review of environmental and social performance on site Recommended actions required by all parties	MEC	PMU, Balochistan EPA BID, DoAC World Bank, PSIAC, Contractor

8.12 Cost of EMP

The cost of implementing the EMP is USD 29.14 million. Details of EMP costs are given in **Table 7-8**.

Table 7-8: EMP Implementation Cost Estimates

Sl.	Description	Estimated Cost (million USD)
1	Watershed and Rangeland Management (also included with project cost)	19.64
2	OFWM Demonstration (also included with project cost)	2.24
3	Implementation of EMP by Contractor (also included with project cost)	1.00
4	Environmental staff in PSIAC	0.75
5	ESSU staff in PMU	0.50
6	Internal auditing	0.25
7	Capacity building, institutional strengthening	0.25
8	Monitoring of air, noise, sediment, biota, and water quality	0.40
10	Tree plantation and landscaping	0.25
11	Biodiversity Conservation and Fisheries Studies (TOR is provided in Annex F)	1.33
12	Cultural Heritage Management Plan (TOR is provided in Annex C)	0.10
13	Communication Strategy	0.25
14	Monitoring and Evaluation Consultant	1.93
15	Contingencies	0.25
	Total	**29.14**

9 Stakeholder Consultation and Disclosure

9.1 Overview

Consultations were held with various stakeholders during the preparation of this Environmental Assessment and its accompanying Social Assessment. The consultations involved institutions, non-governmental organizations and communities at both basins. During the first round of consultations, stakeholders were informed about the project and the study team solicited opinions and concerns in order to consider into the project design.

The consultations were carried out with consideration for the social and cultural contexts in the project areas: as group dialogues, individual household discussions, and focused group discussions, including with women. A conscious attempt was made to include all the tribes in the project area in the discussions to ensure that all groups are duly consulted. Different teams carried out the consultations and the summaries of findings are presented in this chapter. Details of consultation records are presented in Annex G to this report and in the Social Assessment reports of each Basin.

9.2 Consultation Process

Several meetings were held with communities and institutional stakeholders between April 2014 and October 2015. A public consultation workshop took place on 19 March 2014, which involved Community Based Organizations and individual members of the communities. Representatives of the landowners association, local councilors, and other interest groups attended this meeting which was conducted in local language.

Additional consultations were conducted through small group meetings in 46 potentially affected villages. People who were consulted included village elders, school teachers/government employees living in a particular village, or owner of a reasonable size of land. Table 9-1 presents a summary of the consultation meetings.

The consultation revealed that project-affected people are either unaware or are ambivalent towards proposed development schemes. This general lack of awareness was evident through slight disapproval at some instances, possibly due to the fear of relocation. During field surveys and the group meetings, the team engaged in discussion with the communities, explain about the project to create awareness of the Project, explain basic requirements of the schemes, heard specific requests and views of the community.

Besides consulting with the population living in or around the sites those are potentially affected by the Project, the consultants also met the major institutional stakeholders, including the Government line departments and the NGOs working in the area. The proponent of the project, i.e., BID, facilitated the consultation by sending letters to all concerned departments, and also helped in getting appointments. Table 9-1 presents the details of the consultation meetings.

Table 9-1: Summary of the consultation meetings held

Place and date	Villages /institutions represented	Tribes / interests represented	Profile of individuals consulted
March 19th, 2014 Winder	Public consultation workshop	Various stakeholders	Community members
8 April, 2014	Mr. Farooq Khajjak	BSSIP, Irrigation Department	Procurement Engineer

Place and date	Villages /institutions represented	Tribes / interests represented	Profile of individuals consulted
8 April, 2014	Mr. Naseer Khan Kashani	EPA Balochistan	Director General
8 April, 2014	Mr. Zeeshan ul Haq	Fisheries & Balochistan Coastal Development Authority	Secretary
9 April, 2014	Mr. Inam Ullah	Agriculture Irrigation & Extension Department	Director Planning
9 April, 2014	Mr. Abdullah Shah	Irrigation Department	Chief Engineer South
9 April, 2014	Mr. Akhter Bazai		Chief Conservator Forests
8 April, 2014	Dr. Noor Ahmed Baloch	Livestock Department	
ND	Mr. Jahanzeb	Coastal Association for Research & Development (CARD)	Coordinator
11 July, 2014	Mr. Tahir Qureshi	IUCN	
6 and 7 September 2015 Manzaki and Jahangeer Shore	• Manzaki • Basharat Manzaki • Jahangeer Shore	• Luni • Shadozai Kakar	Farmers
8 and 9 September 2015 Din Mohammad Qilla	• Kili Asadullah khan • Saedo chena Kala Khan • Ghazi Chena • Din Mohammad Qilla	• Tareen • Ustranai	Farmers
10 and 11 September 2015 Ismail Shahar	Ismail Shahar	• Tareen	Farmers
3 and 4 October 2015 Sardar Khudaidad House	Khajak Village	• Hameemzai • Isaqzai • Khoshi • Bahramzai • Omarzai • Karyazai • Doulatzai • Jafarzai	Farmers
5 and 6 October 2015 Sardar M. Usman House	Luni Village	• Luni	Farmers
5 and 7 October 2015 Malak Azizullah	• Marghzani Village • Killi Shdanzai	• Shodanzai • Malazai • Bostanzai	Farmers

Place and date	Villages /institutions represented	Tribes / interests represented	Profile of individuals consulted
House		• Marghzani • Safi	
9 and 10 October 2015 Malak Dad House	• Dephal Village	• Sardar khel • Rashidkhel • Bugtti Baloch • Balailzai • Ayoubzai • Ghulam Bolak	Farmers
11 and 12 October 2015 Nawab Ghous Bux Barozai House	• Kurak Village • Gulo Shahar Qadeem	• Lalozai • Barozai • Bijarzai • Khuldband • Mahmoodzai • Rind	Farmers

9.3 Consultation Feedback

Stakeholders concerns and proposed mitigation are summarized in Table 9-2. Figure 9-1 shows the participants of the public consultation workshop.

Table 9-2: Stakeholders concerns and proposed mitigation

Concerns	Proposed Mitigations	Action Points
These schemes will only benefit some influential of the area	Geographical dispersion of interventions to ensure equitable distribution of benefits	The project addresses this concern by intervening in both river basins in a manner that ensures that there are many individual beneficiaries from project activities. As a result, geographical dispersion was one of the determining criteria applied to select the high potential schemes during scheme design.
There might be no compensation for displacement of resident.	Project to ensure due compensation to all Project Affected Persons (PAPs), if there are any, under WB safeguard policy OP 4.12	The Project will ensure compensation as per the Resettlement Policy Framework stipulated in the SIAMP.
Trifurcation structure should be constructed 3 ft below the ground level instead of 3 ft above	Detailed design to consider this	During the detailed design of the schemes, best engineering practices will be applied.
If the major amount of water is utilized in the upstream areas, then the ground water in the downstream areas will be decreased	The Project will only divert water for irrigation purpose. There will be no major storage infrastructure in upstream, which can influence the downstream flow.	Only diversion schemes are planned under in the Project, which has little influence in downstream water flow. In addition, the Project has considered watershed and rangeland management to improve soil moisture retention, reduce erosion and improve groundwater recharge.
Rehabilitate existing structures like Liari existing weir, which is constructed on Titan khore	Project already focusing on rehabilitating existing structures as much as possible	Rehabilitation of existing schemes were considered under the project. Schemes with higher potential, low risk of implementation, and higher

Concerns	Proposed Mitigations	Action Points
		economic return are finally included in the Project.
Many plans are made but nothing on ground takes place.	Ensure consistent communication with local communities, even if there are hurdles in project implementation	Continuous consultation is recommended during project implementation to keep the communities informed about the development of the Project.
The project should plan ahead for at least 20 years.	Expected life of smaller structure is 30 years; for medium structure 50 years; and for Kud dam ~ 100 years	All schemes are designed based on future water demand and supply, life of the structures, and anticipated future development in the command/serving area.
Flawed designs of dams and other such schemes have in the past not only resulted in public money, but have also caused havoc to the local population.	Best design practices to be adopted; designs to be vetted by independent experts	BID will ensure solid engineering design of the structures. In addition, the World Bank team will provide oversight on both technical matters and ensure compliance of the Bank's safeguard instruments.
Spillway of the dams should be very properly planned. Material and planning should be of best quality. Dam height should be optimum.	Best design practices to be adopted; designs to be whetted by independent experts	There is no dam included in the selected schecmes.
Spillway water may support fishing and agriculture	Formulate project steering committee; it could look into this and other possibilities and coordinate accordingly	Proposal has been made to conduct a study to introduce fish farming with necessary capacity building to enhance fish cultivation in the project area.
People living close to the proposed intervention sites will be the major beneficiaries. It should be ensured that those living at a distance also benefit from it	Ensure traditional water rights are not altered. Accommodate some small benefits (e.g. potable water supply tank) for downstream communities	Various schemes, such as perennial irrigation, flood protection and potable water supply schemes are included in the project to cover a wider geographic area in both river basins.
Water calculation should be rechecked before going ahead with the project	Best design practices to be adopted; designs to be vetted by independent experts	BID will ensure solid engineering design of the structures. In addition, the World Bank team will provide oversight on both technical matters and ensure compliance of the Bank's safeguard instruments.
Independent monitoring mechanism should be put in place for the project	Formulate project steering committee; engage IMC for environmental monitoring	A monitoring and evaluation consultants is included in the Project design to monitor both environmental and social aspects of the project during the Project implementation and operation stages.
The project will have no direct benefits for Winder. Winder river has better flow than Porali river. There were some structures previously built, but now they stand completely destroyed.	Winder is outside the project scope	Winder was excluded from the Project using the criteria at the early stage of the Project.

Figure 9-1: Public consultation meeting

Figure 9-2 presents the consultation meetings with various institutions. Table 9-3 presents the concerns raised by the institutional stakeholders, mitigation proposed, and action points considered under the Project.

Balochistan EPA

Coastal Development Authority

Chief Conservator Forests

IUCN Representative

Figure 9-2: Consultation meeting with institutional stakeholders

Table 9-3: Concerns raised by Institutional Stakeholders

Concerns	Proposed Mitigations	Action Points
Top priority must be given to preserve perennial water sources.	Proposed project focuses mainly on perennial water, most interventions are PIS.	Perennial irrigation schemes are given higher priority in the Project. A total of 34,975 ha of command area will be brought under perennial irrigation scheme.
Traditional Karez system has largely been replaced by Tube-wells. This transformation has many downsides: firstly, tube-wells take up energy; secondly, it is leading to unsustainable groundwater use leading to groundwater depletion; and thirdly, this practice socially leads to individualism as opposed to community ownership intrinsic in the Karez system.	The Project to ensure traditional water rights remain intact, and consistent surface water is available to discourage the use of tube wells	The Project promotes the use of surface water and watershed and rangeland management to improve soil moisture retention, reduce erosion and improve groundwater recharge.
Dam should be for irrigation purposes, especially in case of Balochistan. Power production is not an option.	All three proposed dams considered during the pre-feasibility stage are for water storage, and irrigation.	The Project excluded all dam based irrigation from the selected schemes.
Ground water recharge will probably not be a significant result of the proposed project.	Performance monitoring of the project may entail a scientific research to monitor ground water recharge and temporal data generation	The Project has considered watershed and rangeland management to improve soil moisture retention, reduce erosion and improve groundwater recharge. In addition, the Project has considered, 30 Groundwater monitoring wells, which will monitor groundwater table in the project area.
Dam command area development should be taken into account and properly planned.	Project proposed steering committee to ensure command area development through relevant line department	Only high priority and low implementation risk schemes are considered in the Project.
Inter-department coordination is necessary for the success of this project.	Formulate project steering committee having representation from all relevant line departments and other	The Project proposed to establish a steering committee consisting of relevant line departments including BID, Department of Agriculture &

Concerns	Proposed Mitigations	Action Points
	stakeholders	Cooperatives, Department of Fisheries, Department of Forest & Wildlife, Department of Livestock & Dairy Development, and Balochistan Environment Protection Agency.
Groundwater recharge is a necessity	Performance monitoring of the project may entail a scientific research to monitor ground water recharge and temporal data generation	The Project has considered watershed and rangeland management to improve soil moisture retention, reduce erosion and improve groundwater recharge. In addition, the Project has considered, 30 Groundwater monitoring wells, which will monitor groundwater table in the project area.
Proposed interventions on the downstream flows into the Arabian sea should be studied minutely, as the river drains into a Ramsar site i.e. Miani Hor.	EA for individual schemes to take this into account. At the feasibility level, Porali flows are not assessed to be negatively impacted by the project in terms of their vitality for Miani Hor	None of the schemes under the project are within the close proximity of the Miani Hor, and hence no scheme wise EA is necessary to address the impact on Miani Hor. However, the EA has recommended to conduct additional studies on Miani Hor and supplement some of the existing management practices.
Strong monitoring arrangement during post project implementation.	Engage Independent Monitoring Consultants; project team to have at least one dedicated environmental specialist	The services of a Monitoring and Evaluation Consultant is recommended in the Project to conduct independent monitoring and evavaluation during implementation and operation stages.
Project should consider including water storage and distribution system for fishermen, along the same lines as is done in Gwadar and Jeevani.	Accommodate some small benefits (e.g., potable water supply tank) for downstream communities	Sixteen village water supply schemes are considered in the Project to supply potable water to 29,000 people.
The project could also identify potential aquaculture sites upstream, for example the proposed dam at the Kud river, in order to partially shift the burden from catch-culture.	Formulate project steering committee; it could look into this and other possibilities and coordinate accordingly	Proposal has been made under the EMP to conduct a study to introduce fish farming with necessary capacity building to enhance fish cultivation in the project area.
The project should not result in reduction of coastal vegetation cover.	No cutting of trees to be allowed in the mangrove system by the project. cutting of any terrestrial trees to be strictly after permission from forest department	None of the finally selected schemes under the Project are located close proximity of the coastal area.
Build a large dam on Porali at Nimmi	The proposed geographical spread of the interventions is more viable economically, ecologically and socially	More emphasis was given on wider geographical distribution of schemes to serve maximum population and maximize the benefits.
The project should encourage and promote fodder crops at its operational stage. Livestock dispensary and model dairy farm should be considered.	Formulate project steering committee; it could look into this and other possibilities and coordinate accordingly	Rangeland management under the Project will focus on pastures and biomass production by “regulation” or planting activities. Regulation activities will include preventing grazing on degraded land, protecting areas with good natural regeneration potential, reseeding/sowing rangelands with palatable species, establishment of grazing management plans based on carrying capacities, and construction of watering ponds for livestock. Planting

Concerns	Proposed Mitigations	Action Points
		activities will include planting of palatable shrubs and trees and reseeding of grass as well as introduction of stall feeding based on fodder production.
The regulated hydrology regime will be more beneficial for the overall ecosystem health, even with reduced total quantity of water, than the current erratic regime	Three dam projects were considered during the pre-feasibility stage and excluded from the project after detailed study.	This will require huge investments in upstream to regulate the flow by creating large storage reservoirs. This option has also disdvantages and was not considered under the Project.

9.4 Disclosure

The EA will be submitted to Balochistan-EPA and disclosed in the World Bank's Infoshop. The EA summary will be translated into Urdu. The Executive Summary, in English and Urdu, will be presented in the BEPA's website.

Annexures

Annex A: Biodiversity lists

Recorded Fish species in Miani Hor.

	Scientific Name	Family	English name	Local name
1	*Albula vulpes*	*Albulidae*	Bonefish, ladyfish	Viat
2	*Arius maculates*	*Ariidae*	Spotted catfish	Kun, Gullo
3	*Arius tenuispinis*	*Ariidae*	Thinspine catfish	Kun, Gullo
4	*Arius thalassinus*	*Ariidae*	Giant catfish	Kun, Gullo
6	Ancharius brevibarbis	*Arridae*		
7	*Strongylura strongylura*	*Belonidae*	Banded needlefish	Aabre, Aalore
8	*Pseudorhombus arsius*	*Bothidae*	Largetoothed flounder	Swaso
9	*Alepes djedaba*	*Carangidae*	Shrimp scad	Bangra,
10	*Carangoides chrysophrys*	*Carangidae*	Longnose trevally	Bangra, kakkar
11	*Caranx sexfasiatus*	*Carangidae*	Bigeye trevally	Bangra, kakkar
12	*Caranx para*	*Carangidae*	Banded scad	Bakko
13	*Scomberoides commersonnianus*	*Carangidae*	Blacktip leatherskin	Aal,Saram
14	*Scomberoides tol*	*Carangidae*	Slender qeenfish	Aal, Saram
15	*Trachinotus baillonii*	*Carangidae*	Small spotted dart	Sonaf
16	*Trachinotus blochii*	*Carangidae*	Snubnose pompano	Sonab
17	*Trachurus indicus*	*Carangidae*	Arabian scad	Seem, Chum-ma
18	*Parastromateus niger*	*Carangidae*	Black pomfret	Kala-poplet
19	*Chirocentrus dorab*	*Chirocentridae*	Dorab wolf herring	Pashant
20	*Chirocentrus nudus*	*Chirocentridae*	Whitefin wolf- herring	Pashant
21	*Nematalosa nasus*	*Clupeidaae*	Kelee shad	Kolgar
22	*Sardinella gibbosa*	*Clupeidaae*	Goldstipr Sardine	Lugger, Luar
23	*Sardinella longiceps*	*Clupeidaae*	Oil Sardine	Lugger, Luar
24	*Dussumieria acuta*	*Clupeidae*		
25	*S. gibbosa*	*Clupeidae*		
26	*Anodontostoma chacunda*	*Clupeidae*	Shortnose Gizzard Shad	Goi
27	*Ilisha megaloptera*	*Clupeidae*	Bigeye ilisha	Bee-chum
28	*Opisthopterus tardoore*	*Clupeidae*	Tardoore	Portuk
29	*Cynoglossus arel*	*Cynoglossidae*	Largescale Tonguesoles	Munsa swasoo
30	*Cynoglossus puncticeps*	*Cynoglossidae*	Tonguesoles	sole
31	*Cynoglossus bilineatus*	*Cynoglossidae*	Tonguesoles	Munsa swasoo
32	*Dasyatis zugei*	*Dasyatidae*	Stingrays	pittan
33	*Himantura walga*	*Dasyatidae*	Stingrays	pittan
34	*Drepane punctata*	*Drepanidae*	Spotted batfish	Rupichand
35	*Drepane longimana*	*Drepanidae*	Batfish	Rupichand
36	*Coilia dussumieri*	*Engraulidae*	Dussumier's flag-tail anchovy	Patia
37	*Thryssa dussumieri*	*Engraulidae*	Thryssa	Padni
38	*Thryssa hamiltonii*	*Engraulidae*	Thryssa	Padni
39	*Gerres filamentosus*	*Gerreidae*	Long-rayed silver-biddy	Jerkeri
40	*Gerres oyena*	*Gerreidae*	silverbiddy	Jerkeri
41	*Bolepthalmus dusumeri*	*Gobiidae*	Mud skipper	------

	Scientific Name	Family	English name	Local name
42	*Plectorhinchus gibbosos*	*Haemulidae*	Black sweetlip	Dhotri-gisser
43	*Pomadasys kaakan*	*Haemulidae*	Grunter	Kumpo
44	*Pomadasys maculatum*	*Haemulidae*	Saddle grunt	Tantar
45	*Pomadasys olivaceum*	*Haemulidae*	Olive grunt	Kumpo
46	*Pomadasys stridens*	*Haemulidae*	Striped grunt	Kumpo
47	*Pomadasys argenteus*	*Haemulidae*	Silver grunt	Kimpo
48	*Hyporamphus limbatus*	*Hemiramphidae*	Congaturi halfbeak	
49	*Hemiramphus far*	*Hemiramphidae*	Blackbarred halfbeak	Thute
50	*Lactarius lactarius*	*Lactariidae*	White milkfish	Bukko
51	*Gazza minuta*	*Leiognathidae*	Toothpony	Neela punto
52	*Leiognathus equulus*	*Leiognathidae*	Common Ponyfish	Kaanteri
53	*Leiognathus blochii*	*Leiognathidae*	Ponyfish	Kaanteri
54	*Secutor insidiator*	*Leiognathidae*	Pugnose ponyfish	Kaanteri
55	*Lethrinus nebulosus*	*Lethrinidae*	Emperors	Mulla
56	*Lutjanus johnii*	*Lutjanidae*	John's snapper	Hira
57	*Lutjanus argentimaculatus*	*Lutjanidae*	Mangrove red snnaper	Hira
58	*Megalops cyprinoides*	*Megalopidae*	Tarpon	Kinarhal
59	*Liza subviridis*	*Mugilidae*	Green back mullet	Chhodi
59	*Liza melinoptera*	*Mugilidae*	Large scale gery Mullet	Boi, Mori
60	*Liza carinata*	*Mugilidae*	Keeled mullet	Boi, Mori
61	*Mugil cephalus*	*Mugilidae*	Large scale mullet	Pharra, Boi
62	*Valamugil cunnesius*	*Mugilidae*	Long arm mullet	Pharra, Boi
63	*Valamugil speigleri*	*Mugilidae*	Speigler's mullet	Murbo
64	*Nemipterus japonicus*	*Nemipteridae*		
65	*Scolopsis vosmeri*	*Nemipteridae*	Whitecheek monocle bream	Kolonto
66	*Platycephalus indicus*	*Platycephalidae*	Bartail flathead	Kuker
67	*Plotosus lineatus*	*Plotosidae*	Striped eel catfish	Robila
68	*Pomadasys maculatum*		Haemulidae	
69	*Psettodes erumei*	*Psettodidae*	Indian flounder	Hajjam
70	*Rhinobatos annandalei*	*Rhinobatidae*	Guitarfish	Zahro
71	*Paranibea semiluctusa*	*Sciaenidae*		
72	*Nibea albida*	*Sciaenidae*		
73	*Argyrosomus hololepidotus*	*Sciaenidae*	Southern meagre	Sooli
74	*Protonibea diacan*	*Sciaenidae*	Jewfish	Sua
75	*Johnius dussumieri*	*Sciaenidae*	Silver Jewfish	Mushka
76	*Johnius belangerii*	*Sciaenidae*	Jewfish	Mushka
77	*Otolithes rubber*	*Sciaenidae*	Rosy jewfish	Mushka
78	*Scomberomorus koreanus*	*Scombridae*	Korean seerfish	Kalgund
79	*Scomberomorus commerson*	*Scombridae*	Barred Spanish mackerel	Gore
80	*Scomberomorus guttatus*	*Scombridae*	Spotted Spanish mackerel	Kulgun
81	*Rastrelliger kanagurta*	*Scombridae*	Indian mackerel	Bangra
82	*Lagocephalus lunaris*	*Tetradontidae*	Lunartail puffer	Tooro
83	*Epinephelus tauvina*	*Serranidae*	Greasy reefcod	Gissar
84	*Epinephelus diacanthus*	*Serranidae*	Thornycheek grouper	Gissar
85	*Epinephelus coioides*	*Serranidae*	Orrangespotted grouper	Gissar
86	*Sillago sihama*	*Sillaginidae*	Silver whiting	Hashoor
87	*Acanthopagrus berda*	*Sparidae*	Black Bream	Tintle
88	*Acanthopagrus latus*	*Sparidae*	Yellofin seabream	Tintle

	Scientific Name	Family	English name	Local name
89	*Crenidens crenidens*	*Sparidae*	Karanteen seabream	Kissi
90	*Sparidentex hasta*	*Sparidae*	Sobaity seabream	Dathi
91	*Sphyraena putnamiae*	*Sphyraenidae*	Barracuda	Kund
92	*Pampus argenteus*	*Stromateidae*	Silver pomfret	Achopito,
93	*Terapon jerboa*	*Teraponidae*	Jerbua terapon	Ginghra
94	*Trichiurus lepturus*		Trichiuridae	
95	*Lepturacanthus savala*	*Trichiuridae*	Hairtail	Talwar
96	*Muraenesox bagio*	*Muraenesocidae*	Pike conger	Bam
	Sousa chinensis		Humpback dolphin	

Flora of Ziarat Juniper Reserve, IUCN 2013

	Species	Vernacular Name	Family	CITES/IUCN Red List
1	*Pistacia Khinjuk Stocks.*	Buzgai	*Anacardiaceae*	--
2	*Coriandrum sativum Linn.*	Dhanya	*Apiaceae*	--
3	*Foeniculum vulgare Mill.*	Kumala	*Apiaceae*	--
4	*Traychyspermum baluchistanicum E. Nasir.*		*Apiaceae*	--
5	*Eremurus persicus(Jaub.&Spach) Boiss*		*Asphodelaceae*	--
6	*Eremurus stenophyllus (Boiss.&Bushe) Baker*	Shezgi	*Asphodelaceae*	--
7	*Artemisia maritima Linn*	Tarkha sperah (Zeher)	*Asteraceae*	--
8	*Artemisia stricta Edgew*	ZhusaneTurkha	*Asteraceae*	--
9	*Conyzabon ariensis (Linn.) Cronquist*		*Asteraceae*	--
10	*Lactuca orientalis (Boiss.)Boiss.*		*Asteraceae*	--
11	*Lactuca sarriola Linn.*		*Asteraceae*	--
12	*Sonchusasper (Linn) Hill.*		*Asteraceae*	--
13	*Xanthium strumarium Linn*	Chota	*Asteraceae*	--
14	*Berberis baluchistanica Ahrendt.*	Tor zaralga	*Berberidaceae*	--
15	*Berberis calliobotrys Aitch.&Koehne*	Shin zaralga	*Berberidaceae*	--
16	*Berberis densiflora Boiss.&Bushe*	Soorzaralga	*Berberidaceae*	--
17	*Onosma hispidaWall.exG.Don.*	Yarilang	*Boraginaceae*	--
18	*Carthamus oxyacantha M. Bieb.*		*Campanulaceae*	--
19	*Chenopodium foilosum Aschers.*	Goosefoot	*Chenopodiaceae*	--
20	*Salsola paulseniiLitv.*	Jaghun	*Chenopodiaceae*	--
21	*Hertia intermedia (Boiss) O.Ktze.*	Munglian	*Companulaceae*	--
22	*Convolvulus arvensis Linn.*	Bachki	*Convolvulaceae*	--
23	*Convolvulus spinosus Brum.f.*	Vatke	*Convolvulaceae*	--
24	*Ephedra intermedia Schrenk.*	Uman	*Ephedraceae*	Least Concern*
25	*Ephedra procera Fisch. & May*	Uman	*Ephedraceae*	--
26	*Andrachnet elephioides Linn*	Ghuazarpara	*Euphorbiaceae*	--
27	*Astragulus tribuloides Del.*		*Fabaceae*	--
28	*Caragna ambigua Stocks.*	Makhi	*Fabaceae*	--
29	*Medicago sativa Linn*	Spishta	*Fabaceae*	--
30	*Sophoramollis (Royle) Baker*	Zagherah	*Fabaceae*	--

	Species	Vernacular Name	Family	CITES/IUCN Red List
31	*Marrubium vulgare Linn.*		*Lamiaceae*	--
32	*Mentha longifolia (Linn)*		*Lamiaceae*	--
33	*Nepeta glomerulosaBoiss*	Chinganbuti	*Lamiaceae*	--
34	*Peroviskia abrotanoides Karel.*	Shinshobay	*Lamiaceae*	--
35	*Phlomis spectabilis Falc. ex Benth*	Kundulay	*Lamiaceae*	--

NRB Mammals

	Common Name	Scientific Name	Family	Country Status	IUCN
1	Suleiman Markhor	Capra falconeri megaceros	Bovidae	Vulnerable	Endangered
2	Afghan hedgehog	Hemiechinusauritus megalotis	Erinaceidae	Least Concern	Least Concern
3	Grey wolf	Canis lupus	Canidae	Endangered	Least Concern
4	Asiatic jackal	Canis aureus	Canidae	Near Threatened	Least Concern
5	Hill fox	Vulpes vulpes griffithi	Canidae	Near Threatened	Least Concern
6	Striped hyena	Hyaena hyaena	Hyaenidae	Critically Endangered	Near Threatened
7	Caracal or Red lynx	Caracal caracal	Felidae	Critically Endangered	Least Concern
8	Small Five-toed Jerboa	Allactaga elater	Dipodidae	Least Concern	Least Concern
9	Stone marten	Martesfoina	Mustelidae	Data Deficient	Least Concern
10	Balochistan hare	Lepuscapensis	Leporidae	Vulnerable	Least Concern
11	Afghan pika	Ochotonarufescens	Ochotonidae	Least Concern	Least Concern
12	Indian crested porcupine	Hystrixindica	Hystricidae	Near Threatened	Least Concern
13	Sand-colored Soft-furred Rat	Millardiagleadowi	Muridae	Least Concern	Least Concern
14	House rat	Rattusrattus	Muridae	Least Concern	Least Concern
15	House mouse	Musmusculus	Muridae	Least Concern	Least Concern
16	Short-tailed Bandicoot Rat	Nesokiaindica	Muridae	Near Threatened	Least Concern
17	Mouse-like hamster	Calomyscusbailward i	Calomyscidae	Least Concern	Least Concern

18	Grey Hamster	Cricetulusmigratoriu s	Cricetidae	Least Concern	Least Concern
19	Persian Jird	Merionespersicus	Muridae	Least	Least
20	Afghan mole-vole	Ellobiusfuscocapillus	Cricetidae	Near Threatene d	Least Concern
21	Blanford,s hedgehog	Paraechinushypome lashypomelas	Erinaceidae	-	Least Concern
22	Zarudny's Shrew	Crocidurazarudnyi	Soricidae	Least Concern	Least Concern
23	Greater Horseshoe Bat	Rhinolophusferrume quinum	Rhinolophidae	Vulnerabl e	Least Concern
24	Kuhl'sPipistrel le	Pipistrelluskuhlii	Vespertilionid ae	Least Concern	Least Concern
25	Afghan Fox, Blanford's Fox	Vulpescana	Canidae	Near Threatene d	Least Concern
26	Marbled Polecat	Vormelaperegusna	Mustelidae	Least Concern	Vulnerable
27	Manul, Pallas's Cat	Otocolobusmanul	Felidae	Near Threatene d	Near Threatene d
28	Common Leopard	Pantherapardus	Felidae	Critically endanger ed	Near Threatene d
29	Balochistan Urial	Ovisvigneivignei	Bovidae	Endanger ed	Vulnerable
30	Five-striped palm squirrel	Funambuluspennant ii	Sciuridae	Least Concern	Least Concern
31	Sundevall'sJir d	Merionescrassus	Muridae	Near Threatene d	Least Concern

Cumulative list of flora in Nari River Basin

Local Name	Botanical Name	Family	Type
Phulahi/Palosa	*Acacia modesta*	*Fabaceae*	Tree
Jangli Ber	*Zizphus mauritiana*	*Rhamnaceae*	Tree
	Juniperus excelsa	*Cupressaceae*	Tree
Kao, Indian Olive	*Olea ferruginea*	*Oleaceae*	Tree
Uzgai	*P. cabulica*	*Anacardiace*	Tree
	Tecoma undulata	*Bignoniaceae*	Tree
Zarch	*Berberis lyceum*	*Berberidaceae*	Small Tree
Sanzalai/Sinjid	*Elaeagnus angustifolia*	*Eleagnaceae*	Small Tree
Hanuz	*Fraxius xathoxyloides*	*Oleaceae*	Shrub/Small tree
	Pistacia sp	*Anacardiace*	Shrub/Small tree
	Sophora spp	*Papilionaceae*	Shrub/Small tree
Khamazora	*Zygophyllum propinquum*	*Zygophyllaceae*	Shrub
Gonga	*Hertiain termedia*	*Compositae*	Shrub
Makhai	*Caragana ambigua*	*Papilionaceae*	Shrub
Zarga	*Prunus eburnean*	*Rosaceae*	Shrub
Laghonai	*Daphne mucronata*	*Thymelaceae*	Shrub
Mesquite/Kiker	*Prosopis juliflora*	*Fabaceae*	Shrub
	Periploca spp.	*Asclepiadaceae*	Shrub
Ber, Malla	*Ziziphus nummularia*	*Rhamnaceae*	Shrub

Sur ghaz	*Tamarix mactrocarpa*	*Tamaricaceae*	Shrub
Spalmai	*Callotropi sprocera*	*Asclipiadaceae*	Shrub
Shorai	*Haloxylon griffithii*	*Chenopodiaceae*	Shrub
Ghuzaira	*Stockia bruchica*	*Saepindaceae*	Shrub
Sasai	*Erbenus stellate*	*Papillionaceae*	Shrub
KhozLawanai	*Foeniculum vulgare*	*Umbelliferae*	Herb
SperaShakrai	*Isatis minima*	*Cruciferae*	Herb
Khakshir	*Sisymbrium sophia*	*Papaveraceae*	Herb
Sandraza	*Lactuca orientalis*	*Compositae*	Herb
Khatol	*Tulip amontana*	*Liliaceae*	Herb
Zawal	*Achelli asantolina*	*Asteraceae*	Herb
Gazara	*Cousine athomosonii*	*Compositeae*	Herb
Zoz	*Alhagima urorum*	*Fabaceae*	Herb
Tarkha	*Artemisia maritima*	*Asteraceae*	Herb
Shinshobai	*Metha longifolia*	*Asteraceae*	Herb
Sparapongai	*Salvia spinose*	*Labiateae*	Herb
Spanda	*Peganum harmala*	*Zygophyllaceae*	Herb
Parwakt	*Convolvulus arvensis*	*Convolvulaceae compositae*	Herb
Buski	*Cardaria chalepense*	*Brassicaceae*	Herb
Sargara	*Cymbopogon jawarancusa*	*Graminae*	Grass
Sabba	*Chrysopogon serrulatus*	*Graminae*	Grass
Washta	*Stipa pennata*	*Graminae*	Grass

Cumulative list of flora in Porali River Basin

Vernacular name	Taxon	Family	Life form
Babbur	*Acacia nilotica*	*Fabaceae*	Tree
Kandi	*Prosopis cineraria*	*Fabaceae*	Tree
Khajoor	*Phoenix dyctylefera*	*Palmea*	Tree
Kandi	*Prosopis glandulosa*	*Fabaceae*	Tree
Aak, Madar, Mundar	*Calotropis procera*	*Asclepiadaceae*	Shrub
Babbur	*Acacia jacquemontii*	*Fabaceae*	Shrub
Babbur	*Acacia sengal*	*Fabaceae*	Shrub
Devi	*Prosopis juliflora*	*Fabaceae*	Shrub
Kirri	*Tamarix sultanii*	*Tamaricaceae*	Shrub
Ber, Malla, Jher beri	*Ziziphus nummularia*	*Rhamnaceae*	Shrub
Gujo	*Aerva javanica*	*Amarantheaceae*	Shrub
Gujo	*Aerva pseudo tomentosa*	*Amarantheaceae*	Shrub
Karil, karir	*Capparis aphylla*	*Capparidiaceae*	Shrub
	Capparis decidua	*Capparidiaceae*	Shrub
	Arthrocnemum indicum	*Chenopodiaceae*	Shrub
Khar, barilla, sajji	*Haloxylon stocksii*	*Chenopodiaceae*	Shrub
	Suaeda fruiticosa	*Chenopodiaceae*	Shrub
	Suaeda ferinosa	*Chenopodiaceae*	Shrub
	Grewia damine	*Malvaceae*	Shrub
	Alhagi camelorum	*Fabaceae*	Shrub
	Alhagi maurorum	*Fabaceae*	Shrub
	Salvadora oleoides	*Salvadoraceae*	Shrub
	Salvadora persica	*Salvadoraceae*	Shrub
Merin	*Heliotropium sp*	*Boraginaceae*	Shrub
	Calligonum polygonoides	*Polygonaceae*	Shrub
	Rhazya stricta,	*Apocynaceae*	Shrub
	Euphorbia caducifolia	*Euphorbiaceae*	Shrub
Gugul	*Commiphora mukul*	*Burseraceae*	Shrub
Chill	*Grewia tenex*	*Malvaceae*	Shrub
Khimp	*Leptadenia sp*	*Apocynaceae*	Shrub
	Caragana polyacantha	*Fabaceae*	Shrub
	Sericostoma pauciflorum	*Boraginaceae*	Shrub
	Fagonia Arabica	*Zygophyllaceae*	Shrub

Vernacular name	Taxon	Family	Life form
	Acacia rupestris	*Fabaceae*	Shrub
	Salsola sp	*Chenopodiaceae*	Shrub
Mazri Palm	*Nannorrhops ritchieana*	*Arecaceae*	Shrub
Ritchak, Dolako, Titok, Sahsa	*Convolvulus spinosus*	*Convulvolaceae*	Shrub
Kulumurak	*Inula montaine*	*Asteraceae*	Herb
Kulumurak	*Inula grantoides*	*Asteraceae*	Herb
	Astragalus sp	*Fabaceae*	Herb
Gorka/Sewan Grass	*Lasiurus sindicus*	*Poaceae*	Grass
	Cymbopogon sp	*Poaceae*	Grass
	Panicum sp	*Poaceae*	Grass
	Cenchrus sp	*Poaceae*	Grass
Nadak	*Aristida sp*	*Poaceae*	Grass
	Chrysopogon sp	*Poaceae*	Grass

Migratory birds in NRB

Common Name	Scientific Name
Eurasian sparrow hawk	*Accipiter nisus*
Bank myna	*Acridotheres gingianus*
Blyth's reed warbler	*Acrocephalus dumetorum*
Cinereous vulture	*Aegypius monachus*
Small indian (oriental) skylark	*Alauda gulgula*
Chukar partridge	*Alectoris chukar*
Bar-tailed desert lark	*Ammonanes cincturus*
See-see partridge	*Ammoperdix griseogularis*
Desert buzzard	*Buteobuteo vulpinus*
Short toed eagle	*Circaetus pennatus*
Eurasian Crane	*Grus grus*
Demoiselle Crane	*Anthropoides virgo*
Blue rock pigeon	*Columba livia*
Raven	*Corvus corax*
Rock bunting	*Emberiza cia*
Crested lark	*Galerida cristata*
Long-tailed shrike	*Lanius schach*
Migratory house sparrow	*Passer domesticus bactrianus*
Magpie	*Pica pica*
Black-throated thrush	*Turdus atrogularis*
Black throated accentor	*Prunella atrogularis*
Black bellied sandgrouse	*Pterocles orientalis*
Little brown dove	*Streptopelia senegalensis*
Lesser whitethroat	*Sylvia curruca althea*
Hoopoe	*Upupae pops*
Jungle Fowl	*Gallus*

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Hoopoe	*Upupae pops*
Jungle Fowl	*Gallus*

List of terrestrial fauna in the Hingor National Park

Common name	Scientific name
Mammals	
Chinkara	*Gazella bennettii*
Sindh Wild Goat	*Capra aegagrus*
Urial	*Ovis orientalis blanfordi*
Common Leopard	*Panthera pardus*
Jungle Cat	*Felis chaus*
Desert Cat	*Felis libyca*
Striped Hyaena	*Hyaena hyaena*
Desert Fox	*Vulpes vulpes*
Asiatic Jackal	*Canis aureus*
Wolf	*Canis lupus*
Pangolin	*Manis crassicaudata*
Reptiles	
Marsh Crocodiles	*Crocodylus palustris*
Spiny -tail Lizard	*Uromastyx sp*
Monitor Lizard	*Varanus varius*
Northern wolf snake	*Lycodon striatus*
Common Krait	*Bungarus caeruleus*
Common Cobra, Brown or Oxus Cobra	*Naja sp.*
Saw scaled-Sand Viper	*Echis carinatus*
Horned Viper	*P. persicus*
Black Rock Agama	*Laudakia melanura*
Sindh Sand Gecko	*Stenodactylus orientalis*
Three-toed snake skink	*Ophiomorus tridactylus*
Fringe-fingered lizard	*Acanthodactylus cantoris*
Amphibians	
Skittering Frog	*Rana cyanophlyctis*
	Bufo andersoni
Indus Toad	*Bufo stomaticus*
Birds	
Houbara Bustard	*Chlamydotis undulata*
Common Babblers	*Turdoides caudata*
Wheatears	*Oenanthe deserti oreophila*
Spotted-billed Pelican	*Pelecanus philippinus*
Dalmatian Pelican	*Pelecanus crispus*
See-see Partridge	*Ammoperdix griseogularis*
Black-tailed Godwit	*Limosa limosa*

Giant Heron	*Ardea goliath*
Black Bittern	*Dupetor flavicollis*
White-backed Vulture	*Gyps fulvus*
Imperial Eagle	*Aquila heliacal*
Peregrine Falcon	*Falco peregrines*
Crowned Sandgrouse	*Pterocles coronatus*
Lesser Kestrel	*Falco naumanii*
Sooty Falcon	*Falco concolor*
Close-barred/ Lichtenstein Sandgrouse	*Pterocles lichtensteini*
Grey Partridge	*Francolinus pondicerianus*
Stone Curlew/Stone Plover	*Burhinus oedicnemus*
Eurasian Curlew	*Numenius arquata*
Black Ibis	*Pseudibis papillosa*
Brown-necked Raven	*Corvus ruficollis*

Annex B: Checklist of Procedures for Cultural Heritage finds (archaeological and others)

1. Identify the protected sites in the projsect areas and ensure that there is no protected monument within 200 feet from a proposed project site. If the proposed site is not located in a notified area, and there are no apparent archaeological values associated with the site, take no further action.

2. If, during the implementation of works, unlisted cultural heritage is encountered in any form, the Irrigation and Power Department shall contact:

Directorate of Archaeology and Museums
Culture, Tourism and Archives Department, Quetta
Tel: 081-283 3595

3. If the site falls within the boundaries of a protected archaeological site or monument, then depending on its classification the relevant conservation authority (if federally protected, Department of Archaeology and Museums) will determine the level of development allowable, and the applicable conditions.

4. The Department for Irrigation and Power shall obtain written record of the assessment of the potential impacts on the site, by the Balochistan or federal Depatment of Archaeology and Museums – whatever the case might be.

5. The Irrigation and Power Department will liase with the Provincial and/or Federal conservation authority to ensure that any chance finds are managed and protected.

Annex C: Terms of Reference for the Consulting Services to Prepare a Cultural Heritage Management Plan in the Project Area

1. Background

Cultural heritage is important in Balochistan and for this reason forms one of the main components of the Balochistan Conservation Strategy (BCS). It underpins the relationship between humans and their environment over thousands of years and provides basis for new directions for economic development. Evidence of human presence in Balochistan dates back to the Paleolithic era and the most famous site discovered is Mehrgarh which was occupied between 8000-2300 BC. Mehrgarh demonstrates the evolution of Balochistan cultures from hunting and gathering to a settled agro-pastoral system. In addition to the many archaeological sites that dot the landscape, there are forts, tombs and graves, religious places, and other culturally significant elements in the landscape.

The Government is implementing the Balochistan Integrated Water Resources Management and Development (BIWRMD) Project which will address the following issues: (i) establishing adequate and reliable water data, (ii) improving coordination between the water and agricultural sectors, (iii) adopting an integrated approach to project formulation and to project M&E, (iv) improving irrigation water use efficiency, (v) improving groundwater recharge through watershed management and water conservation, and (vi) ensuring effective participation of water users and other stakeholders in water management. The activities of the BIWRMD Project will be implemented in the Nari and Porali River Basins of Balochistan.

As part of the implementation of this project and to ensure the protection of physical cultural resources (PCR) in the Project area in line with the provisions of the BCS, consultancy services are required to prepare a Cultural Heritage Management Plan under the BIWRMD Project. A draft chance finds procedure is also included in the Environmental Impact Assessment for the BIWRMD Project. Preliminary field surveys indicate that no known physical and cultural heritage sites are located in the Project areas.

2. Objective

The overall objective of this consultancy service is to study the physical and cultural resources in the Nari and Porali Basins and outline practical management measures for the resources most likely to be indirectly impacted by the project activities.

3. Specific Objectives

- To carry out field surveys along the planned project alignments to confirm the existence of any PCR,
- To identify the cultural places of local significance in the two basins, and
- To develop programs which will contribute to the awareness and knowledge base of Balochistan cultural heritage.

4. Scope of Work

The consultancy services shall include, but is not limited to, the following:

- Close collaboration between the consulting team and the Balochistan Directorate of Archaeology and Museums as well as with the local communities in the two basins,
- A detailed background of the places studied with listing of any private properties on which cultural heritage might occur,

- Specific mention must be made of all the heritage resources on the subject property which include, but are not limited to: structures, buildings, building elements (like fences and gates), building materials, architectural and interior finishes, natural heritage elements, landscaping, and archaeological resources,
- Documentation of the cultural heritage places inventoried, including measured maps, pictures, and descriptive texts,
- An outline of the proposed BIWRMD Project schemes and how they are likely to indirectly impact on the identified heritage resources,
- Maps of the areas suveyed, clearly indicating the cultural heritage in the area (whether they be of federal, provincial, or local significance), and
- Summary statement, conservation plan and recommendations to the BIWRMD Project and the Balochistan Directorate of Archaeology and Museums. Management recommendations for cultural heritage must be costed.

5. Duration of the Assignment and deliverables

The assignment will last for a period of six months, to coincide with the beginning of the BIWRMD Project and to ensure that the recommendations of the plan are taken into consideration. A concise report including the background information and the management plan are expected to be delivered at the end of the study duration.

6. Qualifications

The consulting team must be led by a cultural heritage management specialist with an academic background of archaeology, architecture, social anthropology or any related discipline, with a minimum of 10 years of experience. The team members must be competent in the following areas:

- archaeological survey
- mapping
- heritage documentation
- social development and community engagement

Annex D: Environmental Code of Practices

Introduction

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

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

ECP 1: Waste Management
ECP 2: Fuels and Hazardous Goods Management
ECP 3: Water Resources Management
ECP 4: Drainage Management
ECP 5: Soil Quality Management
ECP 6: Erosion and Sediment Control
ECP 7: Top Soil Management
ECP 8: Topography and Landscaping
ECP 9: Quarry Areas Development and Operation
ECP 10: Air Quality Management
ECP 11: Noise and Vibration Management
ECP 12: Protection of Flora
ECP 13: Protection of Fauna
ECP 14: Protection of Fish
ECP 15: Road Transport and Road Traffic Management
ECP 16: Construction Camp Management
ECP 17: Cultural and Religious Issues
ECP 18: Worker Health and Safety
ECP 19: Construction and Operation Phase Security

Contractors will prepare site specific management plans, namely Construction Environmental Management Plan (CEMP), in compliance with the World Bank guidelines and Pakistan Environmental Protection Act, 1997 and based on the guidance given in the ECPs. The CEMP will form the part of the contract documents and will be used as monitoring tool for compliance. It is mandatory for the main contractors procured directly by the project to include these ECPs in their subcontracts. Violation of these requirements will be treated as non-compliance leading to the corrections or otherwise imposing penalty on the contractors.

ECP 1: Waste Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
General Waste	Soil and water pollution from the improper management of wastes and excess materials from the construction sites.	The Contractor shall • Develop site specific waste management plan for various waste streams (e.g., reusable waste, flammable waste, construction debris, food waste etc.) prior to commencing of construction and submit to supervision consultant for approval. • Organize disposal of all wastes generated during construction in the designated disposal sites approved by the PMU. • Minimize the production of waste materials by 3R (Reduce, Recycle and Reuse) approach. • Segregate all wastes, wherever practical. • Vehicles transporting solid waste shall be totally confined within an enclosed or fully covered with a tarp to prevent spilling waste along the route. • Tarp must be undamaged (not torn or frayed) properly secured to the body of the vehicle or trailer with ropes, chains, straps, or cords so that no waste is exposed. The edges of the tarps shall extend 12 inches over the permanent sides and back of the open top vehicle or trailer and must be secured to the permanent vehicle. All loads must be tarped from the point of origin of the waste to the tipping area of the final disposal/landfill. • Train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process. • Provide refuse containers at each worksite. • Request suppliers to minimize packaging where practicable. • Place a high emphasis on good housekeeping practices. • Maintain all construction sites clean, tidy and safe and provide and maintain appropriate facilities as temporary storage of all wastes before transporting to final disposal.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Potable water should be supplied in bulk containers to reduce the quantity of plastic waste (plastic bins). Plastic bag use should be avoided.
Hazardous Waste	Health hazards and environmental impacts due to improper waste management practices	The Contractor shall • Collect chemical wastes in 200 liter drums (or similar sealed container), appropriately labeled for safe transport to an approved chemical waste depot. • Store, transport and handle all chemicals avoiding potential environmental pollution. • Store all hazardous wastes appropriately in bunded areas away from water courses. • Make available all Material Safety Data Sheets (MSDS) for hazardous materials on-site during construction. • Collect hydrocarbon wastes, including lube oils, for safer transport off-site to reuse, recycle, treatment or disposal at approved locations. • Construct concrete or other impermeable hard-stand to prevent seepage in case of spills. • Keep sufficient stock of absorbents for generally used chemicals or for petrochemicals (e.g., dirt, sawdust, etc.) within the storage area to contain accidental spills.

ECP 2: Fuels and Hazardous Goods Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Fuels and hazardous goods.	Materials used in construction have a potential to be a source of contamination. Improper storage and handling of fuels, lubricants, chemicals, hazardous goods/materials on-	The Contractor shall • Prepare spill control procedures and submit them for PSIAC and PMU for approval. • Train the relevant construction personnel in handling of fuels and spill control procedures. • Refueling shall occur only within bunded areas.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	site, wash down of plant and equipment, and potential spills may harm the environment or health of construction workers.	• Store dangerous goods in bunded areas on top of a sealed plastic sheet away from watercourses. Store all liquid fuels in fully bunded storage containers, with appropriate volumes, a roof, a collection point and appropriate filling/decanting point. • Store and use fuels in accordance with material safety data sheets (MSDS). Make available MSDS for chemicals and dangerous goods on-site. • Store hazardous materials at above flood level, determined for construction. • Make sure all containers, drums, and tanks that are used for storage are in good condition and are labeled with expiry date. Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur. • Sit containers and drums in temporary storages in clearly marked areas, where they will not be run-over by vehicles or heavy machinery. The area shall preferably drain to a safe collection area in the event of a spill. • Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution. • All machinery is to be stored and away from any water body, drainage inlets or natural drainage area, where practical. Environmental control measures such as appropriate barriers (i.e. bunding, sediment fence, etc.) will be considered and/or implemented to control runoff away from the machinery and prevent any washout in to adjacent water body, drainage inlets or natural drainage area. • Transport waste of dangerous goods, which cannot be recycled, to an approved waste disposal facility. Safe transport of fuel or other hazardous liquids to and from the

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		storage container will be facilitated through the provision detailed within the Material Safety Data Sheets (MSDS). • Wash down of plant and equipment and vehicle servicing will be performed only in isolated impervious areas away from drainage inlets, connecting the drainage with an oil interceptor. Pits/bunds located away from waterways will be provided for concrete wash near construction areas. The contractor's environmental officer with assistance from supervisors is to ensure that pits/bunds are available, maintained at capacity and drivers instructed regarding the location and required procedures. • Keep stock of absorbent and containment material (e.g., absorbent matting, dirt, sawdust, etc.) where hazardous material are used and stored; and ensure staffs are trained in their correct use. • Oil and chemical spills and washouts shall be cleaned up and collected immediately, where safety permits. Disposal of remediated / cleanup/ washout materials shall be to an approved waste disposal facility. Materials shall be transported by an approved / licensed transporter. Contaminated Material to be removed from site as soon as reasonably practical after the incident. • Provide appropriate personal protective equipment (protective clothing, safety boots, helmets, masks, gloves, goggles, etc.) to the construction personnel, depending on the materials handled. • Avoid the use of material with greater potential for contamination by substituting them with more environmentally friendly materials.

ECP 3: Water Resources Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Hazardous material and Waste	Water pollution from the storage, handling and disposal of hazardous materials and general construction waste, and accidental spillage	The Contractor shall • Follow the management guidelines proposed in • ECP 1: Waste Management and ECP 2: Fuels and Hazardous Goods Management. • Minimize the generation of spoils, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways or storm water systems.
Discharge from construction sites	Construction activities, sewerages from construction sites and work camps may affect the surface water quality. The construction works will modify groundcover and topography, changing the surface water drainage patterns of the area. These changes in hydrological regime lead to increased rate of runoff, increase in sediment and contaminant loading, increased flooding, and effect habitat of fish and other aquatic biology.	The Contractor shall • Install temporary drainage works (channels and check dams) in areas required for sediment and erosion control and around storage areas for construction materials. • Install temporary sediment lagoons, where appropriate, to capture sediment-laden run-off from work site. • Divert runoff from undisturbed areas around the construction site. • Stockpile materials away from drainage lines. • Prevent all solid and liquid wastes entering waterways by collecting spoils, oils, chemicals, bitumen spray waste and wastewaters from brick, concrete and asphalt cutting where possible and transport to an approved waste disposal site or recycling depot. • Wash out ready-mix concrete agitators and concrete handling equipment at washing facilities off site or into approved bunded areas on site. Ensure that tires of construction vehicles are cleaned in the washing bay (constructed at the entrance of the construction site) to remove the mud from the wheels. This should be done in every exit of each construction vehicle to

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		ensure the local roads are kept clean.
Soil erosion and siltation	Soil erosion and dust from the material stockpiles will increase the sediment and contaminant loading of surface water bodies.	The Contractor shall • Stabilize the cleared areas not used for construction activities with vegetation or appropriate surface water treatments as soon as practicable following earthwork to minimize erosion. • Ensure that roads used by construction vehicles are swept regularly to remove dust and sediment. • Water the loose material stockpiles, access roads and bare soils on an as needed basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds).
Construction activities in water bodies	Excavation activities associated with construction of river training and flood protection works, and buildings for a facility can cause turbidity and sedimentation in nearby waters, degraded water quality, and substrate alterations.	The Contractor Shall • Dewater sites by pumping water to a sediment basin prior to release off site – do not pump directly off site. • Monitor the water quality in the runoff from the site or areas affected by dredge/excavation plumes, and improve work practices as necessary. • Protect water bodies from sediment loads by silt screen or other barriers. • Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways or storm water systems. • Do not discharge cement and water curing used for cement concrete directly into water courses and drainage inlets.
Drinking water	Untreated surface water is not suitable for drinking purposes	The Contractor Shall • Provide drinking water that meets National and WHO Drinking Water standards. Drinking water to be chlorinated at source,

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		and ensure presence of residual chlorine 0.1 ~ 0.25 ppm as minimum after 30 minutes of chlorine contact time.

ECP 4: Drainage Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Excavation and earth works, and construction yards	Lack of proper drainage for rainwater/liquid waste or wastewater owing to the construction activities harms environment in terms of water and soil contamination	The Contractor shall • Prepare drainage management procedures and submit them to PSIAC and PMU for approval. • Provide alternative drainage for rainwater if the construction works/earth-fillings cut the established drainage line. • Establish local drainage line with appropriate silt collector and silt screen for rainwater or wastewater connecting to the existing established drainage lines already there. • Rehabilitate road drainage structures immediately if damaged by contractors' road transports. • Build new drainage lines as appropriate and required for wastewater from construction yards connecting to the available nearby recipient water bodies. Ensure wastewater quality conforms to National Standards, before it is being discharged into the recipient water bodies. • Ensure that there will be no water stagnation at the construction sites and camps. • Provide appropriate silt collector and silt screen at the inlet and manholes and periodically clean the drainage system to avoid drainage congestion. • Protect natural slopes of drainage channels

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		to ensure adequate storm water drains. • Regularly inspect and maintain all drainage channels to assess and alleviate any drainage congestion problem.
Ponding of water	Health hazards due to mosquito breeding	• Do not allow ponding of water especially near the waste storage areas and construction camps. • Discard all the storage containers that are capable of storing of water, after use or store them in inverted position.

ECP 5: Soil Quality Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Storage of hazardous and toxic chemicals	Spillage of hazardous and toxic chemicals will contaminate the soils	The Contractor shall • Strictly manage the wastes management plans proposed in • ECP 1: Waste Management and storage of materials and ECP 2: Fuels and Hazardous Goods Management. • Construct appropriate spill containment facilities for all fuel storage areas. • Establish and maintain a hazardous material register detailing the location and quantities of hazardous substances including the storage, and their disposals. • Train personnel and implement safe work practices for minimizing the risk of spillage. • Identify the cause of contamination, if it is reported, and contain the area of contamination. The impact may be contained by isolating the source or implementing controls around the affected site. • Remediate the contaminated land using the most appropriate available method.
Construction	Erosion from	The Contractor shall

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
material stock piles	construction material stockpiles may contaminate the soils	• Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds.

ECP 6: Erosion and Sediment Control

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Clearing of construction sites	Cleared areas and slopes are susceptible for erosion of top soils, which affects the growth of vegetation and causes ecological imbalance.	The Contractor shall • Prepare site specific erosion and sediment control measures and submit them for PSIA and PUI approval. • Reinstate and protect cleared areas as soon as possible. • Cover unused area of disturbed or exposed surfaces immediately with mulch/grass turf/tree plantations.
Construction activities and material stockpiles	The impact of soil erosion are (i) Increased run off and sedimentation causing a greater flood hazard to the downstream and silt accumulation and (ii) destruction of aquatic environment by erosion and/or deposition of sediment	The Contractor shall • Locate stockpiles away from drainage lines. • Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds. • Remove debris from drainage paths and sediment control structures. • Cover the loose sediments of construction material and water them if required. • Divert natural runoff around construction areas prior to any site disturbance. • Install protective measures on site prior to construction, for example, sediment traps. • Install 'cut off drains' on large cut/fill batter slopes to control water runoff speed and hence erosion. • Observe the performance of drainage

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		structures and erosion controls during rain and modify as required. • Restrict construction when appropriate to avoid temporary impacts to habitat during critical life history stages (e.g., spawning, egg and embryo development, and juvenile growth).
Soil erosion and siltation	Soil erosion and dust from the material stockpiles will increase the sediment and contaminant loading of surface water bodies.	The Contractor shall • Stabilize the cleared areas not used for construction activities with vegetation or appropriate surface water treatments as soon as practicable following earthwork to minimize erosion. • Ensure that roads used by construction vehicles are swept regularly to remove sediment. • Water the material stockpiles, access roads and bare soils on an as required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds).

ECP 7: Top Soil Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earth works	Earthworks will impact the fertile top soils that are enriched with nutrients required for plant growth or agricultural development.	The Contractor shall • Strip the top soil to a depth of 35 cm and store in stock piles of height not exceeding 2m. • Remove unwanted materials from top soil like grass, roots of trees and others. • The stockpiles will be done in slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil. • Locate topsoil stockpiles in areas outside drainage lines and protect from erosion. • Construct diversion channels and silt

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		fences around the topsoil stockpiles to prevent erosion and loss of topsoil. • Spread the topsoil to maintain the physico-chemical and biological activity of the soil. The stored top soil will be utilized for covering all disturbed area and along the proposed plantation sites. • Prior to the re-spreading of topsoil, the ground surface will be ripped to assist the bunding of the soil layers, water penetration and re-vegetation
Transport	Vehicular movement outside temporary access roads will affect the soil fertility of the agricultural lands	• Limit equipment and vehicular movements to within the approved construction zone.

ECP 8: Topography and Landscaping

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earth works	Construction activities especially earthworks will change topography and disturb the natural rainwater/flood water drainage as well as change the local landscape.	The Contractor shall • Prepare landscaping and plantation plan and submit the plan to PISAC and PMU for approval. • Ensure the topography of the final surface of all raised lands (construction yards, approach roads, access roads, etc.) are conducive to enhance natural draining of rainwater/flood water. • Keep the final or finished surface of all the raised lands free from any kind of depression that causes water logging. • Undertake mitigation measures for erosion control/prevention by grass-turfing and tree plantation, where there is a possibility of rain-cut that will change the shape of topography. • Cover immediately the uncovered open surface that has no use of construction

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		activities with grass-cover and tree plantation to prevent soil erosion and better landscaping. • Reinstate the natural landscape of the ancillary construction sites after completion of works.

ECP 9: Quarry Areas Development and Operation

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Development and operation of borrow areas	Borrow areas will have impacts on local topography, landscaping and natural drainage.	The Contractor shall • Prepare borrow/quarry area management plan and submit the plan for supervision consultant approval. • Use only approved quarry and borrow sites. • Identify new borrow and quarry areas in consultation with PSIAC and PMU, if required. • Reuse excavated or disposed material available in the project to the maximum extent possible. • Store top soil for reinstatement and landscaping. • Develop surface water collection and drainage systems, anti-erosion measures (berms, revegetation etc.) and retaining walls and gabions where required. Implement mitigation measures in ECP 3: Water Resources Management, ECP 6: Erosion and Sediment Control • The use of explosive should be used as low as possible to reduce noise, vibration, and dust. • Control dust and air pollution by application of watering and implementing mitigation measures proposed in ECP 10: Air Quality Management • Noise and vibration control by ECP 11: Noise and Vibration Management.

*ECP 10: **Air Quality Management***

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Air quality can be adversely affected by vehicle exhaust emissions and combustion of fuels.	The Contractor shall • Prepare air quality management plan (under the Pollution Prevention Plan) and submit the plan for PSIAC and PMU approval. • Fit vehicles with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition. • Operate the vehicles in a fuel efficient manner. • Cover hauling vehicles carrying dusty materials moving outside the construction site. • Impose speed limits on all vehicle movement at the worksite to reduce dust emissions. • Control the movement of construction traffic. • Water construction materials prior to loading and transport. • Service all vehicles regularly to minimize emissions. • Limit the idling time of vehicles not more than 2 minutes.
Construction machinery	Air quality can be adversely affected by emissions from machinery and combustion of fuels.	The Contractor shall • Fit machinery with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition in accordance with the specifications defined by their manufacturers to maximize combustion efficiency and minimize the contaminant emissions. Proof of maintenance register shall be required by the equipment suppliers and contractors/subcontractors. • Pay special attention to control emissions from fuel generators. • Machinery causing excessive pollution (e.g., visible smoke) will be banned from construction sites. • Service all equipment regularly to minimize emissions.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Provide filtering systems, dust collectors or humidification or other techniques (as applicable) to the concrete batching and mixing plant to control the particle emissions in all stages, including unloading, collection, aggregate handling, cement application, circulation of trucks and machinery inside the installations.
Construction activities	Dust generation from construction sites, material stockpiles and access roads is a nuisance in the environment and can be a health hazard, and also can affect the local crops	The Contractor shall • Water the material stockpiles, access roads and bare soils on an as needed basis to minimize the potential for environmental nuisance due to dust. Increase the watering frequency during periods of high risk (e.g. high winds). Stored materials such as gravel and sand shall be covered and confined to avoid their being wind-drifted. • Minimize the extent and period of exposure of the bare surfaces. • Restore disturbed areas as soon as practicable by vegetation/grass-turfing. • Store the cement in silos and minimize the emissions from silos by equipping them with filters. • Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust generation is minimized during such operations. • Not use water as dust suppression on potentially contaminated areas, to prevent generation of liquid waste stream. • Crushing of rock and aggregate materials shall be wet-crushed, or performed with particle emission control systems. • Not permit the burning of solid waste.

ECP 11: Noise and Vibration Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Noise quality will be deteriorated due to vehicular traffic	The Contractor shall • Prepare a noise and vibration management plan (under the Pollution Prevention Plan) and submit the plan for PSIAC and PMU approval. • Maintain all vehicles in order to keep it in good working condition in accordance with manufactures maintenance procedures. • Make sure all drivers will comply with the traffic codes concerning maximum speed limit, driving hours, etc. • Perform the loading and unloading of trucks, and handling operations minimizing construction noise on the work site.
Construction machinery	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	The Contractor shall • Appropriately organize all noise generating activities to avoid noise pollution to local residents. • Use the quietest available plant and equipment in construction work. • Maintain all equipment in order to keep them in good working order in accordance with manufactures maintenance procedures. Equipment suppliers and contractors shall present proof of maintenance register of their equipment. • Install acoustic enclosures around generators to reduce noise levels. • Fit high efficiency mufflers to appropriate construction equipment. • Avoid unnecessary use of alarms, horns and sirens.
Construction activity	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	The Contractor shall • Notify adjacent landholders prior to typical noise events outside of daylight hours. • Educate the operators of construction equipment on potential noise problems and the techniques to minimize noise emissions. • Employ best available work practices on-site

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		to minimize occupational noise levels. • Install temporary noise control barriers where appropriate. • Notify affected people if major noisy activities will be undertaken, e.g. blasting. • Plan activities on site and deliveries to and from site to minimize impact. • Monitor and analyze noise and vibration results and adjust construction practices as required. • Avoid undertaking the noisiest activities, where possible, when working at night near the residential areas.

ECP 12: Protection of Flora

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Vegetation clearance	Local flora are important habitats for birds, provide fruit harvest, timber/fire wood, protect soil from erosion and overall keep the natural balance for human-living. As such damage to flora has wide range of adverse environmental impacts.	The Contractor shall • Prepare a plan to protect flora and submit the plan for PSIAC and PMU approval. • Minimize disturbance to surrounding vegetation. • Use appropriate type and minimum size of machine to avoid disturbance to adjacent vegetation. • Get approval from PSIAC and PMU for clearance of vegetation. • Make selective and careful pruning of trees where possible to reduce need of tree removal. • Control noxious weeds by disposing of at designated dump site or burn on site. • Clear only the vegetation that needs to be cleared in accordance with the engineering plans and designs. These

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		measures are applicable to both the construction areas as well as to any associated activities such as sites for stockpiles, disposal of fill, etc. • Not burn off cleared vegetation – where feasible, chip or mulch and reuse it for the rehabilitation of affected area. Mulch provides a seed source, can limit embankment erosion, retains soil moisture and nutrients, and encourages re-growth and protection from weeds. • Return topsoil and mulched vegetation (in areas of native vegetation) to approximately the same location from where it came from. • Avoid work within the drip-line of trees to prevent damage to the tree roots and compacting the soil. • Minimize the length of time the ground is exposed or excavation left open by clearing and re-vegetate the area at the earliest practically possible. • Ensure excavation works occur progressively and re-vegetation done at the earliest. • Provide adequate knowledge to the workers regarding nature protection and the need of avoid felling trees during construction • Supply appropriate fuel in the work camps to prevent fuel wood collection.

ECP 13: Protection of Fauna

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities	The location of construction activities can result in the loss of	The Contractor shall • Prepare a plan for protection of fauna and

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	wild life habitat and habitat quality,	submit the plan for PSIAC and PMU approval. • Limit the construction works within the designated sites allocated to the contractors. • Check the site for trapped animals, and rescue them by the help of a qualified person. • Provide temporary access to the animals to cross trenches, if there any.
	Impact on local and migratory birds, their habitats and active nests	The Contractor shall • Not be permitted to destruct active nests or eggs of birds. • Minimize the tree removal during the bird breeding season. If works must be continued during the bird breeding season, a nest survey will be conducted by a qualified biologist prior to commence of works to identify and locate active nests. • If bird nests are located/ detected with then those areas should be avoided. • Petroleum products should not come in contact with the natural and sensitive ecosystems. Contractor must minimize the release of oil, oil wastes or any other substances harmful to migratory birds' habitats, to any waters, wetlands or any areas frequented by migratory birds.
Vegetation clearance	Clearance of vegetation may impact shelter, feeding and/or breeding and/or physical destruction and severing of habitat areas	The Contractor shall • Restrict the tree removal to the minimum numbers required. • Relocate hollows, where appropriate. • Fell the hollow bearing trees in a manner which reduces the potential for fauna mortality. Felled trees will be inspected after felling for fauna and if identified and readily accessible will be removed and relocated or rendered assistance if injured. After felling, hollow bearing trees will remain unmoved overnight to allow animals to move of their own volition. Care should be taken to make sure bird habitats are not destroyed. If there is

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		no option available, rehabilitate them in other neighboring trees. Also protect and rehabilitate injured or orphaned birds.
Night time lighting	Lighting from construction sites and construction camps may affect the visibility of night time migratory birds that use the moon and stars for navigation during their migrations.	The Contractor shall • Use lower wattage flat lens fixtures that direct light down and reduce glare, thus reducing light pollution, • Avoid flood lights unless they are absolutely required. • Use motion sensitive lighting to minimize unneeded lighting. • Use, if possible, green lights that are considered as bird's friendly lighting instead of white or red colored lights. • Install light shades or plan the direction of lights to reduce light spilling outside the construction area.
Construction camps	Illegal hunting	The Contractor shall • Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal hunting. • Ensure that staff and Subcontractors are trained and empowered to identify, address and report potential environmental problems. • Provide sufficient food allowance to the workers so that they don't engage in illegal hunting.

ECP 14: Protection of Fish

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities in River	The main potential impacts to fisheries are dredging, hydrocarbon spills and leaks from riverine transport, and	The Contractor shall • Prepare procedures for protection of fish and submit them for PSIAC and PMU approval.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	disposal of wastes into the river.	• Ensure the construction equipment used in the river are well maintained and do not have oil leakage to contaminate river water. • Contain oil immediately on river in case of accidental spillage from equipment; make an emergency oil spill containment plan (under the Fuels and Hazardous Substances Management Plan) to be supported with enough equipment, materials and human resources. • Do not dump wastes, be it hazardous or non-hazardous into the nearby water bodies or in the river.
Construction activities on the land	The main potential impacts on river are increased suspended solids from earthworks erosion, sanitary discharge from work camps, and hydrocarbon spills	The Contractor shall • follow mitigation measures proposed in ECP 3: Water Resources Management and ECP 4: Drainage Management.

ECP 15: Road Transport and Road Traffic Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Increased traffic use of road by construction vehicles will affect the movement of normal road traffics and the safety of the road-users.	The Contractor shall • Prepare a traffic management plan and submit the plan for PSIAC and PMU approval. • Strictly follow the Project's 'Traffic Management Plan' and work with close coordination with the Traffic Management Unit. • Prepare and submit additional traffic plan, if any of his traffic routes are not covered in the Project's Traffic Management Plan, and

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		requires traffic diversion and management. • Include in the traffic plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges, temporary diversions, necessary barricades, warning signs / lights, road signs, construction schedule etc. • Provide signs at strategic locations of the roads complying with the schedules of signs contained in the National Traffic Regulations.
	Accidents and spillage of fuels and chemicals	The Contractor shall • Restrict truck deliveries, where practicable, to day time working hours. • Restrict the transport of oversize loads. • Operate vehicles, if possible, to non-peak periods to minimize traffic disruptions. • Enforce on-site speed limit, especially close to the sensitive receptors, schools, health centers, etc.

ECP 16: Construction Camp Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Siting and Location of construction camps	Campsites for construction workers are the important locations that have significant impacts such as health and safety hazards on local resources and infrastructure of nearby communities.	The Contractor shall • Prepare a construction camp management plan and submit the plan to PSIAC and PMU for approval. • Locate the construction camps within the designated sites or at areas which are acceptable from environmental, cultural or social point of view and approved by the PIU and PSIAC. • Conduct consultation with communities including local bodies (Village Head and

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		Group Village Head) prior to set-up the camp. • Consider the location of construction camps away from communities in order to avoid social conflict in using the natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities. • Submit to the PSIAC and PMU for approval a detailed layout plan for the development of the construction camp showing the relative locations of all temporary buildings and facilities that are to be constructed together with the location of access roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, prior to the development of the camps. • Local authorities responsible for health, religious and security shall be duly informed on the set up of camp facilities so as to maintain effective surveillance over public health, social, and security matters.
Construction Camp Facilities	Lack of proper infrastructure facilities, such as housing, water supply, and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	Contractor shall provide the following facilities in the campsites • Adequate housing for all workers. • Safe and reliable water supply, which should meet national/WHO standards. Drinking water to be chlorinated at source, and ensure presence of residual chlorine 0.1 ~ 0.25 ppm as minimum after 30 minutes of chlorine contact time (WHO guideline). • Hygienic sanitary facilities and sewerage system. The toilets and domestic waste water will be collected through a common sewerage. Provide separate latrines and bathing places for males and females with total isolation by location. The minimum number of toilet facilities required is one toilet for every ten persons. • Treatment facilities for sewerage of toilet and

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		domestic wastes. • Storm water drainage facilities. • Provide in-house community/common entertainment facilities. Dependence of local entertainment outlets by the construction camps to be discouraged/prohibited to the extent possible.
Disposal of waste	Management of wastes is crucial to minimize impacts on the environment	The Contractor shall • Ensure proper collection and disposal of solid wastes within the construction camps. • Insist waste separation by source; organic wastes in one container and inorganic wastes in another container at household level. • Store inorganic wastes in a safe place within the household and clear organic wastes on daily basis to waste collector. Establish waste collection, transportation and disposal systems with the manpower and equipment/vehicles needed. • Do not establish site specific landfill sites. All solid waste will be collected and removed from the work camps and disposed in approved waste disposal sites.
Fuel supplies for cooking purposes	Illegal sourcing of fuel wood by construction workers will impact the natural flora and fauna	The Contractor shall • Provide fuel to the construction camps for their domestic purpose, in order to discourage them to use fuel wood or other biomass. • Made available alternative fuels like kerosene on ration to the workforce to prevent them using biomass for cooking. • Conduct awareness campaigns to educate workers on preserving the protection of biodiversity and wildlife of the project area, and relevant government regulations and punishments on wildlife protection.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Health and Hygiene	There will be a potential for diseases to be transmitted including TB, exacerbated by inadequate health and safety practices. There may be an increased risk of sexually transmitted infections and HIV/AIDS.	The Contractor shall • Provide adequate health care facilities within construction sites. • Provide first aid facility round the clock. Maintain stock of medicines in the facility and appoint fulltime designated first aider or nurse. • Provide ambulance facility for the laborers during emergency to be transported to nearest hospitals. • Initial health screening of the laborers coming from outside areas. • Train all construction workers in basic sanitation and health care issues and safety matters, and on the specific hazards of their work. • Provide HIV awareness programming, including STI (sexually transmitted infections) and HIV information, education and communication for all workers. • Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellant sprays during mosquito season in offices and construction camps and yards. • Not dispose food waste openly as that will attract rats and stray dogs. • Carryout short training sessions on best hygiene practices to be mandatorily participated by all workers. Place display boards at strategic locations within the camps containing messages on best hygiene practices.
Security and Safety	Inadequate security and safety provision in construction camps may create security and safety problems of workforces and assets and fire	The Contractor shall • Provide appropriate security personnel (police or private security guards) and enclosures to prevent unauthorized entry in to the camp area.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	hazards	• Maintain register to keep a track on a head count of persons present in the camp at any given time. • Encourage use of flameproof material for the construction of labor housing / site office. Also, ensure that these houses/rooms are of sound construction and capable of withstanding wind storms/cyclones. • Provide appropriate type of firefighting equipment suitable for the construction camps. • All construction material storage should be sit a visible location secured with fence or solid walls with locks to avoid theft and vandalism. • Display emergency contact numbers clearly and prominently at strategic places in camps. • Communicate the roles and responsibilities of laborers in case of emergency in the monthly meetings with contractors.
Site Restoration	Restoration of the construction camps to original condition requires demolition of construction camps.	The Contractor shall • Dismantle and remove from the site all facilities established within the construction camp including the perimeter fence and lockable gates at the completion of the construction work. • Dismantle camps in phases and as the work gets decreased and not wait for the entire work to be completed. • Give prior notice to the laborers before demolishing their camps/units. • Maintain the noise levels within the national standards during demolition activities. • Different contractors should be hired to demolish different structures to promote recycling or reuse of demolished material. • Reuse the demolition debris to a maximum extent. Dispose remaining debris at the designated waste disposal site.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Restore the site to its condition prior to commencement of the works or to an agreed condition with the landowner.

ECP 17: Cultural and Religious Issues

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities near religious and cultural sites	Disturbance from construction works to the cultural and religious sites, and contractors lack of knowledge on cultural issues cause social disturbances.	The Contractor shall • Communicate to the public through community consultation regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restriction. • Not block access to cultural and religious sites, wherever possible. • Restrict all construction activities within the foot prints of the construction sites. • Stop construction works that produce noise (particularly during prayer time) should there be any mosque/religious/educational institutions and health center close to the construction sites and users make objections. • Take special care and use appropriate equipment when working next to a cultural/religious center. • Stop work immediately and notify the site manager, if during construction, an archaeological or burial site is discovered. It is an offence to recommence work in the vicinity of the site until 'approval to continue' is obtained by the archaeological authority. • Provide independent prayer facilities to the construction workers. • Show appropriate behavior with all construction workers especially women and

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		elderly people. • Allow the workers to participate in praying during construction time, if there is a request. • Resolve cultural issues in consultation with local leaders and supervision consultants. • Establish a mechanism that allows local people to raise grievances arising from the construction process. • Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works so as to maintain effective surveillance over public health, social, and security matters.

ECP 18: Worker Health and Safety

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Best practices	Construction works may pose health and safety risks to the construction workers and site visitors leading to severe injuries and deaths. The population in the proximity of the construction site and the construction workers will be exposed to a number of (i) biophysical health risk factors, (e.g., noise, dust, chemicals, construction material, solid waste, waste water, vector transmitted diseases, etc.), (ii) risk factors resulting from human behavior (e.g., TB, STD, HIV/AIDS, etc.) and (iii) road accidents from	The Contractor shall • Prepare an Occupational Health and Safety plan and submit the plan for PSIAC and PMU approval. • Implement suitable safety standards for all workers and site visitors, with sufficient provisions to comply with international standards (e.g. International Labor Office guideline on 'Safety and Health in Construction; World Bank Group's 'Environmental Health and Safety Guidelines') and contractor's own safety standards, in addition to complying with national standards. • Provide the workers with a safe and healthy work environment, taking into account inherent risks in its particular construction activity and specific classes of hazards in the work areas. • Provide personal protective equipment

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	construction traffic.	(PPE) for workers, such as safety boots, helmets, masks, gloves, protective clothing, goggles, full-face eye shields, and ear protection. Maintain the PPE properly by cleaning dirty ones and replacing the damaged ones. • Safety procedures include provision of information, training and protective clothing to workers involved in hazardous operations and proper performance of their job. • Appoint an environment, health and safety manager to look after the health and safety of the workers. • Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works and establishment of construction camps so as to maintain effective surveillance over public health, social and security matters.
	Child and pregnant labor	The Contractor shall • not hire children of less than 14 years of age and pregnant women or women who delivered a child within 8 preceding weeks.
Accidents	Lack of first aid facilities and health care facilities in the immediate vicinity will aggravate the health conditions of the victims	The Contractor shall • Ensure health care facilities and first aid facilities are readily available. Appropriately equipped first-aid stations should be easily accessible throughout the place of work. • Document and report occupational accidents, diseases, and incidents. • Prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards, in a manner consistent with good international industry practice. • Identify potential hazards to workers, particularly those that may be life-threatening and provide necessary preventive and protective measures.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Provide awareness to the construction drivers to strictly follow the driving rules. • Provide adequate lighting in the construction area, inside the tunnels, inside the powerhouse cavern and along the roads.
Construction Camps	Lack of proper infrastructure facilities, such as housing, water supply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	The Contractor shall provide the following facilities in the campsites to improve health and hygienic conditions as mentioned in ECP 16: Construction Camp Management: • Adequate ventilation facilities • Safe and reliable water supply. • Hygienic sanitary facilities and sewerage system. • Treatment facilities for sewerage of toilet and domestic wastes • Storm water drainage facilities. • Recreational and social facilities • Safe storage facilities for petroleum and other chemicals in accordance with ECP 2 • Solid waste collection and disposal system in accordance with ECP1. • Arrangement for trainings • Paved internal roads. • Security fence at least 2 m height and security guards at entrances and every corner of the facility. • Sick bay and first aid facilities
Water and sanitation facilities at the construction sites	Lack of Water sanitation facilities at construction sites cause inconvenience to the construction workers and affect their personal hygiene.	The contractor shall • Provide portable toilets at the construction sites with workforce size 25 people or more, work the whole day for a month. Location of portable facilities should be at least 6 m away from storm drain system and surface waters. These portable toilets should be cleaned once a day and all the sewerage should be pumped from the collection tank once a day and should be brought to the

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		common septic tank for further treatment. • Provide safe drinking water facilities to the construction workers at all the construction sites.
Other ECPs	Potential risks on health and hygiene of construction workers and general public	The Contractor shall follow the following ECPs to reduce health risks to the construction workers and nearby community • ECP 2: Fuels and Hazardous Goods Management • ECP 4: Drainage Management • ECP 10: Air Quality Management • ECP 11: Noise and Vibration Management • ECP 15: Road Transport and Road Traffic Management
Trainings	Lack of awareness and basic knowledge in health care among the construction workforce, make them susceptible to potential diseases.	The Contractor shall • Train all construction workers in basic sanitation and health care issues (e.g., how to avoid malaria, transmission of sexually transmitted infections (STI), and HIV/AIDS. • Train all construction workers in general health and safety matters, and on the specific hazards of their work. Training should consist of basic hazard awareness, site specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. • Implement HIV/AIDS and STI education campaign targeting all workers hired, female and male, skilled, semi- and unskilled workforces, at the time of recruitment and thereafter pursued throughout the construction phase on ongoing and regular basis.

ECP 19: Construction and Operation Phase Security

Project Activity/ Impact	Impacts /Concerns	Mitigation Measures/ Management Guidelines

Source		
Construction Phase	Inadequate construction site security poses a significant risk to assets, construction materials and property. Theft/vandalism of assets, materials and property would increase construction costs and cause delays in project completion.	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 all assets (i.e., tools, equipment, etc.) and construction materials at construction site are identified, inventoried and tracked as closely as possible. All assets should be clearly labeled and marked. Keep records of tool serial numbers and check inventory on a regular basis. • All tools and equipment should have a check out/in system, if not in use should be secured and stored in a proper place to prevent theft or loss. Provide storage sheds for the secure storage of equipment and tools when not in use. • Ensure there is proper fencing around construction site perimeter. Fencing should be chain-link at least 2.4 m high and secured with a steel chain and lock. If possible the entire site should be fenced; if this is not possible, make sure construction trailer and any equipment storage areas are fenced. • Ensure construction site has controlled access points (one or two entry points at most), allowing for close monitoring of comings and goings from the site. • Workers should be easily identified and have credentials that indicate site access. • No trespassing signs should be posted in conspicuous areas throughout the job site. • List of employees who have after hour access to the property should be available to the BWB and local authorities. • Ensure job site is properly lighted at night. Well-lit areas should include any office trailers and equipment storage trailers. Floodlights operated by sensors should also be installed where appropriate. • Pre-employment screening investigations should be used to verify the applicants relating to their employment, education and criminal history

		background.
	Improper security measures may pose security risk for construction workers and especially foreign staff on construction sites.	The Contractor shall: • Prepare site specific security plan. • Maintain register to keep track of number of persons present in the camp at any given time. • Provide appropriate security personnel at job sites as mentioned above. • Ensure proper fencing as mentioned above. • Ensure controlled access points to job site as mentioned above. • Ensure works have easily identified credentials as mentioned above. • Ensure job sites are properly lighted at night, as mentioned above.
Operation Phase	Vandalism/damage (including use of explosives) and theft of infrastructure (i.e. metals and etc.).	• Ensure strategic infrastructure sites are secure and fenced with controlled access points. Fencing should be chain-link at least 2.4 m high and secured with a steel chain and lock.

Annex E: Integrated Pest Management

1. Introduction

1.1 Balochistan is the largest of Pakistan's four provinces. Its total area is over 347,000km^2 constituting up to 44% of the total land mass with a population of 9.9 million[23], or 5% of the national population. Its population density is very low due to its mountainous geography and water scarcity. Agriculture (crops and livestock) is the mainstay of the Balochistan economy (~60 percent of the GDP and ~67 percent of labor).

1.2 The population of Balochistan is primarily rural and spread across 18 river basins. Balochistan is naturally water scarce given the semi-arid climate characterized by short intense rainfall events but low overall rainfall (~200 mm/yr), and rainfall high variability between seasons and years. The natural hydrology causes both extended and flash floods (and associated damage and disruption) and frequent drought conditions. The natural scarcity is compounded by (i) a lack of infrastructure to harvest, store and distribute water, (ii) unsustainable watershed and rangeland management, (iii) inefficient water use in all sectors including irrigation (the largest use sector), (iv) unregulated and indiscriminate groundwater abstraction and (v) weak central and community institutions.

1.3 In the last few decades development in Balochistan has been largely driven by growth in high-value irrigated agriculture achieved by expansion of tubewell-irrigation. Total irrigated area is now ~1.7 million ha (~1.3 million ha of perennial irrigation and 0.4 million ha of spate[24] irrigation and water harvesting systems). Key agricultural products include wheat, apples, grapes, vegetables, barley, milk and meat; horticulture dominates provincial income from agriculture.

1.4 The BIWRMD Project's main beneficiaries will be small-holding farmers (up to 5 ha) and medium-holding farmers (5-20 ha) engaged in irrigated agriculture. In the Project areas ~48,100 farm households will benefit from irrigation sub-projects and improved on-farm water management, ~3,600 households will benefit from improved potable water supply, ~10,200 households will benefit from improved flood protection, and ~33,000 households will benefit from better watershed and rangeland management and environmental protection. In total, ~86,000 households (or ~705,000 people) will directly benefit from the Project. The project will also enhance opportunities for women to participate in profitable agriculture, by tailoring interventions to their specific needs and by promoting gender equity in rural communities.

1.5 In Balochistan, the most common cropping pattern in double cropping system is sorghum mix with beans (mashbeans, mungbeans, moath) and wheat. In certain areas oilseeds or barley are grown instead of wheat. Guar and castor are grown during Kharif. Forest and arid horticulture plants are also grown. The arid horticulture includes almonds, mulberry, pomegranate, olives, etc. Livestock is also dominant part of the farming system: sorghum, mash and mungbeans provide fodder for livestock. The food legumes fix atmospheric nitrogen and provide opportunity fodder fodder in the dry years and both grain and fodder in average and wet years Crop rotation depends on the availability of water. In most parts of Balochistan floodwater is available during the Rabi season, where wheat and melons are grown in spring. In areas, where rainfall is prevalent during Kharif season, both Kharif and Rabi crops are grown. Crop diversification is commonly followed to have more reliable Sailaba farming system covering

[23] Pakistan Economic Survey 2014-15

[24] Spate irrigation (or Sailaba) diverts water from ephemeral rivers beds during "spate" or flood periods. Diversion is by free intakes, diversion spurs or bunds built across the river bed. Floodwaters, typically lasting a few hours or days, is channeled through primary, secondary and sometimes tertiary flood channels. Command areas range from a few hectares to over 25,000 hectares.

cereals, pulses and fodders. In some areas fodder is the main crop having marketing prospects and drought tolerant than cereals. Farmers normally practice deep drilling of seed to have better crop germination and stand.[25]

1.5 The Government of Balochistan (GoB) has adopted a policy of IWRM including 16 "Policy Thrust Areas", which are essential for improving and sustaining the management of surface and groundwater resources. The expected benefits of IWRM include: (i) more economically efficient planning and use of available water, (ii) more socially equitable use of water resources and (iii) more environmentally sustainable use of water resources. For Balochistan, IWRM can address strategic and integrated planning and management of all water resources (surface and groundwater) across all sectors, considering climate variations and climate change and options for cost-effective enhanced water storage including in groundwater systems. Elements of the Balochistan IWRM policy have been tested in the recent Balochistan Small Scale Irrigation Project (BSSIP); the proposed project will further advance IWRM policy implementation.

1.6 Environmental and social and assessments for the BIWRMD Project have been prepared for the proposed works. Under the environmental and social safeguards requirements for World Bank-funded projects, as well as Pakistan environmental requirements, an Environmental Management Plan (EMP) was mandated and prepared. The EMP recommends measures to mitigate possible adverse impacts on the environment, including the potential induced impacts of increased pesticide use. Accordingly, this current Integrated Pest Management Plan (IPMP) has been prepared in fulfillment of the Bank's policy (OP4.01) requirements and is an integral part of the EMP.

2.Current Pest and Pesticide Management Approaches

2.1 At 0.76% use over each hectare[26], pesticide use in Balochistan is currently the lowest in Pakistan. Over half of the pesticide use is on fruits, and vegetable; while the balance is used on rice and cotton. Currently, only 4% of cultivated land depends solely on animal manure[27]. The likelihood that the use of agricultural chemicals will increase with better access to water is high.

Main Agricultural Pests/Diseases by Crop

2.3 Ground plant protection measures (mostly pesticide and herbicide sprays) are employed on 17% of the cropped area of all field crops including vegetables and orchards[28] as compared over 30% on the national basis. However, plant protection on onions, cotton, rice and wheat account for 23%, 14%, 12% and 11% respectively of their cropped area in the province. Irrigation water, thrips (*Thrips spp*.) attack and presence of weeds is the major reported problems of the onion crop in the province[29]. Stem borers and white backed plant hopper (*Sogatellafurcifera*) are the main pests of the rice crop. The diseases caused include: leaf blight, brown leaf spot, stem rot, and smuts.

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[25] Shahid and Ahmad, 2008. Spate Irrigation – Assessment and Cost Effective Development in Sailaba Farming Systems of Balochistan.

[26] Khan, Zia and Qasim, 2010. Use of Pesticides and Their Role in Environmental Pollution. International Journal of Environmental, Chemical, Ecological, Geological and Geophysical Engineering Vol:4, No:12.

[27] Pakistan Agricultural Census, 2010

[28] Pakistan Agricultural Census, 2010

[29] Malik, M.F; Nawaz M and Hafeez Z, 2003. Evaluation of Onion Crop Production, Management Techniques and Economic Status in Balochistan. Pakistan. *Journal of Agronomy, 2: 70-76.*

2.3 **Vegetables and Horticultural Crops.** Vegetables and horticultural crops in the Province include onions, apples, apricot and peach. Pesticides such as DDT are commonly used and the careless handling of agrochemicals poses a major health threat[30].

Apples. Among various insect pests; borers, mites, codling moth (*Cydia pomonella L*.), sanjose scale, heliothus and fruit flies. Major diseases are Apple Bark Split, Powdery mildew, Die Back, chlorosis. Codling moth, *Cydia pomonella* L. infests pome fruits such as apples, pears and quinces, as well as stone fruits and walnuts. In Quetta valley, codling moth is considered a significantly important insect pest of apple. Caterpillar of *C. pomonella* cause heavy losses in unsprayed apple orchards. The loss may rise up to 80% and the recorded host plant besides apple include pear, quince, plum, peach and cherry. In Balochistan there are three generations of codling moth and a partial fourth generation depending upon weather condition is also found.[31]

Thrips in onion are of prime importance The minute looking thrips are soft bodied insects, polyphagous, and occur throughout the year. Both nymphs and adults lacerate the leaf tissues and feed on the oozing sap. Usually young leaves are preferred, but buds and flowers also get infested. The infested leaves become shortened, curl upwards, and crinkle. Under severe infested conditions the leaves shed and hence plant growth is affected. Mites are also tiny insects that live on tender foliage, buds and fruits by sucking the plant sap. These are found mostly on the lower surface of leaves in a protective web. Under severe infestation of chilies the leaves curve downwards and fruit turns brownish with hardened skin. Aphids are also tiny insects and can infest the crops at any time during the growing season. They look like minute dark specks and tend to gather around the shoot tips, flower buds and all over young foliage. Aphids also leave sticky excreta on leaves that they have been feeding on, which could help in the development of fungal molds. Aphid infestation results in stunted or deformed growth. Fruit or pod borers are highly polyphagous and cosmopolitan in distribution. These normally start infesting chilies crop around flowering time. Young larvae are associated with younger shoots and leaf tissues, as well as grown up larvae feed on leaves and fruits by piercing and sucking resulting in holes.

Balochistan is the third major producer of chilies after Sindh and Punjab. In chilies pests may be effectively controlled through plain water sprays/ neem oil-water sprays. However, in rare instances third generation eco-friendly insecticides such as Acetamiprid, and diafenthiuron that could be used, In some literature, Imidacloprid,and Emamectin are wrongly categorized as eco-friendly, but in fact these are not eco-friendly and should not be used; particularly the latter Emamectin which is highly toxic to bees and aquatic arthropods. Similarly, third generation fungicides such as Difenoconazole, mancozeb, could also be used as last option. In Onion plain water spray or neem-oil spray is best to control thrips. Occasionally onion crop is attacked by bulb fly, and certain lepidopterous pests then the pesticides of chloropyrophos, Imidacloprid or any third generation pyrethroid available in the market may be used.

There are implications of these crop pests the on pesticide use patterns in vegetables particularly onions. Aphids, mites and thrips are all notorious for developing resistance to most insecticides which tends to put farmers on a “Pesticide Treadmill” with high concentrations and

[30] Balochistan Conservation Strategy.

[31] Kakar, A., and Hazara A H, 2009. Non-Chemical Treatments for Control of Codling Moth *Cydia pomonella* L. (Lepidoptera: Tortricidae) in Quetta Valley, Balochistan, Pakistan *Pakistan J. Zool., vol. 41(3), pp. 189-196.*

more frequent uses. Therefore it is desirable for an IPM strategy to include a pesticide resistance management strategy as well.

The major insect pests in **wheat** are aphids and seed borers, while the major diseases were yellow rust and grain smut.

Weeds. Herbicides are not usually for weed control in Balochistan because most farmers feed the weeds to their livestock as cheap fodder. This is both environmentally friendly and cost effective for the farmers.

Dates. The date palm and its fruits are subject to attacks by several insect pests such moths and beetles (such as Caroub moth, caused by *Ectomyelois ceratoniae.* and rhinoceros beetle scientifically called *Oryctes rhinoceros* Linné.), and red palm weevil (RPW), scientifically called *Rhynchophorus ferrugineus* Oliv. RPW is also called the Indian palm weevil and lasser fruit borer. To control these pests pesticides of pyrathroid group may be used. Besides insect infestations, some of these diseases (bending head) are believed to be caused *Thielaviopsis paradoxa* and *Botryodiplodiatheobromae fungi. Red palm w*eevil attacks the trees from wound spcially t*he site sucker remo*val at the base. It is best controlled by immediately treat*ing the sucker removal si*te/wound with used mobile oil alternatively by bitter cucumber paste. Fruit moth is occasional pest and through pest scouting if found a threat then it may be controlled through use of any third generation insecticide available in th*e market.*

*It may be us*eful *to mention here the imp*lications of these crop pests on pesticide use patterns. Aphids, mites and thrips are all notorious for developing resistance to most insecticides which tends to put farmers on a “Pesticide Treadmill” with high concentrations and more frequent uses...Hence the need for an IPM strategy or a resistance management strategy (if the option is to go with pesticide use)

Crop Losses

2.5 Reliable data on crop losses due to insect pests and diseases is generally not available. Various reports in the public sector archives put losses in crop production due to insects at 20-30%. The first incidence of white backed plant hopper as a major pest in 1976 caused losses of up to 60% paddy yield in Balochistan.

2.6 Post-harvest losses (PHL) are significant in the case of grain cereals: for example, wheat and rice which are stored for long durations, the national average storage loss is estimated at 3.5% over a period of 5 months and could be as high as 15% if stored for 2-3 years. According to some informal estimates, PHL in Balochistan could be as high as 35% in the case of fruits, 15% in the case of onions and chilies. Alflatoxin contamination is reported to affect 80% of the chili crop.

Pesticide Use

2.7 The use of pesticides have steadily increased in the country from about 250 metric tons (MT) in the mid 1950s, to about 670 MT in 1980 when pesticide business was transferred to the private sector. Pesticides consumption was 3,672 MT in 1981, 20,213 MT in 1991, and 47,592 MT in 2001. It kept on increasing until the middle of first decade of the 21st century (129,598 MT in 2004), but started declining persistently (105,164 MT in 2005), albeit with fluctuating consumption thereafter. In 2008, the consumption of pesticides was reported at 39,186 MT; in 2009 it was 40,643 MT but jumped to 73,632 MT[32] in 2010.

[32] All figures on pesticides consumption reported are taken from Agricultural Statistics of Pakistan

2.8 On the basis of three-years moving averages of the pesticide use in the country, the decline in the use of pesticides from 2005 to 2010 has been considerable; from 104,298 MT to 51,557 MT respectively at an annual decline rate of 12.9%. Prior to this period, the pesticide use had increased at an annual rate of 14.5% from 1992 to 2005. Cotton is the singular largest crop whereupon pesticide use is the highest; 51% of the entire cropped area for all crops in 2000, 64% in 2005, 55% in 20102 and 47% in 2011. In 2010, it was recorded that 0.76% of cultivated land in Balochistan applied pesticide: 16%, rice 27.27%, fruits/vegetables 55.9%, maize 0.3%. These figures indicate that Balochistan's fruits and vegetable sector has accounted over half of pesticides use as compared to 12% at the national level for the same period.

2.9 The excessive use of pesticides has disturbed the agro-ecosystems in the region. Pesticides have been instrumental in the killing of non-targeted and friendly organisms, including birds, and have also induced pest resurgences. In some cases, resistance to pesticides has developed and outbreaks of secondary pests have been witnessed. There have also been deleterious effects of pesticide use on human health, natural resources and the environment.

Safety: Storing and Disposal

2.10 While Pakistani law requires that storage places for pesticides should: (i) be away from populated areas; (ii) be properly ventilated; (iii) have protected electric installations; (iv) have firefighting equipment; (v) be equipped with protective and safety clothing; and (vi) have emergency showers and eyewash facilities; these requirements are seldom met. Also the rules for disposal are also generally disregarded. There are also accountability issues of six thousand tons of out-dated pesticides lying in different stores in Pakistan as most of the containers leak and contaminate soil. The usual practice in factories is to dig holes and bury the contents. Preventive measures are not adopted to decompose the poisonous material. It used to be a common observation about a decade ago that end users do not dispose off the empty papers, cardboard or plastic packs by enclosing them in weatherproof containers and glass containers are not crushed in sacks, as required by law. A survey conducted by the National Fertilizer Development Center (NFDC) in 2002 revealed that about 48% of pesticide users simply threw away pesticide packing, 34% buried it, and surprisingly 3% washed and reused it. However vigorous campaigns by the public and private sectors on the safe disposal as well the introduction IPM practices and education since then could have had some positive impacts as well.

2.11 An emerging and persistent issue for pesticides handling in Pakistan is that the inventory of outdated pesticides needs to be updated and safe disposal arranged. The quantity of outdated pesticides was reported by the Plant Protection Department of the Federal Ministry of Agriculture, as of 1999, in the Agriculture Statistics Book. The issue is about three decades old when pesticide sales and distribution, then handled by the provincial public sector extension departments, was privatized in 1984. Much of the stocks of pesticides were depleted, sold out or held at remote areas; yet because of poor bookkeeping by the extension agents, were not properly accounted for. In all likelihood, no such stock can exist after three decades. However, public sector auditing kept such stocks outstanding against the extension agents. It is therefore recommended that inventory should to be updated and a policy decision be taken at the appropriate government level waiver off the outstanding stock that exist on paper only. Similar situation is not possible in the Project areas because agriculture extension department does not handle any pesticide anymore for sales and distribution to the farmers.

Externalities of Pesticide Use

2.12 The cost of pesticide use is much more than the cost of the pesticide itself. The social cost is enormous which is generally disregarded while determining the economic gains in terms of higher crop yields. These costs include: occupational poisoning, food residues, drinking water contamination, pest resistance, loss of biodiversity, cost of prevention and abatement measures and the cost of awareness campaigns. Further, there are health related issues; such as (a) ***Sickness Incidence of Pesticide Applicators,*** pesticide-related sickness is very common in the cotton zone as about 63% of households report sickness during the spraying season, mortalities are about 1 per 400 households while main reported ailments were vomiting, dizziness, and breathing problems; (b) ***Sickness in Women Cotton Pickers,*** about 87% women pickers complain of a variety of symptoms like headache, nausea, vomiting, skin irritation, general weakness, fever, dizziness, stomach pain, and blisters; (c) ***Industrial Worker Poisoning,*** about half of the labor force, working in the pesticide plants report sickness by inhaling pesticide emissions; and (d) ***Pesticide Residue in Food Chain,*** fruits and vegetables are contaminated with pesticide residues to the extent of 40% and 63%-70% of these are above the Maximum Residue Limit (MRL)[33].

2.13 **Other externalities**. Pesticide residues can be present in irrigation and drinking water, cotton seed, oil, lint and cattle feed, cottonseed cake, animal milk, and soil. Increased pesticide resistance is resulting in additional applications of pesticides to maintain expected crop yields. The consequences are lower yields and higher production costs. Pesticide use is affecting biodiversity too but it is little understood and appreciated. Some examples are: pollinator damage (honey bee poisoning), soil fauna, wildlife and birds.

2.14 **Monetization of Pesticide Externalities**. Clearly there are substantial costs that the society has to bear on account of harmful effects of pesticides. Periodic research needs to be carried out on the economic costs of pesticide-related externalities. An assessment made in 2000 shows (Annex 1) that the external costs of pesticide use in Pakistan amounts to about Rs. 11.7 billion annually[34].

Integrated Pest Management (IPM)

2.15 No single method of pest control is adequate to give satisfactory results in all situations. Therefore an integrated approach needs to be adopted. For this purpose, Integrated Pest Management (IPM) is the best available alternative. IPM has no standard definition, but is commonly referred as a diverse mix of approaches to manage pests; keep them below damaging levels by using control options that range from cultural practices to chemicals. Technologies involved, such as use of bio-pesticides (derived from neem, dhatura and aak that are local tree/bushes and tobacco), augmentation releases of predators/parasites, development of pest resistant species, crop rotation, cultural practices, and balanced use of fertilizers.

Integrated Plant and Soil Nutrient Management (IPSNM)

2.16 The concept of Integrated Plant and Soil Nutrient Management (IPSNM) entails the management of both organic and inorganic plant nutrients for optimal production of the cultivated crop, forage, and tree species while conserving the natural resource base that is essential for the long-term sustainability of the agro-ecosystems and the environment. Organic fertilizers bring about many useful changes in the chemical, microbiological and physical properties of soil that enhance soil fertility. The effect is long-term and not immediate, and, therefore, farmers hesitate to use organic fertilizers. High levels of organic residue incorporation especially in fine textured soils, improves its structure as indicated by several of the parameters such as soil porosity, pore size distribution, bulk and particle densities, aggregate stability, water holding capacity, aeration, infiltration, and hydraulic conductivity. The recycling of soil-derived nutrients is also improved through proper organic residue management.

[33] indicated by two different studies at about mid 1990s and 2000
[34] Ahmed (2002), "External Costs of Pesticide Use in Pakistan"

Good Agriculture Practices (GAP) and Participatory Development Technology (PDT)

2.17 The Good Agricultural Practices (GAP) can be introduced as the main focus of all extension activities to all areas of the production and post harvest handing of produce. There are internationally recognized standards that can form the basis of a set of codes of practice that can be slowly introduced to farmers, and it could be possible to identify traditional agricultural practices which could be adapted to the GAP model. It is unlikely that all farmers would be in a position to enact all the practices that were required by the most demanding market outlets. However, the more GAP elements that a farmer could adopt, the greater would be their gain in productivity and the quality of the produce finally sent to market. The main vehicle to be employed for implementing GAP is though the Farmer Field School (FFS) approach, which also is the principal methodology for delivering the IPM programs. As for example, cultural practices, crop rotations, use of organic or bio-fertilizers, pest scouting are salient aspects of the FFS curriculum that would be an integral part of the GAP curricula. Similarly Participatory Development Technology (PDT) approach, which although is the main investment vehicle of the SAGP for the farmers and producers to improve their productivity of the target crops, is through the FFS. The focus of all PTD groups is on new technologies and methods of crop protection, cultivation, irrigation and improved cultural practices. Through the PTDs the farmers apply a number of new technologies, along with IPM, in perennial and annual horticulture. Some of the important elements in PTD are to compare the traditional methods of crop protection practices with the IPM based new technologies. The details of FFS and PDT, along with FFS curricula development are given in Annex 2.

Research and Development

2.18 Pakistan has actively pursued research and development on IPM since 1971, during which period national and provincial governments and international agencies have funded several project. A 2010 ICARDA on poverty alleviation in Balochistan included a training component on IPM.[35] The FFS approach was also shared with the trainees during this project. During this period, the project activities demonstrated

National Integrated Pest Management Project (Nat-IPM)

2.19 Currently, the focal point of all IPM activities in Pakistan is the NARC. With a view to up-scaling its ongoing IPM activities, NARC has been implementing a national IPM project that was approved in 2001-02 by the federal government for a total outlay of Rs 950 million during the 10 years perspective plan, 2001 to 2011. It was executed by the Nat-IPM Coordinator at NARC in collaboration with Provincial Coordinators/District Officers (Agriculture). The main objective of the project is expanded and sustainable implementation of IPM in Pakistan, rationalizing the use of pesticides while maintaining production levels, and increasing farmers' profit. The specific targets laid down, initially were: (i) training of 500 extension staff and 55,000 farmers in IPM technologies through 20 ToFs and 840 FFSs; (ii) development of 840 village organizations in 20 districts of Pakistan; (iii) studies to recommend policy options to reduce indiscriminate/overuse of pesticides; (iv) training of 250 teachers of colleges and universities in IPM philosophy; (v) establishment of IPM information network and website, and issuance of newsletter; and (vi) training of public sector professionals and students (200) in IPM related research and development. No update is available yet on the achievement of the targets and outcomes of the Nat-IPM.

[35] ICARDA (International Center for Agricultural Research in the Dry Areas). 2010. Food security and poverty alleviation in arid agriculture: Balochistan GCP/PAK/095/USA, pilot project phase. Final Report. ICARDA, Aleppo, Syria. vi + 156 pp.

3.Policy, Regulatory Framework, and Institutional Capacity

3.1 At present the Ministry of National Food Security and Research is the controlling agency for the import and production of pesticides, while the department of Plant Protection (Karachi) is responsible for the registration and regulation of Pesticides. The rules and regulations for Pesticides manufacturing, import and usage are stated in the Agriculture Pesticide Ordinance Government of Pakistan 1971 and the Agriculture Pesticides Rules Government of Pakistan 1973. These rules and regulations are based on guidelines from Food and Agriculture Organization. The Ordinance was amended later with respect to import of Pesticides and punishment for defaulters. To assist and advise the Federal Government on the technical aspects of the Pesticide Ordinance, the Agricultural Pesticide Technical Advisory Committee (APTA) was established. It comprises representatives from Universities, Government Departments, Pakistan Agriculture Research Council and Central Cotton Committee.

Integrated Pest Management as a Coping Strategy

3.2 The IPM approach is a knowledge-intensive process of decision-making that combines various strategies (biological, cultural, physical and chemical) to manage pests. The IPM program adopted by the Federal Government aims in the first instance at improving sustainable agricultural production by reducing the use of chemical pesticides, and promoting the adaptation of IPM strategies to field and horticultural crops through Farmer Field School (FFS) methodology. The Ten Year Perspective Plan (2001-11) also emphasized IPM as follows h:

"It has been estimated that around 25 percent of crop outputs are lost due to attack of pests and diseases. Although the application of pesticides has increased over the years, its indiscriminate use should be avoided as it kills useful insects and predators, and causes environmental degradation. In order to reduce pesticide application and promote biological control of insects and pest, Integrated Pest Management (IPM) programs will be undertaken. Adulteration of pesticides will be controlled through strict implementation of the Pesticide Act."

Laws, Rules and Regulations

3.3 The first law called The Agricultural Pesticide Ordinance, 1971 was promulgated. The Agricultural Pesticide Rules under the law were framed in 1973. The 1971 Ordinance is a comprehensive law for regulating imports, formulation, sale, distribution, and use, and establishing of institutions, ensuring quality control, and prescribing penalties for offences. It was amended in 1979 to let pesticide business transition from public sector to private sector, thereafter in 1992 to allow pesticide imports under generic names, and lastly in 1992 to strengthen the punishment provisions for adulteration. The Pakistan Environmental Protection Agency (Pak-EPA) has also developed a set of guidelines for pesticide control.

Institutional Framework

3.4 Under the Act and Rules, an Agricultural Pesticide Technical Advisory Committee (APTAC) was established to advise the Federal Government on all matters relating to agricultural pesticide use and approve the registration of pesticides on the recommendations of the APTA Sub-Committee. The former is headed by the Secretary, Ministry of Food, Agriculture and Livestock, and the latter by the Plant Protection Adviser and Director General, Department of Plant Protection, Karachi. At the federal level, the Department of Plant Protection is responsible for the registration of pesticides, monitoring of import, and assuring quality control, while at the provincial level, the Provincial Agricultural Extension Departments are responsible for standardization of doses, registration of distributors and dealers, and quality control through its inspectors and pesticide laboratories.

3.5 **Registration of Pesticides** is carried out in three categories: (i) under trade name for which efficacy trials are done in the field for 2 years and registration takes place over a period of

2-3 years; (ii) under generic name for which government analyst's report is considered sufficient; and (iii) importation of pesticides registered in countries of manufacture on the basis satisfactory documentary proof. By 2000, a total of 2,116 pesticides were registered: 498 products trade names, 792 under generic names, and 826 on the basis of registration in the country of manufacture.

3.6 **Banned Pesticides**. In 1994, twenty-three (23) pesticides were deregistered and their use banned in the country (Annex 3). Four products have been recommended for de-registration on the basis of WHO hazard classes 1a (extremely hazardous) and 1b (highly hazardous). Pakistan also subscribes to FAO/UNEP code of conduct and has placed 17 products on FAO/UNEP Prior Informed Consent (PIC) list. However, despite the restrictions, banned pesticides are still in use on a limited scale as these are smuggled from the neighboring countries.

3.7 **Enforcement Experience**. Implementation of the laws is generally poor. Although an adulterator can be given a punishment of 7-year imprisonment and a fine of Rs. one million, no such punishments have ever been awarded. Fines, at maximum, have been of the order of a few thousand rupees. Inspectors draw samples and have them tested in laboratories. Data show that a very small percentage of samples are sub-standard or adulterated whereas the fact is that the proportion is much higher. The problem of adulteration and use of spurious pesticides generally is due to import of sub-standard products, formulation of pesticides using less active ingredient, adulteration by distributors during re-packing, adulteration by pesticide dealers, and preparation of totally spurious material and labeling them as pesticides.

4 Rationale for the Pest Management Plan Adverse Environmental and Health Impacts

4.1 The rational for adopting an integrated approach to pest management is based on the need to reduce adverse effects on the environment, ensure ecosystem balance, in order to prevent the loss in biodiversity, as well direct effects on human and animal health. A 2002 survey conducted by the NFDC highlights the need to adopt the integrated approach. The results of these are shown in the following two tables:

Environmental Problems on National Basis

	Freq (Number)	Percentage	Cumulative
Soil Pollution	245	5	5
Water Pollution	253	6	11
Environmental Pollution	1,276	28	39
Health Hazard	1,102	24	63
Fish Pond	92	2	65
Animal Health	429	10	75
Habitual Change	1,100	24	99
Others	10	0	100

Source: NFDC National Pesticide Survey 2002

Different Types of Sickness Symptoms Reported

Symptoms	Freq (Number)	Percentage	Cumulative
Headache	456	15	15
Dizziness	621	21	36
Irritation of skin, eyes, nose Throat	706	24	60
Vomiting	435	15	75
Blurred vision	138	5	80
Heart trouble	187	6	86
Cancer	158	5	91
Fatality	15	1	92
Other	247	8	100

Source: NFDC National Pesticide Survey 2002

World Bank Procedures

4.2 For any Bank funded project, in which an increased use of pesticides is likely to be induced, the Bank's policies and procedures require that a Pest Management Plan (PMP) should be prepared. Under the BIWMDP, the labor intensive fruit and vegetable crops that would enhance the livelihoods of small landholder and tillers are expected to have increased cropped area higher crop yields as well, which could result in correspondingly higher use of pesticides, unless mitigation measures on the effective use of IPM practices are promoted and farmers are encouraged to employ them. Therefore a PMP is considered to be an integral part of the project.

Emerging Issues

4.3 A number of emergent issues regarding pesticides and IPM have been drawn up for the Sindh Province. These 12 issues, also relevant to Balochistan, are appended in Annex 4. The highlights of those issues are: (a) Review of Registration Procedures, (b) Amendment of Existing Legislation to Strengthen Enforcement, (c) Enhancement of the Awareness of Stakeholders, (d) External Costs of Pesticides (e) Deepening of IPM Philosophy in Educational Institutions, (f) Training of Farmers with due focus on gender, (g) Enhancement of Coordination among Donors/Decision Makers, and (h) WTO Implications.

5. Implementation of the PMP of BWIRMP Project Background – Main Objective and Strategy

5.1 Sub-component B3 of the BIWRMD Project includes training in IPM practices. This will build upon national initatives in the subject area. It will build on the strategy of the National IPM Project that has been executed by NARC. The main element of the strategy is an eco-system based system of agricultural crop management that does not exclude the use of pesticides but at the same time promotes an integrated approach to use all available options for controlling pest population for sustainable productivity with no adverse effect on human beings, animals and the environment. The ToF/FFS training system through its strategy of making farmers self-reliant by acquiring basic knowledge of crop management was designed to achieve the objectives of the IPM Plan. The BIWRMD Project will adapt thr concept of Integrated Plant and Soil Nutrient

Management (IPSNM), which promotes not only long-term sustainability of the agro-ecosystems and the environment but, inter alia, also pro-IPM strategies such as improved crop rotations, better managing plant-soil-pest-predator interactions and maximizing crop, soil and animal biodiversity to reduce diseases and pest outbreaks.

5.2 **Pesticide Residue**. In the ToF/FFS system of training, control plots, where prevalent practices of pesticide use are undertaken and experimental plots where farmers practice IPM, are laid out. Samples of pesticide residue on crops, particularly cotton, rice, fruits and vegetables, would be collected from both kinds of plots and the quantity of pesticide residue determined. This would help establish the usefulness of adopting IPM practices. The work of pesticide residue determination would be contracted out to existing research laboratories that possess the desired facilities (eg University of Balochistan). Monitoring of pesticide residue would be carried out throughout the project period and information disseminated widely to help bring down the level of residue to below the Maximum Residue Limit (MRL). Post-harvest use of pesticides, particularly on vegetables would also be monitored. An analytical study on the work done would be prepared in the last year of the project period.

6. The Proposed Integrated Pest Management Plan (IPMP) of BIWRMD Project

Objectives

6.1 The main objectives of the Pest Management Plan are:

• Promotion of IPM: To minimize pesticide usage while increasing the productivity of agricultural crops targeted in the BIWRMD Project through Integrated Pest Management (IPM), Integrated Plant and Soil Nutrient Management (IPSNM) and Good Agricultural Practices (GAP), because they include the rational use of chemical pesticides, promote cultural practices and the use of nutrients from organic resources;

• Management of Pesticides: To monitor the pesticides management such as their usage before, during and after, and the level of pesticide residues on targeted crops in normally-treated and IPM-treated areas and to disseminate information to stakeholders on the usefulness of undertaking IPM practices.

• Capacity Building: To raise awareness of all stakeholders about the IPM approach to crop management, and train extension agents and farmers through FFS system to become practitioners of IPM.

Strategy

6.2 The main elements of the strategy would be to promote IPM practices in Balochistan , which do not absolutely exclude the use of pesticides yet it promotes an integrated approach to use all available options for controlling pest population with no adverse effect on human beings, animals and the environment that eventually results in attaining sustainable productivity. IPM practices aim at increasing the complexity and diversity of the insects and animals within an agro-ecosystem to encourage its sustainability. IPM practices do not envision agricultural fields devoid of insect life but they essentially from part of an eco-system of agricultural crop management.

6.4 The traditional agricultural extension and research systems are not equipped well enough to deal with the complex situations emerging in the crop management area. There is a dire need for these services to meet the new challenges. Farmers need to upgrade their basic knowledge of crop management, while extension agents need to perceive themselves as facilitators of change.

6.5 The strategy calls for sensitizing the decision makers and key officials also on the importance of IPM, particularly on the promotion of GAP and the rational use of pesticides.

6.6 The Farmers Field Schools (FFS) methodology would be adopted to introduce, promote and implement, among others, GAP and IPM approaches. The key elements of FFS entail training of facilitators (ToF) or lead facilitators (LF) whereby such training system focuses on each trainee, whether a farmer or an extension agent (Government, NGO or specific gender focused) or a researcher, first practices the skills under an expert advice from a lead trainer to reach a minimum level of competency, and then practices further until the trainee has mastered the skills. Thereby such facilitators of change, having undergone ToF they would have acquired knowledge about environmental conservation, public health, social participation, and organization, and become. Further, farmers are trained by facilitators through group participation, known as FFS in comparing new techniques in systematic field evaluations. Therefore it is essentially a field-based participatory training where extension agents and farmers work together for the duration of a cropping season. The expected output of such training is that farmers become more self-reliant and are able to evaluate new technologies by themselves, whereas extension agents are enabled to facilitate the change processes. The latter group carries out dialogues with farmer on public interest issues, including environmental conservation and health; whereas research institutions, with feedback from extension groups as well as direct observation, are enabled to provide technologies that can be tested in the field by farmers.

6.7 The concept of Integrated Plant and Soil Nutrient Management (IPSNM) would be also incorporated into the GAP because it complements the IPM practices. The strategy for IPSNM would include:

a) improving crop rotations by growing legumes as food crop or live mulch (cover crop);

b) maximizing organic matter production through green manure, cover crops and agro-forestry;

c) enhancing natural processes of nutrient recycling through managing plant-soil-pest-predator interactions;

d) providing soil cover (mulch, cover crops) to supply nutrients, reduce weeds and labor, and enhance functions of soil biota and plant roots;

e) selecting and breeding crops with higher nitrogen use efficiency, resilience to deficiencies and nitrogen fixing capacity; and

f) Maximizing crop, soil and animal biodiversity to reduce diseases and pest outbreaks.

6.8 The Participatory Development Technology (PDT) being the main investment mode at the farmer level for the targeted crops, also aims at improving crop productivity, would be implemented through the FFS. The focus of all PDT groups is on new technologies and methods of crop protection and improved cultural practices, among others, that are also the core of IPM practices. Through the PDTs the farmers apply a number of new technologies, along with IPM, in perennial (such as date palm) and horticultural crops (chilies and onions). Important ingredients in the PTD approach also entail comparing the traditional methods of crop protection practices with the IPM based new technologies

Activities Proposed for the IPMP

6.9 **Review of Policy and Laws**. The Balochistan provincial government will work on formulating its own pesticide policy based on its IPM experience. Further work on these aspects, such as policy development, reforms, amendments or update for IPM/GAP will be required.

6.10 **Awareness Programs**. To disseminate awareness programs, adequate resources are provided in the SAGP to use all media that include print and electronic media, newspapers, agricultural department's monthly magazine, seminars, workshops, exposure visits of farmers/project staff, field demonstrations, etc. The main areas that would be covered for the promotion of GAP, IPM and IPSNM practices would relate to human health, like pesticide handling, usage, storage and disposal, other health hazards, types of pesticide application equipment, protective gears, eco-friendly alternatives and promotion of bio-pesticides. The capacity building on IPM will be mainstreamed into the overall capacity building component of the project.

6.11 **Farmer Field Schools (FFS)**. About 50 Lead Trainers or Trainers of Facilitators (LT/ToF) and 125 Extension Facilitators (EF) and well over 110,000 farmers would be trained. While most LTs would focus on the Participatory Development Technology (PDT) aspects, such as varietal suitability, production technologies, post- harvest handling and marketing requirements, some of these LTs would be commodity specific; 3 for dates and 1 each for onions and chilies. Apart from them, 4 IPM managers, based at the district headquarter level commodity clusters, would coordinate and monitor the inclusion and due emphasis on the IPM/IPSNM and related practices and technologies in the FFS agenda. The 50 LTs/ToFs would train 125 EFs in different commodity/crop zones. An estimated total 6,800 FFS groups will be formed over the course of the implementation period, each comprising from 15-20 producers. As the PDT items are demand driven and the nuclear FFS group formation would be PTD and GAP, the number of FFS may vary in the phasing or in eventual totals if there is a lag in demand, or low demand persists for certain technology items. During the curriculum development (see Annex 2, section 2.8), safe pesticide management and use would be a principal chapter of the IPM related topics.

6.12 **Integrated Plant and Soil Nutrient Management (IPSNM)**. The IPSNM approach uses both organic and inorganic fertilizers in proper proportion accompanied by sound cultural management practices and seeks to both increase agricultural production and safeguard the environment for future generations. Research has proved that neither inorganic fertilizers nor organic fertilizers alone can achieve a sustainable productivity of soils as well as crops under highly intensive cropping systems. The application of organic fertilizers needs to be encouraged to increase the soil water holding capacity in view of the ever increasing water scarcity. Institutional capacity on the IPSNM will be strengthened by short refresher courses for the officials of the Plant Protection Directorate of the Agricultural Extension Department and District Officers (Agriculture) that would be arranged through the University of Balochistan, Quetta, the various ARIs and resource persons from other credible institutions in Balochistan.

6.13 **Pilot Demonstrations on IPSNM**. A pilot scale demonstration, in a cluster of FFS groups, would be undertaken in the project area to promote the use of organic fertilizers/residues, composting and mulching. Since the activity would initially affect farmer income and only benefit him in the longer term, suitable financial incentives would be provided to the farmers under the project to compensate them for the losses incurred. About 10-15 demonstration one acre plots for each of three horticultural crops to promote IPSNM would be laid out, and their results would be monitored by the IPM managers and their teams PIMU.

6.14 **Pesticide Residue.** Under the FFS system, samples of pesticide residue on the crops, would be collected from the control and IPM treated plots and the quantity of pesticide residue determined. The control plots are where prevalent practices of pesticide use are undertaken and experimental plots where farmers' practice of IPM are carried out. This would help establish the usefulness of adopting IPM practices. The work of pesticide residue determination would be contracted out to existing research laboratories that possess the desired facilities (University of Balochistan, Quetta). Monitoring of pesticide residue would be carried out throughout the project period and information disseminated widely to help bring down the level of residue to below the Maximum Residue Limit (MRL). Annual monitoring will be conducted for all project interventions that focus on on-farm productivity enhancements. Post-harvest use of pesticides, on the produce of commodities would also be monitored. An analytical study on the work done would be prepared in the last year of the project period.

Implementation Responsibility and Institutional Arrangements

6.15 The Director General (DG), Agriculture Extension Balochistan will be responsible for agricultural extension activities of the project with major focus on FFS approach, in which IPM, IPSNM and GAP activities would be the principal capacity building measures whereby the core investments under the PDT activities would also be carried out. The Directorate of Plant Protection (PP) under the DG will help implementing the IPM related activities. The Director PP who is assisted in his work by a Plant Protection Officer and three Agricultural Officers at the headquarter level, will have additional support of 4 IPM Managers under the SAGP, who would be placed at the district headquarters level project implementation units (PIUs). In the field, District Governments handle this work through a hierarchical setup: Deputy Director , Agricultural Extension at District level; Assistant Director at Taluka level, Agricultural Officer at Sector level, and Field Assistant at the Union Council level. Thus the actual frontline workers who would implement the activities are Sector Agricultural Officers and Union Council Field Assistants.

6.17 The horizontal linkages in the area of pest management between agriculture research and extension and vertical linkages between DG Extension and District Government are not strong. There are two main reasons for this: firstly, the operational budget for pest management, both for extension and research, is very small and there is little research or extension work that could to be shared; and secondly, Extension and Research officials report directly to their superiors and horizontal collaboration is only on a needs basis. In such a situation, the role of the existing Research-Extension Coordination Committee becomes much more important. It would be the endeavor of the government to ensure that this committee meets regularly on a monthly basis. IPM Managers and Deputy Directors (Agriculture Extension) would be actively associated with these committees.

Monitoring and Evaluation

6.18 Monitoring would involve establishing a baseline of the current status of crop yields, agronomic practices particularly cropped area sprayed (number of sprays and quantity of pesticides used), knowledge and adoption of IPM measures; and observing the adoption rates IPM/IPSNM and related activities (GAP/PDT) and measuring the impact of project interventions on the target crops disaggregated by farm type and gender, by over the project period. Mid-term and post-project evaluations would also be carried out. The following key monitoring indicators are suggested: quantity of pesticide used; number of sprays and area sprayed by crop; pesticide residues on fruits and vegetables; and the use of banned pesticides, if any. Pesticide residue studies would be carried out for crops where on-farm productivity enhancements are planned on an annual basis, with a baseline study establishing the indicative baseline numbers for selected pesticides for each crop (chili, onion, dates and rice) for the province.

Cost

6.19 The following costs associated with implementation of this IPMP in terms of pesticides usage and residue monitoring shall be included as part of the studies for component C of the project. The awareness raising activities shall be streamlined with the capacity building components of the project.

Item	**Amount (USD)**
Baseline Pesticide Residue Study	20,000
Annual Pesticide Residue Survey (4)	40,000
Soil Testing for IPSNM	10,000
Total	**70,000**

Recommendations

6.20 IPM work done so far in the country has been mainly donor driven and on a pilot scale. The National IPM project is going on for the past decade was the first major indigenous endeavor funded through the public sector development program. Consideration has been given to have an independent provincial IPM project; however before fully embarking upon such a project, it would only be appropriate to wait for the implementation experience and ex-post evaluation of the National IPM Project. Beside this, the key recommendations concerning the promotion of IPM are:

(i). **Monitoring of Pesticide Use and Residue**. The work of testing pesticide residue on agricultural crops, particularly fruits and vegetables, should eventually be done on payment basis by existing research laboratories. Samples would be collected from control and experimental plots of the on-going and future Nat-IPM programs under the ToF/FFS system, in association with FFS groups. The test results would thus establish the usefulness of adopting IPM practices. Monitoring of pesticide use and residues would be carried out throughout the project period and efforts made to bring down the level of residue to below MRL. After establishing a baseline of pesticide usage, post-harvest use of pesticides, particularly on vegetables and rice would also be monitored;

(ii). **Integrated Plant and Soil Nutrient Monitoring and Management**. A pilot scale operation would be undertaken in the project area to promote the use of organic fertilizers/residues in association with the FFS-initiated producers groups. About 10-15 such groups per commodity groups would be to establish an equal number of one acre demonstration plots to promote IPSNM in their farming practices. Soil testing of the demonstration plots would be would be carried out to determine the physical and chemical properties and macro and micronutrients of soil. The activities to be demonstrated would inter alia include: use of organic fertilizer, green manuring, mulching, weeding, nitrogen fixing by legumes, composting, and worm culture. The plots would be maintained for two years (see para 6.13 also); and

(iii). **Awareness Raising/Dissemination of Information**. Printed brochures, pamphlets, and booklets on various aspects of IPM and IPSNM would be prepared and distributed widely through FFS groups. Apart from these groups of producers, the circulation of the departmental agricultural magazine should be increased to reach maximum number of stakeholders, which, among others, would include government officials, particularly of the newly established district governments and their lower tiers, water user groups (WCAs, FOs), educational institutions, pesticide manufacturers and sellers, farmers, NGOs, and women. Seminars at district and provincial levels for discussing project achievements would also be held. The main areas that would continue to be covered for the wider audience would relate to human health, like pesticide handling, usage, storage and disposal, other health hazards, types of pesticide application equipment, protective gears, eco-friendly alternatives to pesticides including bio-pesticides, and promotion of IPM and IPSNM practices. The awareness raising on IPMP will be streamlined into the general capacity building for the project.

Annex 1

PAKISTAN

BALOCHISTAN INTEGRATED WATER RESOURCES DEVELOPMENT PROJECT (BIWRDP)

PEST MANAGEMENT PLAN (PMP)

Ahmed (2002), "External Costs of Pesticide Use in Pakistan"

Externality Category	**Rs. in Millions**
Health:	**833.0**
Applicators	42.0
Pickers	765.0
Industry	0.6
Distribution	25.0
Pesticide Residues:	**110.0**
Production	**7,034.0**
Pesticide Resistance	5,667.0
Animal Loss	1,304.0
Wild Honeybee Loss	63.0
Biodiversity Loss:	**3,745.0**
Total Externality Cost (Annual)	**11,742.0**

Source: Ahmad 2002

Annex 2

BALOCHISTAN INTEGRATED WATER RESOURCES DEVELOPMENT PROJECT (BIWRDP)

Farmers Field Schools, Participatory Development Technology and FFS Curriculum Development

Farmer Field Schools (FFS)

A2.1 The methodology used to deliver extension to target beneficiaries would be the Farmer Field School (FFS) approach. Although the FFS methodology has been used previously by provincial extension services all over Pakistan, closer examination of the methods employed indicate that what is often represented as FFS is, in fact, the long established Training and Visit model that has been shown to be a far less effective extension tool. A number of FFS's were visited during the course of the project preparations and in every case, the extension officer was instructing farmers on some aspect of production system under discussion. It was also apparent that these meetings were taking place near an extension centre or some communal focal point, rather than in a farmer's field.

A.2.2 The core of the FFS approach is Learning by Doing. Farmers are not given a prescriptive agenda. They meet regularly at a prescribed interval in a farmer's field and choose amongst themselves the topics for discussion. The role of the Extension Facilitator (EF) is to help guide the group in deciding what to examine and how to go about it, not to teach. If the farmers have a problem, they are encouraged to experiment and seek solutions to those problems through a process of constructive investigation. In this way, farmers are empowered to seek answers to their own problems. Where this is not feasible, the EFs can take a lead role and propose alternative methodologies. However, in order to facilitate greater sustainability to the whole extension approach, the Project intends to train Lead Farmers (LFs) as well as EFs to lead the FFS. The Extension Facilitator and the Lead Farmers would regularly attend training sessions with Master Trainers (MT), to ensure that both the EF and the LF were aware of both technical and group support functions. Facilitators would encourage groups to consider key aspects such as varietal suitability, post-harvest handling and marketing. Both EFs and LFs would also be schooled in leading problem-solving exercises.

A.2.3 The optimum size for a FFS is 15 to 25 participants. The number of meetings held by each group would be determined by the cropping calendar and could range from weekly at certain periods to monthly in others. One Lead Farmer could facilitate two FFSs and would be paid a small stipend to do so. The LF would also receive a bicycle, which they would pay for, out of their stipend. The LF would also be issued a number of tools and equipment, such as moisture meters, sprayers and soil testing kits that would allow them to demonstrate better production technologies to members of the group. Any novel equipment demonstrated to the group would be available for purchase by a group member at subsided cost. The Extension Facilitator would supervise up to four LFs and would be issued with a motorcycle, which would be paid for by the EF over the depreciation period of the machine. Some of the tools issued to the LF would also be issued to the EF. Each FFS would be expected to run for approximately three hours and would not be held at a frequency of more than once a week, at the peak of the cropping calendar. Marketing activities would naturally occur at the end of the season. The key likely areas of exposure of the farmers through the FFS approach are outlined below.

A.2.3.1 **Cultural Practices** - The focus of all cultural practices would be to introduce GAPs to all activities along a crop's production and post-harvest management chain. This would include varietal selection, cultural practices such as weeding and spraying, and the correct application of fertilizers. Due consideration would be given at all times to the effects of such practices on the quality of the produce and the environment.

A.2.3.2 **IPM** - IPM extension would focus on developing an environmentally sensitive approach to pest management. Although the FFS approach is rooted in the principles of farmers defining and answering their own problems, there are skill sets that would greatly aid them in defining their problems. In the field of IPM there are four steps that go to make an effective IPM program, which are (i) Monitoring; (ii) Setting Action Thresholds; (iii) Prevention (cultural & mechanical) and (iv) Control, including pheromone traps, biological controls and targeted spraying. Lead Farmers and Extension Facilitators would be trained in how to lead farmers are guided discussions to effectively implement IPM within their GAPs.

A.2.3.3 **OFS&WM – On-Farm Soil & Water Management**; efficient use of available water would be a major theme. There is scope to look at alternative irrigation technologies such as drip to see if the investment in infrastructure would yield beneficial results for participating farmers. OFS&WM extension would work with farmers to minimize the effects of inappropriate irrigation frequencies through the introduction of moisture meters and measured inflows of water.

A.2.3.4 **Post-Harvest Handling & Quality** – This activity would seek to improve the harvesting techniques and subsequent post-harvest handing to produce to ensure that optimum quality was maintained at all times. Washing, sorting and grading practices would be considered, along with improved packing techniques. Removal of field heat and maintaining a conducive environment for the produce, whether for drying, curing or processing, would raise the standard of the final produce leaving the farm.

A.2.3.5 **Marketing –** Embedded within the FFS timetable would be a time to discuss marketing issues. The ideal time to do this would be at the end of the cropping calendar, but the group itself would eventually decide this. Horticultural crops are often produced on a commercial basis and farmers use a variety of channels to sell their crops. The marketing sub-activity with the FFS would seek to maximize the returns a farmer could expect from selling their produce, either within their existing contractual arrangements or by seeking more advantageous marketing avenues, such as collective marketing strategies. However, no particular model would be favored, with the choice left to the participants. Marketing activities could include organized meetings between farmers and traders to discuss issues related to varieties, quality, quantity, timing and price. Exchange visits to other production areas and markets would also be beneficial to both farmers and traders, especially regional markets. Finding and opening new markets, based on existing production or tailoring varieties or processing to suit the demands for new markets would be actively promoted.

A.2.3.6 **Producer Marketing Organizations (PMO).**Subject to sufficient demand, the extension activity would foster the development of PMOs that could emerge from formal or non-formal farmer organizations. PMOs increase off-farm incomes and support business development when their members have had the benefit of market orientation, have input suppliers are mobilized, market linkages are developed and a greater awareness of markets has been created among producers. The project extension activity, may use innovate ways to leverage experience and resources resulting from Farmer Field School trainings. The FFS producer groups could be clustered to form a Produce Market Organization, comprising 10 FFS groups. The PMO could be organized to sell directly to wholesalers and processors, or to traders, but would gain greater bargaining power due to their size and greater volume of produce to sell. Individual PMOs could be eventually organized into district level PMOs. The PMO formation would help producers negotiate better access to markets, while also providing members with information, training, and the development of quality assurance standards. Importantly, the PMO would play an advocacy role, with a stronger collective voice, and offer better access to research, extension, inputs and market services. The PMO could be further strengthened to become an apex body for the horticulture sector.

Participatory Technology Development (PTD)

A.2.4 After a single cropping season, for those farmers that are interested, PTD is a possible next step, allowing farmers to further their knowledge of plant ecosystems through discovery-based learning. After FFS graduation, farmer sub groups can select their priority crops and identify their limiting factors. A Common Interest Group (CIG) could emerge as a part of discussions on “what next”. Each CIG or PTD unit comprise of a number of farmer with common interest in a specific issue(s) for their crop. In this manner, the momentum of the FFS is not lost and farmers are constructively encouraged to continue meeting and problem solving together.

A.2.5 PTD is an approach, which involves farmers in developing agricultural technologies that are appropriate to their particular situation, local bio-climatic conditions and resources. It is a practical process in which farmers identify a specific problem, bring their knowledge and practical experience to test a number of options, including new technologies and interact with facilitators to solve their problem with the most suitable technologies available. In this way, farmers and the facilitators are able to identify, develop, test and apply new technologies and practices. PTD seeks to reinforce the existing creativity and experimental capacities learned by farmers through FFS, and help them keep control over the process of generating innovations. As it is a ‘bottom up’ approach, as with FFS, facilitators do not come to the farmers with off-the-shelf options and packages, but rather help them to find better solutions for themselves, which fit their resources and situations. The LF and EF therefore facilitate the process of innovation of technology most suitable for farmer’s localized need.

A.2.6 This field-based participatory research and extension method, which is an extension of the FFS approach, not only results in enhanced agricultural yields but also increases farmers’ confidence. Even more importantly, it provides an opportunity to share experiences, which may include successes and failures. It creates social cohesion and a spirit of collective action amongst rural farmers; PTDs would be a self-managed group. This extension activity would provide basic training at the initial stage to orientate the farmers in research and technology development and could provide initial agricultural inputs, technical guidance and facilitation of the processes with farmers. Unlike FFS, PTDs farmers specify the objective, develop criteria to verify indicator, identify the key elements to be address and pinpoint the suitable time to address the issues, hence PTD farmers get together based on the problem calendar instead of regular sessions. In this way, farmers utilize their time more efficiently compared to routine FFS.

A.2.7 The main focus of all PTD groups is on new technologies and methods of crop protection, cultivation, irrigation and improved cultural practices. Through the PTDs the farmers apply a number of new technologies in perennial and annual horticulture, along with IPM. Activities on pesticide safe management and use would also be incorporated in the curriculums with respect to the crops and pests farmers will need to use pesticides. The issues and problems are then discussed in groups and corrective measures are taken after consultation with facilitators. Some of the important elements in PTD are to compare the traditional methods of crop protection practices with new technologies; old against new varieties, and test the quality of crops and products in the farmer’s own environment.

Curriculum development for the FFS

A.2.8 Although the core of the FFS approach is learning by doing, there is a need to ensure over the period of a single FFS cycle, groups of farmers are exposed to the best agricultural practices that pertain to the crop they are growing, taking into consideration the variety used, resources available and the degree of mechanization available to the farmer. This required knowledge forms the basis of Good Agricultural Practice (GAP). The skill in delivering this GAP to farmers is to ensure it is woven into the fabric of the FFS in such a way that Lead Farmer (LF) and the Extension Facilitator (EF) are able to introduce GAPs and allow farmers to experiment with the ideas and techniques being proposed, while not seeming to lead them in what have up to now been traditional training for delivering extension.

A.2.9 To begin this process, a curriculum has to be developed by the Department of Agriculture, supported by technical expertise drawn from all relevant sources. This process can be achieved by running a series of concentrated workshops where specialists can gather and flesh out what should form the basis for GAP's in any particular crop. It must be borne in mind that these GAP's would be transmitted to LFs and EFs by Master Trainers (MT) and for this reason it is advisable to have MT's present as the GAPs are developed. There are nine universal steps that form the core for any curriculum development:

a) Determine the scope and limitations of the farming system.

b) Identify the elements of the GAP that need to be communicated.

c) Select and sequence the delivery of the GAP information based on the seasonal calendar and the structure of FFS delivery.

d) Develop performance objectives linked to the GAP.

e) Develop a likely instructional schedule, linked to the crop calendar.

f) Structure delivery in a 'learning by doing' approach.

g) Develop instructional material appropriate to the environment and the educational level of the target audience. This material should augment the FFS session, not form the core of it.

h) Develop Monitoring and Evaluation (M&E) criteria that would allow the project to test if the curriculum was effective.

i) Implement the curriculum embedded in the FFS

A.2.10 Any material developed would need to be tested with target farmers to see that it was being understood and as the material was disseminated during the FFS activities, the M&E finding would need to feed back into any of the steps above to take corrective action needed to improve the GAP curriculum.

Annex 3

BALOCHISTAN INTEGRATED WATER RESOURCES DEVELOPMENT PROJECT (BIWRDP)

Banned Pesticides (Active Ingredients)

1. BHC
2. Binacryl
3. Bromophos ethyl
4. captafol
5. Chlordimeform
6. Chlorobenzilate
7. Chlorthiophos
8. Cyhexatin
9. Dalapon
10. DDT
11. Dibromochloropropane + Dibromochloropropene
12. Dicrotophos
13. Dieldrin
14. Disulfoton
15. Endrin
16. Ethylene dichloride + Carbontenachloride
17. Leptophos
18. Mercury Compound
19. Mevinphos
20. Toxaphene
21. Zineb
22. Heptachlor
23. Methyl Parathion

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Annex 4

PAKISTAN - BALOCHISTAN INTEGRATED WATER RESOURCES DEVELOPMENT PROJECT (BIWRDP)

Emerging Issues

(i). **Review of Plant Protection and IPM Policies**. There is a need to discuss pesticide related issues at the provincial level and enunciate a provincial policy which is non-existent;

(ii). **Review of Registration Procedures**. Provincial government is concerned with the registration of only distributing companies. Rules, in this regard, need to be reviewed and made more stringent so that malpractices of adulteration etc are minimized;

(iii). **Amendment of Existing Legislation to Strengthen Enforcement**. From the provincial point of view, legislation needs to be reviewed for framing amendments that would lead to better enforcement of the pesticide law;

(iv). **Enhancement of the Awareness of Stakeholders**. This is the most pertinent and important issue that would be addressed by the Plan;

(v). **External Costs of Pesticides**. There is very little awareness of the externalities associated with the pesticide use. Decision makers, therefore, need to be particularly sensitized about it.

(vi). **Introduction of IPM Philosophy in Educational Institutions**. This is part of the awareness raising program that would need to be launched;

(vii). **Training of Farmers**. The main stakeholder is the farmer. He needs to be trained to identify, understand, and resolve pesticide related problems;

(ix). **Enhancement of Coordination among Donors/Decision Makers**. The main actors in the field of IPM are government, donors, and international organizations. Their efforts need to be coordinated;

(x). **Stronger Partnership among Research, Extension and Farmers**. This partnership would need to be forged on stronger footings;

(xi). **Disposal of Obsolete Pesticides**. Large stocks of outdated and obsolete pesticides have been stored at various places. Their inventory needs to be updated and safe disposal arranged; and

(xii). **WTO Implications**. The developed countries, USA and EU included, have framed regulations disallowing import of agricultural products with pesticide residues above a certain limit. More emphasis, therefore, would have to be laid in the future on the need for producing pesticide free agricultural commodities for export.

Annex F: Terms of Reference for Consulting Services for Biodiversity conservation and Fish Farming

1. Background

The Government of Balochistan recently adopted an Integrated Water Resources Management (IWRM) Policy. The policy describes the provincial situation of severe water scarcity, inefficient and profligate usage, prolonged droughts, and the dire consequences for rural livelihoods and economic growth. It is organized into 16 "thrust areas" for improving and sustaining the management of surface and groundwater resources. The policy identifies numerous studies required to fill important knowledge gaps, critical capacity gaps, regulatory reforms and institutional reforms. As part of the implementation of this policy, the Government is implementing the Balochistan Integrated Water Resources Management and Development Project (BIWRMDP) which will address the following issues: (i) establishing adequate and reliable water data, (ii) improving coordination between the water and agricultural sectors, (iii) adopting an integrated approach to project formulation and to project M&E, (iv) improving irrigation water use efficiency, (v) improving groundwater recharge through watershed management and water conservation, and (vi) ensuring effective participation of water users and other stakeholders in water management.

Under the Environmental Management Plan (EMP) for the BIWRMD Project, several activities have been identified as critical for conserving the existing delicate environmental and biodiversity balance likely to be affected by the project. To this end, the Government of Balochistan requires to conduct a study and consulting services to ensure that the provisions of the EMP in this regard are implemented.

2. Focus Areas

Fisheries, sub-sector of agriculture, play a significant role in Pakistan's national economy (about 1.0 percent of the GDP or 4% of the agriculture sector) and contribute towards the food security of the country. Fishery sector employ 1% of the country's labor force. There are about 382,817 fisher folks, mainly fishing in the coastal area. The export of fish and fishery products during 2013-14 reached 150,500 t, this corresponding to a value of $US 446 million[36]. Fish production in Pakistan during 2014 was 735,000 t, of which 493,000 t (about 67%) were from marine waters and 242,000 t were from inland waters. Eighty percent of the freshwater catch came from wild resources of rivers, irrigation canals, streams, lagoons, and natural lakes. Twenty percent of the inland fish production is contributed by aquaculture. Aquaculture in Pakistan benefits from irrigation and about 75% of the fish ponds in the country are supplied with water from irrigation canals.[37]

In 2014, total fish production in Balochistan was 147,000 t of which 10,018 t were produced in inland waters. Livelihood of 59,635 fisherman in Balochistan depend on fisheries. Fish production in the project area, such as, Sibi and Kalat districts were 99 t and 1,712 t in 2014 an increase of 110% and 11% from the previous year.[38]

Innovative ideas and scientific knowledge in fish farming is desperately needed. This will improve the livelihoods in the communities, resulting in less pressure on forest resources for income from firewood collection and sale.

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[37] Compendium on Environment Statistics of Pakistan 2015; Pakistan Bureau of Statistics Government of Pakistan, ISLAMABAD
[38]Department of Fisheries (2015), Government of Balochistan.

Miani Hor is a large shallow sea bay and estuarine system with several low-lying islands and extensive mangrove swamps and intertidal mudflats separated from the adjacent Sonmiani Bay by a broad peninsula of sand dunes. The Hor receives freshwater input from a number of seasonal streams (Porali and Winder) rising in the hills of eastern Balochistan to the north, and empties into Sonmiani Bay through a broad channel at its eastern end. The area is important on account of having large concentrations of water birds. Occasionally, cetaceans are also sighted in the coastal wetland. A small Porali delta has been developed with occasional fresh water runoff (especially during the monsoon) into the lagoon, enriching the mangrove forest in the vicinity. Miani Hor was designated a Ramsar Wetland site in 2001.

The World Wildlife Fund (WWF) and the International Union for Conservation of Nature (IUCN) have made proposals to the provincial and federal governments to declare Miani Hor the first marine protected area of Pakistan. To this end, they have carried out scientific research to validate the proposal. Biodiversity conservation and management of Miani Hor is needed by: (i) providing resources to support attain the desired state of conservation and for declaration as a national marine park, (ii) supporting and building upon existing community based management and thus contribute to improving the resilience of the local people to climate change and natural disasters.

The Ziarat Juniper forest ecosystem is a great example of biodiversity conservation and ecological significance which accrue local, regional and global benefits. The area is habitat to the largest patch of Juniper forests (*Juniperus excelsa polycarpos*) in Pakistan. It is believed that the Junipers of Ziarat are the second largest Juniper forest of its kind in the world and measures about 110,000 ha. Over 37,000 ha of this ecosystem is protected as the Ziarat Juniper Biosphere Reserve (formerly Ziarat Wildlife Sanctuary). The IUCN developed a management plan for the Biosphere Reserve in 2013. Juniper tree species of Ziarat have a global significance because of their adaptation to the arid location, old age, and slow growth rate. This ecosystem is habitat to endangered wildlife species including Suleiman Markhor, Urial, Black Bear and Wolf and supports a rich diversity of plant species. The ecosystem is also rich in diversity of plant species of medicinal plants. Furthermore, it provides valuable services of regulating aquifers by protecting the watersheds in the catchment areas that conserve and sustain provision of water resources for various production functions that support livelihoods of the local communities.

The surrounding area of the Juniper forest has very limited water resources therefore watershed management is pivotal for sustainable development of the area and the downstream catchments, which are dependent on this watershed. Mountainous terrain of the area provides some excellent opportunities for watershed development and management, which has intensive influence on agriculture, forestry and livestock sectors. Besides, the ecosystem provides valuable services of regulating aquifers by protecting the watersheds in the catchment areas that conserve and sustain provision of water resources for various production functions that support livelihoods of the local communities and the Nari River Basin.

The proposed activities will improve the livelihood of the local community by creating a positive impact on the economic conditions, conservation of biodiversity in Miani Hor and Ziarat Juniper forest, and improvement in watershed to regulate water flow in the downstream river system.

3. Overall Objective

The overall objective of this consultancy services is to carry out detailed design and implementation of the provisions of the EMP regarding the focus areas outlined above. It will carry out relevant studies, implement actions for a specific period tied to the cycle of the BIWRMD Project and make provisions for the sustainability of all plans developed beyond the project cycle while involving young people and women in conservation work by developing culturally sensitive activities.

4. Specific Objectives

The specific objectives of the consultancy services, by focus areas, are to:

Fisheries

(i) carry out studies to develop scientific knowledge customized to local condition for the sustainable development of fish farming in selected locations of Nari and Porali River Basins,

Miani Hor

(ii) Carry out extensive studies on the biodiversity of Miani Hor,

(iii) Develop a site management plan for the Miani Hor Ramsar Wetland site, along with implementation budget,

(iv) Implement prescribed actions in the management plan,

(v) Identify community based managements and study how to implement them, and

(vi) Contribute to current initiative to declare Miani Hor a Marine Protected area.

Ziarat Juniper Biosphere Reserve

(vii) Review the existing management plan for the Reserve to strengthen and update it,

(viii) Develop a detailed implementation plan for critical activities for the conservation of the ecosystem, and

(ix) Contribute to Government of Balochistan's initiative to declare Ziarat Juniper Biosphere Reserve a National Park.

5. Scope of Work

A consulting firm with team of consultants led by an environmental specialist/or biodiversity specialist with strong project management experience will review and make use of all the existing information available and in particular data, tools and models used in preparing the documents. This will include, reports of pilot studies, maps, management plans, surveys conducted so far, environmental, ecological, watershed, and species surveys and habitat management, and mitigation measures and analysis, etc.

The specific tasks will include, but are not limited to:

For Fish Farming:

1. Selection of proper location with water availability and quality,
2. Selection of species suitable for the location identified, since fish is very sensitive to temperature and other climate conditions,
3. Identify the source of seedlings and the transportation and management, as healthy seedlings must be procured from reliable/reputed dealers, for their survival and growth,
4. Assess the risk of diseases, monitoring mechanism, and mitigation measures,
5. Identify the capacity of the farmer and recommend the training needs including the women,
6. Design fishing courses for the community youth emphasizing on small-scale entrepreneurship, and

7. Identify instruments for strong market linkages for effective disposal of produce.

For Miani Hor:

1. Assess the potential of the mangrove ecosystem, its functioning and its relationship with other coastal ecosystems by considering traditional empirical knowledge on mangroves and transfer them to present knowledge,
2. Develop scientific data on the biodiversity in the area, through desk review and field based study,
3. Identify community based managements, study how to implement them and incorporate these into the management plan,
4. Prepare a ten year management plan for Miani Hor, including budget and the definition and details of indicators that will be used for monitoring and evaluation, and
5. Supervise the implementation of the Miani Hor management plan during the implementation of the Project.

For Ziarat Juniper Biosphere Reserve:

1. Revise and strengthen the existing management plan for the reserve, including budget and the definition and details of indicators that will be used for monitoring and evaluation and
2. Supervise the implementation of the revised management plan during the implementation of the project. Activities to include:
    - Facilitate access of the local communities to obtain fuel efficient technologies in order to reduce the felling of trees for fuel,
    - Support forest regeneration activities,
    - Develop and implement strategies for grazing control in the core zone of the forest,
    - Identify and implement sustainable livelihood activities for identified communities, while ensuring equitable representation of the various tribes, and

• - Involve young people and women in conservation work by developing culturally sensitive activities in this respect.

6. Implementation Arrangements

The Consultant will work closely with the Head of Project Management Unit (PMU)/ Project Director, Balochistan Integrated Water Resources Management and Development Project, Irrigation Department. Close consultation will be needed with Department of Fisheries, Department of Agriculture and Cooperatives, Department of Forest and Wild life, IUCN, WWF, UNESCO, and other NGOs and CBOs active in the project areas.

The Consultant shall be responsible for all aspects of performance of services as set forth in the preceding sections of this TOR. Government of Balochistan and the Project Director of Project Management Unit, Irrigation Department will be responsible for providing the existing data and information including all reports prepared so far for the project.

7. Duration of the Assignment and expected deliverables.

The consultancy services will be required in two parts, to develop the requisite plans and to implement the designed plans.

Duration of the Phase 1 consultancy will be for an initial period of 12 months. Expected deliverables for this period are:

1. Fisheries management plan with detailed implementation planning;
2. Miani Hor Biodiversity Conservation Plan with detailed implementation arrangements
3. Ziarat Juniper Biosphere Reserve, revised management plan, with detailed implementation arrangements

Duration of the Phase 2 consultancy will be the pilot implementation of the provisions of the management plans for the duration of the implementation of the BIWRMDP. The selected team will be required to supervise the implementation of the management plan, organize monitoring and evaluation surveys to assess the performance of the pilot program. A yearly monitoring report will be submitted to the Project Director, Irrigation Department. The management plans will be adapted and revised throughout the implementation period in line with Project realities and/or modifications. A completion report will be submitted to the relevant authority for final approval.

8. Composition of Team

Team members must have competency in the following areas of specialization with respect to biodiversity:

- i) Environmental Specialist/Biodiversity Specialist, Team Leader
- ii) Fisheries Specialist
- iii) Civil engineer (experience in design of fish farm)
- iv) Biodiversity Specialist
- v) Community Coordinator with experience in community based environmental management
- vi) Databases and database management specialist
- vii) Legal, policy and institutional framework specialist

All the specialists should have a relevant post-graduate degree with at least 15 years of field and research experience.

Annex G: Consultation Documents

Nari Gorge sub-project

A meeting was held with the farmers of Khajak village (proposed main canal of the Khajak perennial scheme, Arand flood scheme and proposed branch channels Hameemzai nalla, Isaqzai Nalla, Khoshi nalla, Jam Brahamzai Nalla, Omarzai Nalla, Jafarzai Nalla, Karyazai Nalla and Sabzreg Nalla). The farmers were briefed about the objectives of the project and they were prepared for participation in walk through resettlement survey along the canal and cooperation in baseline data collection. At the end of the survey, next day another meeting of the farmers were organized briefed about the proposed engineering interventions and findings of the walk through survey on main canal and branches. In the first meeting, the farmers shown their willingness in participation and cooperation and in the second meeting, the farmers shared their views about the project and signed the copy of Tender Drawing.

Venue & Date	• 1st Meeting at Khajak Village on 3rdOctober,2015 2nd Meeting at same village on 4thOctober, 2015
Location/Venue	• Khajak Village at Sardar Khudaidad House
BIWRMD Project Consultants Team Members	• Mr. Niamatullah khan Mr.Abdul Shakoor Kakar Mr.Sar Anjam Khan Mr.Aorangzeb
Results/Outcome	• The farmers expressed their willingness and cooperation with the project staff during survey and implementation of the project. • They have expressed willingness to provide land if required voluntarily (without demanding any compensation) for completing the designed canal and other appurtenant structures. • They have also committed for not demanding or creating any problem in cutting of trees/bushes along the banks of canal, in case; if the cutting was unavoidable during construction phase. • They confirmed that there is no residential, commercial, public or private structure within RoW of 15ft and committed if the communities constructed any building within 15ft RoW after the cut off date (as agreed 3rdand 4th October, 2015) will be demolished during construction phase and will be responsibility of the owner. • Despite the earlier dissemination of the information about the scheduled meeting, those farmers who were not present in the meetings, in case, if they are raising any issue or creating any hurdles for the project, will be the responsibility of the sitting/present farmers to resolve and handle the matter.

List of Farmers Consulted at Killi Khaja, Nari River Basin

S.No.	Name and Fathers Name	Tribe	Village
1	Sardar Khudaidad khan/sardar Ismail khan	Khajak/Hameemzai	Khajak
2	Malak Azad Khan/malak Sayed Khan	Khajak/Isaqzai	Khajak
3	Malak Ahamad Khan/Moheem Khan	Khajak/ Khoshi	Khajak
4	Malak Mazar Khan/ Ali Khan	Khajak/Bahramzai	Khajak
5	Malak Hazar Khan/A. Rahman	Khajak/Omarzai	Khajak
6	Malak Mazar Khan/Abdullah Khan	Khajak/Karyazai	Khajak
7	Mussa Khan/Ahamad khan	Khajak/Doulatzai	Khajak
8	Mujeebullah/Fatheh Khan	Khajak/Jafarzai	Khajak

9	M.Yaqoob/M.Hussain	Khajak/Hameemzai	Khajak
10	Niaz Mohd/ Mir Khan	Khajak/Isaqzai	Khajak
11	Rais M.Azeem/ Rais Taj Mohammad	Khajak/Isaqzai	Khajak
12	Mubarak/M.Hussain	Khajak/Bahramzai	Khajak
13	Mohammad Omar/Mulla Mohammad	Khajak/ Khoshi	Khajak
14	Allah Dina/ Fathah Khan	Khajak/ Khoshi	Khajak
15	Abdullah Khan/Mohammad Essa	Khajak/Jafarzai	Khajak

Luni main and Ralla, Ralla 1 & 2 branches, Budra Nalla, Rarhe nalla and Bagh

A meeting was held with the farmers of Luni Village (proposed main canal of perennial scheme, Bori and Arand Flood Schemes and proposed branchs Ralla, Budrha,and Bagh Nallas). The farmers were briefed about the objectives of the project and they were prepared for participation in walk through resettlement survey along the canal and cooperation in baseline data collection. At the end of the survey, another meeting of the farmers was organized briefed about the proposed engineering interventions and findings of the walk through survey on main canal and branches. In the first meeting, the farmers shown their willingness in participation and cooperation and in the second meeting next day, the farmers shared their views about the project and signed the copy of Tender Drawing.

Venue & Date	3rd Meeting at Luni Village on 5th and 6th October,2015
Location/Venue	Luni Village at Sardar M. Usman House
BIWRMD Project Consultants Team Members	Mr. Niamatullah khan Mr.Abdul Shakoor Kakar Mr.Sar Anjam Khan Mr.Aorangzeb
Results/Outcome	• The farmers expressed their willingness and cooperation with the project staff during survey and implementation of the project. • They have expressed willingness to provide land if required voluntarily(without demanding any compensation) for completing the designed canal and other appurtenant structures. • They have also committed for not demanding or creating any problem in cutting of trees/bushes along the banks of canal, in case; if the cutting was unavoidable during construction phase. • They have confirmed that there is no residential, commercial, public or private structure within RoW of 15ft and committed if the communities constructed any building within 15ft RoW after the cut off date (as agreed 5thand 6th October, 2015) will be demolished during construction phase and will be responsibility of the owner. • Despite the earlier dissemination of the information about the scheduled meeting, those farmers who were not present in the meetings, in case, if they are raising any issue or creating any hurdles for the project, will be the responsibility of the sitting/present farmers to resolve and handle the matter.

List of Farmers Consulted at Luni Village, 2015

S.No	Name and Father Name of Farmer	Tribe	Village
1	M.Anwar/ Haji Rahim	Luni	Kili Luni
2	Mohammad Usman/ Mohammad Khan	Luni	Killi Luni
3	Edayatullah/Mahmood Khan	Luni	Killi Luni
4	Haji Rashid/Mustafa Khan	Luni	Kili Luni
5	Dr. Allah Dad/ Mohammad Khan	Luni	Kili Luni
6	Mohammad Khan/ A. Satar	Luni	Kili Luni
7	Haji A. Rahman/Haji Ahamad Khanl	Luni	Kili Luni
8	Haji Yaqoob / Mohammad Khan	Luni	Kili Luni
9	Kaleem Ullah/ Misri Khan	Luni	Kili Luni
10	Azizullah/ Sadullah	Luni	Kili Luni
11	Obaidullah/ Habiullah	Luni	Kili Luni
12	Yaqoob/Allah Bux	Luni	Kili Luni
13	Ghulam Sarwar/Azamat Khan	Luni	Kili Luni

Marghzani Canal and Branches

A meeting was arranged with the farmers of Killi Marghzani (proposed main canal and proposed branchs Sibi nalla faqeer M. Sibi nalla Qadar Bux, Sibi Nalla Attaullah, Sibi nalla kurak Nalla, Safi, Kurak Nalla and Samzai branch). The farmers were briefed about the objectives of the project and they were prepared for participation in walk through resettlement survey along the canal and cooperation in baseline data collection. At the end of the survey, another meeting of the farmers were organized briefed about the proposed engineering interventions and findings of the walk through survey on main canal and branches. In the first meeting, the farmers shown their willingness in participation and cooperation and in the second meeting next day, the farmers shared their views about the project and signed the copy of Tender Drawing.

Venue & Date	5th Meeting at Marghzani Village on 7th and 8th October, 2015
Location/Venue	Marghzani Village malak Azizullah House
BIWRMD Project Consultants Team Members	Mr. Niamatullah khan Mr.Abdul Shakoor Kakar Mr.Sar Anjam Khan Mr.Aorangzeb
Results/Outcome	• The farmers expressed their willingness and cooperation with the project staff during survey and implementation of the project. • They have expressed willingness to provide land if required voluntarily(without demanding any compensation) for completing the designed canal and other appurtenant structures. • They have also committed for not demanding or creating any problem in cutting of trees/bushes along the banks of canal, in case; if the cutting was unavoidable during construction phase. • They have confirmed that there is no residential, commercial, public or private structure within RoW of 15ft and committed if the communities constructed any building within 15ft RoW after the cut off date (as agreed 7th and 8th October, 2015) will be demolished during construction phase and will be responsibility of the owner. • Despite the earlier dissemination of the information about the scheduled meeting, those farmers who were not present in the meetings, in case, if they are raising any issue or creating any hurdles for the project, will be the responsibility of the sitting/present farmers to resolve and handle the matter.

List of Farmers Consulted in Marghzani Village

S.No	Name and Father Name of Farmer	Tribe	Village
1	Malak Faqeer Mohammad/Nouradin	Shodanzai	Killi Shdanzai
2	Malak Haji Bux/Noor Khan	Shodanzai	Killi Shdanzai
3	Mohammad Iqbal/ Zaro Khan	Shodanzai	Killi Shdanzai
4	Abdul Wahab/ Ghous Bax	Shodanzai	Killi Shdanzai
5	Qadar Bux/Ilahai Bux	Malazai	Marghzani
6	A.Rahman/Ghulam Yaseen	Malazai	Marghzani
7	Malak Lateef/malak A. Samad	Malazai	Marghzani
8	A. Wahab/Ghul Mohammad	Malazai	Marghzani
9	Malak Attaullah/Rab Nawaz	Bostanzai	Marghzani
10	Mohammad Sherdil/M.Nawaz	Bostanzai	Marghzani
11	Mohammad Qasim/Nasrullah	Bostanzai	Marghzani
12	Mohammad Javaid/Salah Mohammad	Bostanzai	Marghzani
13	Asad Khan/Allah Bux	Marghzani	Marghzani
14	Habib Nawaz/Khan Mohammad	Marghzani	Marghzani
15	Khalilullah/Arbab khan	Marghzani	Marghzani
16	Mohammad Alam/Mustqeem	Marghzani	Marghzani

17	Malak Dur Mohammad/Ghulam Nabi	Safi	Marghzani

Dephal canal and Branches

A meeting was arranged with the farmers of Killi Dephal (proposed main canal and proposed branchs Hasham Khan Nalla, Raza hasham Satar Nalla, Raza Hasham nalla, Malak Raza nalla, Malakdad nala 1,2,3). The farmers were briefed about the objectives of the project and they were prepared for participation in walk through resettlement survey along the canal and cooperation in baseline data collection. At the end of the survey, another meeting of the farmers were organized briefed about the proposed engineering interventions and findings of the walk through survey on main canal and branches. In the first meeting, the farmers shown their willingness in participation and cooperation and in the second meeting next day, the farmers shared their views about the project and signed the copy of Tender Drawing.

List of Farmers Consulted in Dehpal Village

Venue & Date	7th Meeting at Dephal Village on 9th and 10th October,2015
Location/Venue	Dephal Village Malak Dad House
BIWRMD Project Consultants Team Members	Mr. Niamatullah khan Mr.Abdul Shakoor Kakar Mr.Sar Anjam Khan Mr.Aorangzeb
Results/Outcome	• The farmers expressed their willingness and cooperation with the project staff during survey and implementation of the project. • They have expressed willingness to provide land if required voluntarily(without demanding any compensation) for completing the designed canal and other appurtenant structures. • They have also committed for not demanding or creating any problem in cutting of trees/bushes along the banks of canal, in case; if the cutting was unavoidable during construction phase. • They have confirmed that there is no residential, commercial, public or private structure within RoW of 15ft and committed if the communities constructed any building within 15ft RoW after the cut off date (as agreed 9th and 10th October, 2015) will be demolished during construction phase and will be responsibility of the owner. • Despite the earlier dissemination of the information about the scheduled meeting, those farmers who were not present in the meetings, in case, if they are raising any issue or creating any hurdles for the project, will be the responsibility of the sitting/present farmers to resolve and handle the matter.

List of Farmers Consulted in Dephal Village

S.No	Name and Father Name of Farmer	Tribe	Village
1	Ghulam Nabi/Allah Dad	Sardar khel	Dephal Kala
2	Mohammad Anwar/Shadad Khan	Sardar khel	Dephal Kala
3	Mohammad Ibrahim/Rashid khan	Rashidkhel	Dephal Kala
4	Imam bux /Rashid Khan	Rashidkhel	Dephal Kala
5	A.Karim/Mirza Khan	Rashidkhel	Dephal Kala
6	Rasool Bux/Noor Mohammad	Rashidkhel	Dephal Kala
7	A. Aziz/Noor Mohammad	Bugtti Baloch	Dephal Kala
8	Khuda Bux/ Metta Khan	Balailzai	Dephal Kala
9	Malak Dad/Abdullah	Balailzai	Dephal Kala
10	Haji M.Hassan/ Rasool Bux	Ayoubzai	Dephal Kala
11	Mohammad Ilyas/Mohammad Hussain	Rashidkhel	Dephal Kala
12	Ghulam Haidar/Khudidad	Ghulam Bolak	Dephal Kala

Consultation with Farmers of Kurak canal and Branches

A meeting was arranged with the farmers of Killi Kurak Barozai (proposed main canal Kurak). The farmers were briefed about the objectives of the project and they were prepared for participation in walk through resettlement survey along the canal and cooperation in baseline data collection. At the end of the survey, another meeting of the farmers were organized briefed about the proposed engineering interventions and findings of the walk through survey on main canal. In the first meeting, the farmers shown their willingness in participation and cooperation and in the second meeting next day, the farmers shared their views about the project and signed the copy of Tender Drawing.

Venue & Date	7th Meeting at Kurak Village on 11th and 12th October,2015
Location/Venue	Kurak Village Nawab Ghous Bux Barozai (X CM Balochistan) House
BIWRMD Project Consultants Team Members	Mr. Niamatullah Khan, Mr.Abdul Shakoor Kakar Mr.Sar Anjam Khan Mr.Aorangzeb
Results/Outcome	• The farmers expressed their willingness and cooperation with the project staff during survey and implementation of the project. • They have expressed willingness to provide land if required voluntarily(without demanding any compensation) for completing the designed canal and other appurtenant structures. • They have also committed for not demanding or creating any problem in cutting of trees/bushes along the banks of canal, in case; if the cutting was unavoidable during construction phase.

List of Farmers Consulted in Kurak Village

S.No	Name and Father Name of Farmer	Tribe	Village
1	Rais Abdul Hakeem/Fathah Mohammad	Lalozai	Kurak
2	Mohammad Isaq/Muhabat Khan	Barozai	Kurak
3	Baro Khan/Nawab M. Khan	Barozai	Kurak
4	Ahamad Khan/Atta Mohammad	Bijarzai	Kurak
5	Mir Mohammad/Bahr Khan	Khuldband	Kurak
6	Mohammad Yaqoob/A.Rahim	Khulband	Kurak
7	Hazoor Bux/Khair Bux	Mahmoodzai	Kurak
8	Khan Mohammad/Haji Khan	Lalozai	Kurak
9	Malak Shah Mohammad/Karam Khan	Rind	Gulo Shahar Qadeem
10	Tariq Aziz/Abdul Aziz	Rind	Gulo Shahar Qadeem
11	Abdul Ghafar/Abdul Haleem	Rind	Gulo Shahar Qadeem
12	Rab Nawaz/Mohammad Isaq	Rind	Gulo Shahar Qadeem

Yetabad Sub-Project

A meeting was arranged with the farmers of Manzaki, Basharat Manzakiand Jahangeer Shore (proposed Weir site and proposed main canal and proposed branch canal 1, 2 & 3). The farmers were briefed about the objectives of the project and they were prepared for participation in walk through resettlement survey along the canal and cooperation in baseline data collection. At the end of the survey, next day another meeting of the farmers were organized briefed about the proposed engineering interventions and findings of the walk through survey on main canal and branches. In the first meeting, the farmers shown their willingness in participation and cooperation and in the second meeting, the farmers shared their views about the project and signed the copy of Tender Drawing.

Venue & Date	1st Meeting at Manzaki and Basharat Manzaki on 6th September,2015 2nd Meeting at Jahangeer Shore on 7th September, 2015
Location/Venue	Manzaki and Jahangeer Shore
BIWRMD Project Consultants Team Members	Mr. Niamatullah khan Mr.Abdul Shakoor Kakar Mr.Sar Anjam Khan Mr.Aorangzeb
Results/Outcome	• The farmers expressed their willingness and cooperation with the project staff during survey and implementation of the project. • They have expressed willingness to provide land if required voluntarily (without demanding any compensation) for completing the designed canal and other appurtenant structures. • They have also committed for not demanding or creating any problem in cutting of trees/bushes along the banks of canal, in case; if the cutting was unavoidable during construction phase. • They have confirmed that there is no residential, commercial, public or private structure within RoW of 54m and committed if the communities constructed any building within 54m RoW after the cutoff date (as agreed 6th and 9th September, 2015) will be demolished during construction phase and will be responsibility of the owner. • Despite the earlier dissemination of the information about the scheduled meeting, those farmers who were not present in the meetings, in case, if they are raising any issue or creating any hurdles for the project, will be the responsibility of the sitting/present farmers to resolve and handle the matter.

List of Farmers Consulted at Manzaki, Basharat Manzaki and Jahangeer Shore

S.No.	Name and Fathers Name	Tribe	Village
1	Haji Jahangeer/Haji Zarif	Luni	Manzaki
2	Haji Shahjahan/H. Zarif	Luni	Manzaki
3	Mujeebullah/H.Shar Hassan	Luni	Manzaki
4	Jaffar Khan/Mohammad Husain	Luni	Manzaki
5	Mohammad Anwar/M.Husain	Luni	Manzaki
6	Haji Abdul Waheed/Haji Pahind	Luni	Basharat Manzaki
7	Baz Mohammad/ Gul Baran	Luni	Basharat Manzaki
8	Haji Ghazi/Gul Baran	Luni	Basharat Manzaki
9	Gul Khan/ Gul Baran	Luni	Basharat Manzaki
10	Ashaq/Noor Mohammad	Shadozai Kakar	Jahangeer Shore
11	Qalandar/Mir Jan	Shadozai Kakar	Jahangeer Shore
13	Ghulam Nabi/habibullah	Shadozai Kakar	Jahangeer Shore
14	Bangul Khan/Nasrullah Khan	Shadozai Kakar	Jahangeer Shore
15	Sanaullah/Dur Mohammad	Shadozai Kakar	Jahangeer Shore
16	Ghulam Nabi/Habibullah	Shadozai Kakar	Jahangeer Shore
17	Baboo fathe / Lal Mohammad	Shadozai Kakar	Jahangeer Shore

Branch 5, 6, 7 and 8

A meeting was arranged with the farmers of Manki, Ghazi China, Din Mohammad Qilla and Killi Asadullah (proposed main canal and proposed branch canals 6,7 and 8). The farmers were briefed about the objectives of the project and they were prepared for participation in walk through resettlement survey along the canal and cooperation in baseline data collection. At the end of the survey, another meeting of the farmers were organized briefed about the proposed engineering interventions and findings of the walk through survey on main canal and branches. In the first meeting, the farmers shown their willingness in participation and cooperation and in the second meeting, the farmers shared their views about the project and signed the copy of Tender Drawing.

Venue & Date	3rd Meeting at Manki, Ghazi China, Din Mohammad Qilla and killi Asadullah on 8th and 9th September, 2015
Location/Venue	Din Mohammad Qilla
BIWRMD Project Consultants Team Members	Mr. Niamatullah khan, Mr.Abdul Shakoor Kakar Mr.Sar Anjam Khan Mr.Aorangzeb
Results/Outcome	• The farmers expressed their willingness and cooperation with the project staff during survey and implementation of the project. • They have expressed willingness to provide land if required voluntarily(without demanding any compensation) for completing the designed canal and other appurtenant structures. • They have also committed for not demanding or creating any problem in cutting of trees/bushes along the banks of canal, in case; if the cutting was unavoidable during construction phase. • They have confirmed that there is no residential, commercial, public or private structure within RoW of 54m and committed if the communities constructed any building within 54m RoW after the cut off date (as agreed 6th and 9th September, 2015) will be demolished during construction phase and will be responsibility of the owner. • Despite the earlier dissemination of the information about the scheduled meeting, those farmers who were not present in the meetings, in case, if they are raising any issue or creating any hurdles for the project, will be the responsibility of the sitting/present farmers to resolve and handle the matter.

List of Farmers Consulted for Branch 5, 6, 7 & 8

S.No	Name and Father Name of Farmer	Tribe	Village
1	Malik Noor Mohammad /Haji Sobidar	Tareen	Kili Asadullah khan
2	Akber Tareen / Haji Sobidar khan	Tareen	Kili Asadullah khan
3	Aslam Khan / Shobidar kahn	Tareen	Kili Asadullah khan
4	Sarwar khan / Noor Mohammad	Tareen	Kili Asadullah khan
5	Kamal Khan/ Noor Mohammad	Tareen	Kili Asadullah khan
6	Malik Janan /Khair Mohammad	Ustranai	Saedo chena Kala Khan
7	Malik Bahdur khan/ Haji Gul	Ustranai	Saedo chena Kala Khan
8	Khair Mohammad / Sultan Mohammad	Ustranai	Ghazi Chena
9	Mohammad Khan / Nazar Mohammad	Ustranai	Ghazi Chena
10	Malik Sattar /Malik Waheed	Tareen	Din Mohammad Qilla
11	Malik Amir Mohammad / Abdul Rehman	Ustranai	Din Mohammad Qilla
12	Malik Faqeer Mohammad/ Abdul Rehman	Ustranai	Din Mohammad Qilla
13	Malik Dewa Khan/ Abdullah khan	Ustranai	Din Mohammad Qilla
14	Sahib Khan / Gul Bahran	Ustranai	Din Mohammad Qilla
15	Fateh Mohammad / Kala Khan	Ustranai	Din Mohammad Qilla

Branch No.of 9 & 10 of Ismail Shahar

A meeting was arranged with the farmers of Killi Ismail Shahar owners of branch 9 &10 (proposed main canal and proposed branch canals). The farmers were briefed about the objectives of the project and they were prepared for participation in walk through resettlement survey along the canal and cooperation in baseline data collection. At the end of the survey, another meeting of the farmers were organized briefed about the proposed engineering interventions and findings of the walk through survey on main canal and branches. In the first meeting, the farmers shown their willingness in participation and cooperation and in the second meeting, the farmers shared their views about the project and signed the copy of Tender Drawing.

Venue & Date	4th Meeting at Ismail Shahar, (Sardar Shahar, Gaman Shahar and Killi Abdullah) on 10th and 11th September, 2015
Location/Venue	Ismail Shahar
BIWRMD Project Consultants Team Members	Mr. Niamatullah khan Mr.Abdul Shakoor Kakar Mr.Sar Anjam Khan
Results/Outcome	• The farmers expressed their willingness and cooperation with the project staff during survey and implementation of the project. • They have expressed willingness to provide land if required voluntarily(without demanding any compensation) for completing the designed canal and other appurtenant structures. • They have also committed for not demanding or creating any problem in cutting of trees/bushes along the banks of canal, in case; if the cutting was unavoidable during construction phase. • They have confirmed that there is no residential, commercial, public or private structure within RoW of 54m and committed if the communities constructed any building within 54m RoW after the cut off date (as agreed 6th and 9th September, 2015) will be demolished during construction phase and will be responsibility of the owner. • Despite the earlier dissemination of the information about the scheduled meeting, those farmers who were not present in the meetings, in case, if they are raising any issue or creating any hurdles for the project, will be the responsibility of the sitting/present farmers to resolve and handle the matter. • The farmers also requested for provision of road culverts on the canal. • The farmers also requested for provision of extension for main canal (2 kilo meter)

List of Farmers Consulted at Ismail Shahar

S.No	Name and Father Name of Farmer	Tribe	Village
1	Aslam Khan / Shobidar kahn	Tareen	Ismail Shahar
2	Zahir Khan/ Mohammad Aslam	Tareen	Ismail Shahar
3	Shadi Khan/……………	Tareen	Ismail Shahar
4	Akbar Khan/Khan Badur	Tareen	Ismail Shahar
5	Sardar Shafiq/S. Faqeer Mohammad	Tareen	Ismail Shahar
6	Abdul Rauf/Abdul Rashid	Tareen	Ismail Shahar
7	Jalil khan/Abdul Aziz	Tareen	Ismail Shahar
8	Tahir Jan/ haji Mohammad jan	Tareen	Ismail Shahar
9	Sardar Shadozai/Ali Mohammad	Tareen	Ismail Shahar
10	Mohammad Rahim/karam	Tareen	Ismail Shahar
11	Mohammad Razaq/ Karam	Tareen	Ismail Shahar
12	Sardar Shafiq /Faqeer Mohammad	Tareen	Ismail Shahar
13	Mohammad Shohaib/Niaz Mohammad	Tareen	Ismail Shahar
14	Amir Jan/Samad Jan	Tareen	Ismail Shahar
15	Noor Shadozai/Malik Noor Mohammad	Tareen	Ismail Shahar
16	Faqeer Mohammad/ Salah Mohammad	Tareen	Ismail Shahar
17	Noor Gul/ Allah Yar khan	Tareen	Ismail Shahar

Public Consultation in Field

This activity was initiated by the consultants during April – May 2013 alongside the socio-economic survey. The consultation was done through meetings in 46 potentially affected villages. Mostly people who were consulted included village elders, school teachers / government employee living in a particular village, or owner of a reasonable size of land. All the villages visited and consulted are located in the Bela district; no village in Khuzdar or Awaran district was covered due to security situation.

During the first phase of consultation, it was realized that among Potentially Affected Persons, there prevails either unawareness or an ambivalent attitude towards proposed development schemes. There seemed slight disapproval at some instances, possibly due to the fear of relocation.

During field activity, the team had discussed the basic requirements, requests, views and perceptions with the local residents of these settlements about this project. Following opinions were shared by the people of respective areas.

- Local residents have a very encouraging opinion regarding this activity, they are very positive about the project as they assume that it will provide not only water for irrigation purpose but will also improve their quality of life, monthly income, live stocks, infrastructure like roads etc. However, some of them had reservations as they thought, these structures will only benefit some influential persons of the area as has happened in the past, e.g. Gijri Dam, which was constructed only for benefiting the lands of a local Sardar. According to people of Shadi Village, Gijri Dam only serves the Sardar's land, causing injustice in water distribution, without any compensation for displacement of resident.
- Some people had concern regarding design or modification in the existing structures like Trifurcation at Lakhra. They thought that trifurcation structure should be constructed 3 ft below the ground level instead of 3 ft above as proposed by the irrigation department to fulfil their needs of irrigation water.
- Some of the villagers from Ganda cha village raised their concern about the ground water depletion. According to them, if the major amount of water is utilized in the upstream areas, then the ground water in the downstream areas will be decreased. It was suggested by the villagers that appropriate measures should be taken to solve with problem.
- Some people showed their interest in the rehabilitation of existing structures like Liari existing weir, which is constructed on Titan khore. By the passage of time, it is nearly ruined due to the negligence of concerned department. The situation is creating drought condition in Liari and its surrounding.
- Many people showed their concerns about the implementation of the project. They were sceptic about the performance of Government departments, and said that many plans are made but nothing on ground takes place.

Consultation with Institutional Stakeholders

Besides consulting with the people living in or around the sites that are potentially affected by the project, the consultants also met the major institutional stakeholders, including the Government line departments and the NGOs working in the area. The proponent of the project, i.e. BSSIP, facilitated the consulting team by sending out a letter to all concerned departments, and also helped in getting appointments.

Mr. Farooq Khajjak – Procurement Engineer BSSIP, Irrigation Department

The consulting team met Mr. Khajjak in his office on 8th April, 2014. Main ideas shared by him are listed below:

- Top priority must be given to preserve perennial water sources.
- Traditional Karez system has largely been replaced by Tube-wells. This transformation has many downsides: firstly, tube-wells take up energy; secondly, it is leading to unsustainable groundwater use leading to groundwater depletion; and thirdly, this practice socially leads to individualism as opposed to community ownership intrinsic in the Karez system.
- Dam should be for irrigation purposes, especially in case of Balochistan. Power production is not an option.
- Ground water recharge will probably not be a significant result of the proposed project.
- Dam command area development should be taken into account and properly planned. Mirani dam is an example of wasted resources because it is a dam without command area.
- Inter-department coordination is necessary for the success of this project. The irrigation department has deputed people from forest and agriculture departments in BISSP so far.

Mr. Khajjak inquired about relevance of Fisheries Department as stakeholder for this project. The consulting team responded that where Porali River drains into the sea, there is a significant population of fishermen, and also sizeable commercial fishing activity. Therefore, fisheries department is a legitimate stakeholder.

Mr. Naseer Khan Kashani – Director General EPA Balochistan

The consulting team met Mr. Kashani in his office on 8th April, 2014. The team briefly explained the proposed project to Mr. Kashani. He took special interest in the proposed locations of various interventions.

Main ideas shared by him are listed below:

- Mr. Kashani welcomed the development of Balochistan. However, he said, the development should also take into account the sensitivities of indigenous ecosystem, and should not result in unsustainable harvesting of any natural resources.
- He specially emphasized that groundwater recharge is a necessary thing, and the project is likely to have this positive impact. The project design should consider enhancing this positive impact to maximum possible extent.
- He stressed that the project environmental report should take into account any possible impacts on Hingol National Park. The consulting team explained that the project influence is not likely to expand to Hingol National Park.
- M. Kashani stressed that the impact of the proposed interventions on the downstream flows into the Arabian Sea should be studied minutely, as the river drains into a Ramsar site i.e. Miani Hor.
- Finally, Mr. Kashani emphasized that there should be a strong monitoring arrangement post project. He said that the EPA will check it and ensure that proper monitoring is carried out, so that there is no inadvertent environmental damage caused by the project.

Mr. Zeeshan ul Haq – Secretary Fisheries & Balochistan Coastal Development Authority

The consulting team met Mr. Zeeshan ul Haq in his office on 8th April, 2014. The team briefly explained the proposed project to him with the help maps and other relevant documents. Main information shared and concerns raised by him are the following:

Main stake of fisheries department is close to the proposed intervention at Titian; and towards the tail-end where Porali drains into the Arabian Sea.According to him, the interests of fishermen are three pronged, in that order of priority: clean drinking water; fresh water flows; and perennial flows.

The proposed project would regulate the flows and hence likely to improve the situation from the current ephemeral one to a quasi-perennial one. However, a more pressing requirement is of fresh water, not only for the downstream ecosystem, but also for the sprawling anthropogenic activities in the area. He informed that the fish meal factories have gone up from 02 a few years back to 17 now.

He also informed that Damb is an important landing site for shrimps and fish; one of the 08 landing sites on Balochistan coast. It is a permanent abode of fishermen community. Its population size swells during the fishing season, when people from outside the area – and even from outside the province – come here for economic reasons. He said that freshwater requirement for ecosystem, domestic consumption and industrial / commercial use has to be taken into account.

He also sees the proposed project as an opportunity to ease the burden on fishery sector in terms of offering a relatively diversified availability of trade, particularly agriculture and livestock, which potentially reduces the juvenile catch of fishes for fish meal.

He recalled that the floods previously caused damage to the Makran Coastal Highway to the extent of around 9 km. One reason was that the existing Titian FIS was not working properly. Therefore, rehabilitation and improvement of this structure will help sustain the infrastructure as well.

He also advised that the project could also identify potential aquaculture sites upstream, for example the proposed dam at the Kud River, in order to partially shift the burden from catch-culture. **He further advised that the project should not result in reduction of coastal vegetation cover. He emphasized that reduction of coastal erosion potential is a definite positive of the proposed project.**

Mr. Inam Ullah – Director Planning (Agriculture Irrigation & Extension Department)

The consulting team met Mr. Inam ullah in his office on 9th April, 2014. The team briefly explained the proposed project to him with the help maps and other relevant documents. Main concerns raised by him related to inter-department coordination. He was of the opinion that Irrigation department must be more forthcoming in sharing their plans with all other departments. He advised that the project must consider the climatic factors, so that the ultimate objective of improved agricultural productivity could be obtained.

He also shared the limitations of his jurisdiction to effectively convince the farmers particularly in some of the pockets of the proposed project area to adopt farming of less water intensive crops; he identified the social setup of the area playing a leading role for such deviation from the demand.

He suggested that the Irrigation department, being the proponent of the project, must hold a meeting of various line departments and give a detailed presentation to all concerned, so that every department could know its role in the proposed project and hence all could contribute to it jointly.

Mr. Abdullah Shah – Chief Engineer South, Irrigation Department

The consulting team met Mr. Abdullah Shah in his office on 9th April, 2014. The team briefly explained the proposed project to him with the help of maps and other relevant documents.

He informed that Gandacha dam is being recharged by precipitation. It is part of the Porali basin. He suggested that a better option could be to build a large dam on Porali at Nimmi. He has previously recommended it to the concerned authorities. He is of the view that such large dam will basically serve all the purposes currently envisaged from any delay action dam, check dam or flood protection arrangement. Such large dam would store enough water which could then be supplied for irrigation through pipes.

This will also ensure elimination of flood damages downstream. He added that the ancillary infrastructure with a large dam would also serve the area that is currently under-developed in terms of infrastructure. Whatever infrastructure is there, is also prone to destruction by flash floods.

Mr. Akhter Bazai – Chief Conservator Forests

The consulting team met Mr. Bazai in his office on 9th April, 2014. He was assisted by the deputy conservators and other staff of forest department. The team briefly explained the proposed project to them with the help maps and other relevant documents.

Mr. Bazai strongly supported the project and even recommended adding further check dams and delaying action dams at Uthal and Bela. He lamented that currently there is almost no provision to use the floodwater of Porali.

Since there is almost no delay or storage arrangement, the floodwater could not be used for rangeland development or raising plantation. Once flood is controlled and plantation is raised, it will enable a continual cycle of flood control and sustainability of proposed intervention by creating positive inter-dependencies.

He expressed willingness by the forest department to develop the rangeland as soon as the water storage arrangement is there. He also instructed his staff to ensure appropriate plantation at all the streams and distributaries embankments of the proposed scheme.

Dr. Noor Ahmed Baloch – Livestock Department

The consulting team met Dr. Baloch in his office on 8th April, 2014. Dr. Amjed was also present. The team briefly explained the proposed project to them with the help maps and other relevant documents.

Dr. Baloch supported the idea of the project in a long term manner. He was of the opinion that more consistent availability of water would lead to better availability of nutrition to the livestock through rangelands. This would, in turn, lead to better livestock productivity both in terms of quality and quantity.

The livestock people recommended that the project should also encourage and promote fodder crops at its operational stage. They were of the view that livestock dispensary and model dairy farm should be considered as off-farm components of the integrated agricultural development of the area – expected to result from the implementation of proposed project.

Mr. Jahanzeb – Coordinator Coastal Association for Research & Development

Coastal Association for Research & Development (CARD) is a community based non-government and non-profit organization. It was established in 2002. It is a community focused organization working to strengthen ultra-poor people in the coastal areas, particularly in Lasbela and Gwadar districts of Balochistan. CARD had been identified by the consulting team to be an effective representative of area people, especially those from the fishermen community. CARD members shared their views about the development potential of the area.

They informed that the fishermen community is now much more aware about the harmful effects of unsustainable fishing methods, but economic pressures may still sometimes force them into such practices. They were of the view that the project might help in eradicating abject poverty in the fishermen community by providing them freshwater on a more regular basis and also by ensuring minimal flood damages.

Mr. Tahir Qureshi – IUCN

The consulting team met Mr. Tahir Qureshi in his office in Karachi on July 11, 2014. Mr. Qureshi is amongst the most authentic experts on mangroves in the region. The purpose to meet him was to confirm the validity of the positive perceptions about the project benefits shown by the people of project area. The team briefly explained the proposed project to them with the help maps and other relevant documents.

Mr. Qureshi has been working on the mangrove ecosystems of the coastal belts of Pakistan since a very long time and is well versed with the ecosystem sensitivities of Miani Hor. He also contributed in getting Miani Hor the status of Ramsar Site. He informed the consulting that the Ramsar site actually consists of Sranda Lake and the Miani lagoon jointly. Siranda lake used to form a natural storage for monsoon flood waters around quarter of a century ago. However, with development of infrastructure upstream, specially around the RCD Highway, the lake stopped receiving flood waters and now it is practically dry. Even when there is water, it is sea water.

Mr. Qureshi was of the view that the existing water flow regime is not significantly supportive for the mangrove ecosystem. A major share of water comes in sporadic bursts within very short time spans, while the life forms have to survive without fresh water for the remainder of the year. As is the case with Indus delta, rather than flash floods, more regulated flow is required.

Mr. Qureshi informed that there could be three major beneficiaries of the regulated water supplies, namely: mangroves; agriculture; and freshwater fisheries. He emphasized that regulated hydrology regime will be more beneficial for the overall ecosystem health, even with reduced total quantity of water, than the current erratic regime.

Public Consultation Workshop

The consulting team had previously requested CARD to arrange a meeting with the local community representing people from all areas and all walks of life. CARD, along with another CBO DAWN, arranged the requested meeting in Winder on March 19th, 2014. The purpose of this meeting was to present the salient features of the proposed project, and the progress of the environmental study to the public stakeholders.

The meeting was attended by more than 50 members of local community. They represented people belonging to agriculture as well as fisheries and other professions. The participants included Vice Chairman of the Landowners Association, President Dawn Welfare Organization, Coordinator CARD, general councillor of the area etc. The attendance list of participants is attached below.

Engineer Muhammad Ali Daudpota presented the salient features of the project, while Mr. Rafiul Haq informed the participants of the progress of EIA. He has had vast experience of working in the area of proposed project from the platforms of IUCN and WWF, and therefore knows the local issues and problems very well. The participants agreed whole heartedly when he suggested that lack of water storage and management is rather a bigger problem in the area than the actual availability of water.

The main points raised by the participants during the discussion are summarized in the following:

- The project should plan ahead for at least 20 years. Our area is suffering from ad hoc development as much as from no development.
- The communities have no issues with the concept of dams; but the issue is with the design. Flawed designs of such schemes have in the past not only resulted in public money, but have also caused havoc to the local population.
- Spillway of the dams should be very properly planned. Material and planning should be of best quality. Dam height should be optimum.
- Spillway water may support fishing and agriculture.
- People living close to the proposed intervention sites will be the major beneficiaries. It should be ensured that those living at a distance also benefit from it.
- Dams will also help in reducing flow of debris into the sea. However, water calculation should be rechecked before going ahead with the project.
- Dams will also support groundwater recharge. In this regard, engineering design of the project should expand this benefit to the maximum possible area.
- Independent monitoring mechanism should be put in place for the project.
- The project will have no direct benefits for Winder. There should be some component to this end. Winder river has better flow than Porali river. There were some structures previously built, but now they stand completely destroyed.

Mr. Abdus Sattar Angaria, Mr. Abdul Hafeez Angaria, Haji Abbas Mahigeer, Nabi Bux Angaria, Wadera Suleman, Taimur Hamza and others spoke on the occasion. The forum unanimously supported the project.

It is evident that the agricultural activity will have direct benefits from the project, and therefore, landowners and peasants are in favour of the project. However, one key feature of the forum was that the people engaged with fishing trade also supported the proposed interventions. Fishermen community residing very close to the Porali mouth supported the proposed project because they felt that the intensity of damage due to ephemeral flow is likely to reduce if the flow is made into a regulated perennial type. Further, it will also help reduce the amount of silt at the river mouth and the lagoon.

Community concerns and suggestions
Resettlement
• Concern over guarantees for payment of resettlement compensation. • Resettlement process should be unbiased and entitlements for resettlement compensation should be clear before the start of the Project. • During the resettlement settler communities should not affect the native people. This voice was from Baloch areas quoting the example of Gwadar where settler communities dominate and vast majority invest and purchase the land and host community were assuming deprived. • During the initial consultation phase at grass root level it was assessed that there is no issue of resettlement in all project components at Reservoir, watershed, downstream and command area level. Sub-projects are located in Communal land/Shamalat under tribes of the area. There is no effect on houses or agricultural land in all the sub-projects during or after construction of the project. The community is willing to donate the land for this project without any compensation.
Alternative livelihoods
• Person whom livelihoods will be destroyed due to the project should be considered as project-affected populations and should be compensated in term of alternative livelihoods.
Hiring local community
• Community and local NGOs raised concern that the local people should be preferred for employment during and after the project. All the unskilled labour should be hired from respective community. Contractor should be bound for hiring of local labour.
Loss of law and order situation
• In remote areas community concern, by this project the infrastructure like road access will improve and criminal can access their areas easily which ultimately impact on law & order situation and peace will affect in remote areas.
Loss of culture and cultural sites
• Community expressed concern about loss of their culture due to migration of skilled labour and technical staff during construction and after completion. There was also fear in community that cultural sites may affect by this project
Concerns related to safety and environment
• The project should plan ahead for at least 20 years. Our area is suffering from ad hoc development as much as from no development. • The communities have no issues with the concept of dams; but the issue is with the design. Flawed designs of such schemes have in the past not only resulted in public money, but have also caused havoc to the local population. • Spillway of the dams should be very properly planned. Material and planning should be of best quality. Dam height should be optimum. • The project will have no direct benefits for Winder. There should be some component to this end. Winder river has better flow than Porali river. There were some structures previously built, but now

they stand completely destroyed. • Dams will also help in reducing flow of debris into the sea. However, water calculation should be rechecked before going ahead with the project.
Institutional concerns and suggestions
Potential environmental impacts
• Forest, Wildlife and local NGOs and INGO-IUCN raised strong concerns regarding potential loss of biodiversity in the project area. The environmental hotspots should be protected at any cost. • The IUCN representative pointed out that the construction of project would increase the risk to lose more endangered species. • Excessive use of ground water resources should be discouraged. Surface water resources should be preferred • Natural vegetation is important element to control soil erosion and play a positive impact on environment. During project implementation the tree cutting should be avoided, if needed an additional plantation should be done to improve environment and economy of the area • The pollution during construction should be supervised and monitored. The contractor should be responsible during construction
Capacity building
• The research institutions should play a role for capacity building of farmers • The concept of IRBM and integrated schemes development process should be adopted
Resettlement
• The resettlement if any should be addressed. The compensation process should be transparent • The alternative livelihoods plans should be developed for affected persons
Cultural heritage
• The archaeological sites if any exists in the project area should be protected and conserved
Access to water for existing coal mines
• It was main concern from mines industry relevant stakeholders that due to dams or reservoir construction in Beji sub-basin especially in the Duki area, the water level will increase which may affect the production of coal mines in the area.
Gender
• Gender issues should be addressed during designing and implementation phase of the project

Attendance at Winder Public Consultation Workshop

Consultative meeting to discuss Proli River Rasin project
at Winder, Balochistan; March 20th , 2014

نمبر موبائل	دستخط	پتہ	نام	نمبر
03333547683	[illegible]	وندر کالونی	عبدالحفیظ (زراعت)	1
03449912699	محمد خان	ساگئی گوٹھ	وڈیرا محمد خان زراعت	2
		سفر گوٹھ	یار محمد زراعت	3
0332-2278521	علی بخش	حاجی حسن گوٹھ	علی بخش زراعت	4
03322353440	نور محمد	حاجی حسن گوٹھ	نور محمد ولد محمد صدیق	5
0315-2801241	[illegible]	سفر گوٹھ	A Majeed	6
	[illegible]	موضع بار	خیر محمد ولد صالح محمد	7
03312060035	[illegible]			8
03456278767	[illegible]	Hossen goth	A. Sallor Angaria	9
03128385089	[illegible]	حاجی گل گوٹھ	محمد ایوب ولد محمد ابراہیم	10
0332-3181217		بنو گوٹھ	محمد الیاس ولد بنو الله زراعت	11
0334-3824326	A. Karim	شاگئی گوٹھ	عبدالکریم ولد محمد صدیق	12
	محمد حسن	سفر گوٹھ	محمد حسن ولد سلیمان	13
03009299388	محمد حسین	محمد خان گوٹھ باندو	وڈیرہ محمد سلیمان انگاریہ	14
03318878580	[illegible]	گوٹھ	[illegible] ولد [illegible]	15
03343832791	[illegible]	ابراہیم گوٹھ	حاجی محمد حسن ولد محمد رمضان	16
03442156051	[illegible] khan	اسحاق گوٹھ	عظیم خان ولد محمد [illegible]	17
03128966133	manzoor	محلہ سومیانی	منظور احمد ولد آدم خان	18
03128010626	zaheer	محلہ سومیانی	ظہیر احمد ولد آدم خان	19
03332587749	محمد حسن	سفر گوٹھ	محمد حسن ولد موسیٰ	20
03118021031	شہباز علی	کھیڑو	شہباز گل ولد گل محمد	21
03152412378	تیمور حمزہ	کھیڑو	تیمور حمزہ ولد میر حمزہ	22
				23

Consultative meeting to discuss Proli River Rasin project at Winder, Balochistan; March 20th , 2014

نمبر موبائل	دستخط	پیشہ	نام	
03128843921	H Abbas	ڈرائیور	حاجی محمد عباس	24
03130842020	A-Latheeb	ڈرائیور	عبداللطیف	25
03131062600	Ejaz Ali	سونمیانی	اعجاز علی	26
03138638153	Hassan	سونمیانی	محمد حسن	27
03362178188	Abdul Hamid	عارب گوٹھ زراعت	عبدالحمید	28
03323516370	محمد سلیم	زراعت عارب گوٹھ	محمد سلیم	29
03432325869	[illegible]	سائیں گوٹھ	محمد حسن ولد محمد اسحاق	30
03143926097	[illegible]	حاجی حسن گوٹھ ونڈر	محمد حسن ولد رشید بخش [illegible]	31
03125752770	T. [illegible]	ونڈر لسبیلہ	محمد سلیم ولد خان محمد - ونڈر	32
03453431942	[illegible]	ونڈر	محمد یوسف ولد حاجی گل ونڈر	33
03332707300	M. A[illegible]	حسن گوٹھ	محمد ایوب ولد [illegible] یوسف	34
03138608756	Imam Bux	سونمیانی	امام بخش ولد عبدالرحمٰن	35
03152681135	عبدالحلیم	حسن گوٹھ	عبدالحلیم ولد محمد رمضان	36
——	[illegible]	Hassan Got	Allah Dina Allah Bux	37
0333-3628655	[illegible]	[illegible] گوٹھ	محمد اسلم [illegible]	38
0343482510	[illegible]		حاجی نادر خان ونڈر	39
03332945634	عبدالغفور	دودا بلوچ گوٹھ	عبدالغفور دودا ونڈر	40
03332902621	[illegible]	حاجی چاکر	محمد بلوچ افضل ونڈر	41
03323266691	M. Bux	حسن گوٹھ	نبی بخش [illegible] ونڈر حسن گوٹھ	42
03432561236	[illegible]	حسن آباد	نزیم جان آکھا دیہ ونڈر حسن آباد	43
03368526189	M. Tahir	حسن آباد	محمد طاہر بلوچ ونڈر حسن آباد	44

نمبر	نام	پتہ	دستخط	فون نمبر
45	محمد عمران	وڈیرہ کانوڑی قبیلہ لسبیلہ بلوچستان	[illegible]	0333-2587650
46	بشیر احمد	بوجی گوٹھ کوطوڑا	Bent	03458746271
47	محمد الیاس	حسن آباد	[illegible]	03333028675
48	عبدالکریم	ساشہ گوٹھ	Azam	0345 7349714
49	عبداللہ	حاجی حسن گوٹھ	[illegible]	0342 2429270
50	نواز علی	سونمیانی	[illegible]	0315 8939601
51	احمد خان	حاجی حسن گوٹھ وندر	Ahmed Khan	03022870317
52	غلام محمد	حاجی حسن گوٹھ وندر	GM	0312-8513455