Government of Sindh, Pakistan

Irrigation Department

Agriculture, Supply &Prices Department

Sindh Water and Agriculture Transformation (SWAT) Project

Environmental and Social Management Framework

Project Coordination & Monitoring Unit

Planning and Development Department

July 2021

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List of Acronyms

A/RAP	Abbreviated/Resettlement Action Plan
ADU	Agriculture Development Unit
BP	Bank Practice
BOQ	Bill of Quantity
CSC	Construction Supervision Consultant
C-ESMP	Construction Environmental Social Management Plan
C&W	Communication & Works
DC	Deputy Commissioner
EA	Environmental Assessment
ECP	Environmental Code of Practice
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMU	Environmental Management Unit of SIDA
EPA	Environmental Protection Agency
EQS	Environmental quality standards
ESHGs	Environmental, health and safety guidelines
ESHS	Environmental, Social, Health & Safety
ESU	Environmental and Social Unit
FGD	Focus Group Discussion
E&S	Environmental and Social
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
GBV	Gender-Based Violence
GoS	Government of Sindh
GoP	Government of Pakistan
GWh	Gigawatt hours
GRC	Grievance Redress Committee
IEE	Initial Environmental Examination
ILO	International Labor Organization
IUCN	International Union o for Conservation of Nature
M&E	Monitoring and Evaluation
MSC	Management Support Consultants
NEQS	National Environmental Quality Standards
NGO	Non-Government Organization
O&M	Operation and Maintenance
OP	Operational Policy
OHS	Occupational Health and Safety
PAP	Project Affected Person
PCR	Physical Cultural Resources
PCMU	PCMU Project Coordination and Monitoring Unit
PD	Project Director
PIC	Project Implementation Consultants
PM	Particulate Matter
PMO	Project Management Organization
MSIP	Management Strategies and Implementation Plans
RPF	Resettlement Policy Framework
SAGP	Sindh Agriculture Growth Project
SWAT	Sindh Water & Agriculture Transformation
ToR	Terms of Reference
WHO	World Health organization
WB	World Bank
WBG	World Bank Group

1 Introduction

Sindh Water and Agriculture Transformation (SWAT) Project (herein after referred to as the SWAT Project or the Project) is the proposed project by the Government of Sindh. The Project Coordination & Monitoring Unit (PCMU) of the Planning and Development (P&D) Department has been assigned coordination task for preparation of the project in close consultation with the 'Agriculture, Supply and Prices Department' and 'Irrigation Department' supported by SIDA. The Government of Sindh has requested the World Bank (WB) to finance the SWAT Project. The overarching theme of the SWAT concept is the water and agricultural nexus to boost the rural economy and promote sound water resources management. The SWAT Project will support the Government of Sindh in agriculture and water management and facilitate a transformation along the three dimensions – agriculture, water resources and water service delivery.

To address the generic environmental and social impacts of the Project, the present Environmental and Social Management Framework (ESMF) has been prepared in compliance with the national/provincial regulatory and WB policy requirements. Similarly, a Resettlement Policy Framework (RPF) has also been prepared to guide the resettlement planning of individual subprojects under the Project. In addition, an Environmental and Social Management Plan (ESMP) and a Resettlement Action Plan (RAP) have been prepared for one of the subprojects, Rehabilitation of Akram Wah Canal. The RPF, ESMP and RAP are available under separate covers.

1.1 Background[1]

Sindh is the second largest province of Pakistan, covering an area of 140,914 km² (17.7% of the total area of Pakistan) and a population of 50.4 million people (23 percent of the population of the country). Despite generating 27 percent of Pakistan's GDP, the province faces significant levels of rural poverty. Nearly half (48 percent) of Sindh's population lives in rural areas; about 37 percent of the rural population lives below the poverty line, and over 70 percent of the rural population is landless.

An estimated 70 percent of the population of Sindh depends on the agriculture sector, with an estimated 83 percent of farmers cultivating on less than 5 hectares. The dominant crops grown in the province are wheat, cotton, rice and sugarcane, which comprise two-thirds of the total cultivated area. Agriculture growth rates in the province have been modest over the last decade, and much of the growth resulted from increased inputs rather than through improvements in efficiency and productivity. Agriculture productivity is low both in economic and agronomic terms, with yields below the average for Pakistan and below its potential.

Arguably, the current performance of the agriculture sector is (a) a symptom of the absence of a structural transformation to address economic growth, population increases, diversifying economy, and changes in markets; (b) the result of policy incentives and subsidies that favour low-value crops, do not trigger more efficient use of the available resources and incentivize water-intensive crops; and (c) the absence of adequate value addition.

Sindh is almost entirely dependent on the flows of the Indus River for its diverse water uses, including urban water supply, industrial demands, irrigated agriculture and the environment. The Indus Basin Irrigation System (IBIS) is at the heart of the provincial water supply and comprises Sindh of three barrages, 14 main canals, 117 branch canals, over 1,400 distributary and minor canals, and about 44,000 water courses. The system is under significant strain due to socioeconomic development, changing

[1] Concept Project Information Document Report No: PIDISDSC25551, the World Bank, December 2020

cropping patterns, and a breakdown in management arrangements. It was originally designed as a protective irrigation system to counter the risks of famine within the agro-climatic setting of Sindh, increase the collection of land revenue, maintain stability, and optimize production per unit of available water[2]. These objectives resulted in low irrigation intensities by design. It has been estimated that design intensity of approximately 90%[3] gradually increased to annual cropping intensities close to 150%. This increase in intensity was made possible by abstractions well above canal design allocations, particularly for the two upstream barrages (Guddu and Sukkur), and it is common practice to run main canals up to 40% above design discharge. These changes have resulted in the deterioration of infrastructure.

Irrigation water use and the lack of drainage have resulted in high levels of waterlogging and salinization. This not only constraints agricultural productivity but also results in the canal and on-farm water losses being rendered unfit for downstream reuse when potential return flows empty into saline groundwater bodies. The overall low efficiency of water use contributes to the relatively low levels of water productivity in Sindh, in terms of a kilogram of product per cubic meter of water; it is 50%-100% lower than elsewhere in the IBIS.

An increase in cropping intensity through excessive canal abstractions has also led to changes in the overall share of crops grown towards crops such as rice and sugarcane. Sugarcane comprises 24.1% of the cultivated command, a crop with water productivity as low as 0.6 PKR per m^3 within Sindh. Rice, another key crop cultivated on around 24.0% of cultivated command area, yields only around 2.5PKR per m^3. While the cultivation of such crops maximizes returns to individual farmers within the current system of agricultural subsidies, this comes at high economic costs to Sindh while equally being a key contributing factor to the significant levels of inequities within the canal command area.

Uncontrolled discharge of effluents into the canal system renders increasing shares of available freshwater resources unfit for consumption and productive use by all key user groups. Various studies have found all three types of pollutants (physical, chemical, biological) in the canal waters. This potentially leads to serious public health and environmental concerns. Some of Pakistan's most important wetlands are located in Sindh, including the Indus Delta, Manchar Lake, and a total of 10 Ramsar sites. All of these have been severely degraded, resulting in a reduction in ecosystem services.

Climate change is projected to significantly alter the hydrology of the Indus River Basin; changes to the volume and/or timing of inflows will have a significant impact on Sindh. Increased temperatures are projected to have a considerable impact on water consumption, while climate change more generally may (a) reduce the productivity of crops and livestock due to heat stress; (b) change rainfall patterns, which will particularly impact rainfed areas; (c) increase frequency and intensity of extreme climate events (floods, droughts); and (d) cause saltwater intrusion, affecting coastal agriculture, forestry and biodiversity. With most available freshwater resources already allocated to existing uses, this is likely to put increasing stress on water resources and water allocation agreements (both within Sindh and the Indus Basin). As the socio-economic development potential increases in upstream diversions, this has the potential for an even more acute water security crisis.

The introduction of the Sindh Water Management Ordinance (2002) aimed to introduce reforms to the irrigation sector. However, the progress of reform has remained slow, and it did not result in the improved service delivery initially anticipated. Furthermore, past reforms did not consider the need for a wider

[2] Jurriens M., P.P. Mollinga, P. Wester. 1996. Scarcity by Design: Protective Irrigation in India and Pakistan. Wageningen Agriculture University

[3] PCMU, 2017. Irrigation Management Strategy for Irrigated Agriculture of Sindh Province (Draft). Water Sector Improvement Project. Department of Planning and Development. Government of SIndh

framework for the whole water sector. This resulted in a lack of rules and regulations governing the inter-sectoral allocation of water between agricultural, urban, industrial, and environmental uses, as well as a lack of a mechanism for allocating and controlling water use within sectors. Managing water quality remains by and large absent. The focus has been to seek supply-side solutions rather than managing water demand and allocating resources towards uses with higher water productivity.

The lack of an appropriate framework for the water and irrigation sector runs parallel to the lack of adequate policies and incentives in the agriculture sector and results in the water-agriculture nexus not being holistically addressed by the Government of Sindh. At the field level, this results in disjointed investments on the larger distributary system without due consideration of constraints at the farm level. While the Agricultural Department invests in improvements at the water course level without due consideration of system constraints prohibits any meaningful gains. However, the province has recently endorsed the National Water Policy, which advocates Integrated Water Resources Management. The province has also developed a provincial water policy, which is at the draft stage.

1.2 Sindh Water and Agriculture Transformation Project

The Project will have the following components:

- **Component 1: Water Resources Management.** This component will provide the foundation for integrated water resources management in Sindh by supporting policy and institutional reforms, improving planning, and establishing a hydro-agro informatics program that will benefit both the water and agriculture sectors. The PCMU will be responsible for implementing the component in coordination with the Irrigation Department.
- **Component 2**: **Water Service Delivery**. This component will improve water delivery service (improved measurement and control of flows resulting in better predictability and reliability of the service) for agricultural users. It will encompass the rehabilitation of three left bank canals, modernization of distributary and minor canals managed by Farmers Organizations in the canal systems of the three existing Area Water Boards, and preparatory studies for rehabilitation of right bank infrastructure.
- **Component 3: Agricultural Subsidies and Investments**. This component support actions targeting implementing the agricultural policy reforms introduced in Component 1. Most of the investment activities will be focused on those parts of the province where the irrigation systems have improved (i.e., the principle of co-location) in order to obtain the synergies between agricultural and water improvements
- **Component 4**: **Project Coordination and Monitoring**. The Component provides support to the PCMU under the P&D Development. The PCMU is expected to provide overall coordination of project activities to ensure synergy between the different project components.

1.3 Environmental and Social Assessment of the Subprojects

The proposed subprojects under the SWAT are likely to have potential environmental and social impacts and hence require detailed environmental and social assessments in compliance with the government and World Bank requirements. The feasibility study for one of the subprojects, Akram Wah has been completed, and the detailed engineering designs are in progress; and hence ESMP and RAP have been prepared for this subproject. However, for the remaining subprojects, feasibility studies are yet to be carried out to confirm the locations of the proposed project facilities and designs of these facilities. These

feasibility studies will be carried out during the Program implementation. The present ESMF has been developed to:

- integrate the environmental and social concerns into the identification, design, and implementation of all the Project interventions in order to ensure that those are environmentally and socially sustainable;
- ensure all relevant environmental and social issues are mainstreamed into the design and implementation of the subprojects;
- consider in an integrated manner the potential environmental and social risks, benefits and impacts of the program and identify measures to avoid, minimize and manage risks and impacts while enhancing benefits; and
- provide guidance to conduct ESIAs, prepare ESMPs and carry out resettlement planning studies for the projects under the Program in compliance with the government's policies, acts, and rules as well as with the World Bank's safeguard policies and guidelines.

This ESMF presents detailed guidelines on preparation of ESIAs and ESMPs of the subprojects, including (i) Environment and Social Screening, (ii) Description of the surrounding environment and socio-economic data (establishment of "baseline environment and social" against which impacts of the proposed subproject would be evaluated); (iii) analysis of alternatives; (iv) identification of major project activities during both construction and operational phases; (v) assessment, prediction and evaluation of impacts of the subproject activities; (vi) carrying out public consultations; (vii) preparation of environmental codes of practice (ECPs); and (viii) identification of mitigation measures and preparation of impact specific environmental and social management plans (ESMP) including monitoring requirements. In addition to the present ESMF, an RPF has also been prepared and presented under a separate cover to guide the preparation of A/RAPs for these subprojects.

1.4 ESMF Study Methodology

The methodology followed in preparing the present ESMF consists of the following steps:

- Review of the Project details and meeting/discussions with various stakeholders
- Reconnaissance field visits and initial scoping and screening to determine the key environmental and social parameters and aspects that are likely to be impacted by the Project activities
- Review of environmental and social issues from other ongoing projects in Sindh of similar nature, including World Bank-funded irrigation projects
- Review of the policy and regulatory requirements
- Collection and analysis of baseline environmental and social data, with the help of secondary literature review and field data collection
- Consultations with the stakeholders, including affected communities and developing the consultation process
- Compile the present ESMF document.

1.5 ESMF Study Team

PCMU has engaged the services of independent environmental and social consultants to develop the ESMF and RPF, who were supported by several environmental and social specialists of the irrigation and agricultural departments of GoS. The team members of the study are Venkata Nukala (team leader and environmental specialist), Seema Khurram (social specialist), Ibad ur Rehman (environmental specialist), Shaukat Shahid (social specialist), Abdul Basit (Deputy Director Environment, PCMU), Ghulam H. Qureshi (Deputy Director Social, PCMU), Habib Ahmedani (Deputy Director, Agriculture Economist, PCMU),

Shadab Bughio (Environment and Social Safeguards Specialist, SAGP), Muhammad Amin Khushk (Ecologist, SIDA), and Shakeela Leghari (Sociologist & Participation Specialist, SIDA), Farooq Laghari (GIS Specialist).

1.6 Content of the Report

Chapter 2 presents a simplified description of the proposed investments under the Program and other salient information relevant to the environmental and social assessment. **Chapter 3** reviews the prevailing government regulatory requirements and relevant to the environmental assessment and World Bank safeguard policies applicable to this Project. Description of the baseline environmental and social conditions is presented in **Chapter 4**. Screening and assessment of potential environmental and social issues have been discussed in **Chapter 5**. **Chapter 6** presents a step-by-step methodology for carrying out environmental and social assessments for the subprojects, including the preparation of ESIAs and ESMPs. **Chapter 7** presents the Project's institutional structure. Finally, **Chapter 8** describes the consultations that have been carried out with the stakeholders while preparing this ESMF.

2 Project Description

This chapter presents a detailed description of the proposed Project and also a summary of the proposed physical and soft interventions. A more detailed description will be included in the ESIAs/ESMPS of the individual subprojects to be implemented under the Project.

2.1 Development Objectives of the Project

The development objective of the Project is to increase agricultural water productivity and improve water resources management. This will help boost Sindh's rural economy and address water-related environmental degradation.

2.2 Project Components

The Project has four components that are described below.

2.2.1 Component 1: Water Resources Management ($30 million)

Objectives of Component 1: This component will provide the foundation for integrated water resources management in Sindh by supporting policy and institutional reforms, improving planning, and establishing a hydro-agro informatics program that will benefit both the water and agriculture sectors.

Implementing Arrangements: The PCMU will be responsible for implementing the component in coordination with the Irrigation Department. The PCMU will be responsible for procurement and financial management. This arrangement was selected because the component is multi-sectoral in nature, and the transformation of the Irrigation Department into an IWR Department is expected to take place during project implementation.

1.1 Water Resources and Irrigation Policy and Institutional Reforms ($2 million)

Supporting Water Policy Reforms with consultant services, workshops, training and equipment to achieve the following

- **Formulate new Water Management Legal Framework:** Building upon the (anticipated) Sindh Water Policy, this activity will prepare and adopt a new Sindh Water Act and supporting by-laws. The goal is to advance and adjust the irrigation institutional reforms and principles initiated under the Sindh Water Management Ordinance of 2002 based upon experience gained under WSIP. The revised legal framework will adjust the roles and responsibilities of the Irrigation Department, SIDA, AWB, Farmer Organizations, and Water Course Associations. In addition, the new legal framework will establish an integrated water resources management for Sindh Province that will promote the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.
- **Transform the Irrigation Department into an Irrigation and Water Resource Management Department.** Develop and implement a plan for restructuring and capacity building for the Department to fulfill its functions under the Sindh Water Policy and subsequent Law. This will include ensuring a professional irrigation service and rationalizing the Department's size over time, and as well as creating water resource management functions and expertise within the IWR Department.

- **Comprehensive Water Pricing Reform**: Conduct studies and consultations to comprehensively reform the Abiana system to achieve the goals to strengthen sustainable O&M of the canal network, provide economic signals in the use of water, and promote transparency and accountability in the provision of water services to farmers, cities, and industry. This would include adjusting Abiana rates and how revenue is collected, distributed, and accounted.

The project will support these activities by financing consulting services, study visits, and, very importantly, extensive stakeholder consultations, communications, and media outreach.

1.2 Sindh Strategic Water Plan and Specialized Studies ($10 million)

Description:

- Building upon the new Sindh Water Policy and Sindh Water Law, preparation of a "Strategic Water Plan" on a periodic basis (every 5 to 10 years) will be institutionalized. The plan will address key water and environmental issues, including strategic directions on infrastructure development, water allocation, and water-related environmental priorities. The Plan will be prepared through the IWR Department and approved by the government. Extensive stakeholder consultations, communication, and media outreach will be employed through the preparation of the Plan. Preparation of the Plan will be supported by the Hydro-Agro Informatics program (Component 1.3) and other specialized studies.

- As an ancillary to the Strategic Water Plan, a provincial-wide "Drought Risk Management Plan" will be prepared. This will be a multi-sector effort lead by the IWR Department, Agriculture Department, and the Provincial Disaster Risk Management Office and approved by the government. It is expected that the Drought Plan will be periodically updated every 5-10 years in parallel with the Strategic Water Plan. The key elements of the Drought Plan include: i) drought monitoring program and adoption of Sindh specific drought indicators; ii) assessment of drought vulnerabilities, including at-risk populations and potential agricultural, urban, and industrial impacts; and iii) set of mitigation options based upon pre-defined indicators including agricultural and income support.

- Updating the Right Bank Master Plan: The original Master Plan was prepared in the late 1990s and needed to be updated to take into account new developments, including the status of the right bank outfall drain, continued deterioration of Lake Manchar, and the severe soil salinization issues on the Right Bank.

1.3 Hydro-Agro Informatics Program ($18 million)

Insufficient information is hampering the ability of Sindh to properly deliver bulk water services, manage water and environmental resources, and support agricultural growth. The Hydro-Agro Informatics Program will help Sindh leapfrog into modern water and agricultural management. It is envisioned that the project will support:

- **1.3.1 HAI Centre**: "Hydro-Agro Informatics Center" which will be a service provider for the IWR Department, Agriculture Department, Environment Department, and Provincial Disaster Management Authority (PDMA).These departments will collect the ground-based information and send to the Center which will then processes with the information, including remote sensing

data, into a useful format to allow the Departments to make better management decisions. Close collaboration with Pakistan Meteorological Department (PMD) is required.

- **1.3.2. Remote Sensing**: Building upon the FAO GCF funded project, a remote sensing program will be established that will provide vital water and agricultural information such as crop evapotranspiration, soil moisture, water stress, flood and drought monitoring, crop monitoring, vegetative growth, irrigation advice, etc.
- **1.3.3. Canal Flow and Level Monitoring:** Monitoring at all key points in the canal network are envisioned, including main canals and FO canals, as well as large direct outlets and urban and industrial intakes. The canal monitoring works, and equipment would belong to the IWRD.

- **1.3.4. Groundwater Monitoring:** Monitoring wells at key locations throughout Sindh to track groundwater levels, groundwater quality, and help better define aquifer characteristics in order to improve conjunctive management of water resources. Ground-level soil moisture monitoring will also complement groundwater monitoring. The groundwater monitoring network would belong to the IWRD.

- **1.3.5. Water-Environmental Monitoring:** This includes monitoring for river flows, water quality in canals, rivers, and lakes. The Water-Environmental Monitoring network would belong to either the IWRD or the Environment Department.

- **Agrometeorological Monitoring:** In order to provide more information to support agricultural production, and irrigation planning, the existing agrometeorological network will be expanded in coordination with the PMD. The network will provide in-situ weather and climate data to help capture the local variations in microclimatic factors and increase the reliability of the modelled outputs. The network will also collect data on crop production data that will then be processed to provide better information to farmers on crop planting and harvesting and the application of pesticides, fertilizers, and water. The ground collected agrometeorological data will help in increasing the accuracy of the remote sensing-based measurements. A link with FAO Agriculture Stress Index System on Drought (ASIS)

- **1.3.7. Floods and Droughts**

- **1.3.8. Agriculture Extension** This includes monitoring for river flows, water quality in canals, rivers, and lakes. The Water-Environmental Monitoring network would belong to either the IWRD or the Environment Department.

2.2.2 Component 2: Water Service Delivery ($165 Million)

Objectives of the Component: This component will improve water delivery service (improved measurement and control of flows resulting in better predictability and reliability of the service) for agricultural users. It will encompass the modernization of distributary and minor canals managed by Farmers Organizations in the canal systems of the three existing Area Water Boards. The modernization program will include social structures for which women's groups will contribute to the selection and prioritization. This component will also finance the rehabilitation of Akram Wah main canal on the Left Bank of River Indus and undertake preparatory studies and urgent repair works for three main canals on the right bank. The component will help strengthen the Area Water Boards and Farmer Organizations participating in the canal modernization program for improved service delivery and support conjunctive

surface water and groundwater management to the extent possible. The canal modernization will be implemented jointly with agricultural support activities under subcomponent 3.3, including climate-smart agriculture technical assistance to improve farmer incomes under joint subprojects implemented by Farmers' Organizations.

Implementing Arrangements: SIDA will manage this component, including procurement and financial management, under the general supervision of the Irrigation Department. The PCMU will provide coordination and oversight for the component, including ensuring coordination between SIDA and the Agriculture Department on the FO subprojects.

Subcomponent 2.1 – Preparatory Studies for Right Bank Main Canals Infrastructure ($10 Million)

Description of Subcomponent Activities

The irrigation system on the right bank of River Indus suffers from a lack of investment in the past decades, and the canals are in dilapidated condition. The same kind of investment that was done for the left bank under the predecessor project (WSIP) is now required on the right bank. There are also severe sedimentation issues affecting the right bank canals, which require some drastic changes in the hydraulic regime. A pre-feasibility study was completed under the Water Sector Improvement Project (WSIP) project for the rehabilitation of the three right bank main canals (Dadu, Rice and Northwest Canals). The recommended option encompasses a re-allocation of the discharges between Rice and Northwest canals, with the objective to ensure an appropriate supply to the Warah Branch Canal (off-taking from NW Canal) while resolving the sedimentation issues in the main canals.

The project will finance the detailed studies for the rehabilitation and modification of the three main canals on the right bank, as well as Warah Branch. Studies will include preparation of detailed design, bidding documents and environmental and social management assessments and plans (ESIA + ESMP+ RAP). It will also include a provision for urgent rehabilitation of the most damaged structures that are in near-collapse condition. The full rehabilitation will be done under the next investment phase. The rehabilitation works will also improve the flow control using upstream regulation through the modification of the outlets, calibration of all canal head regulators and construction of long-crested weirs.

Financing for urgent desilting work is already included under the Sindh Barrage Improvement Project (SBIP).

Subcomponent 2.2 – Left Bank Main Canals Infrastructure ($100 M)

Description of Subcomponent Activities

On the Left Bank of River Indus, the project will finance the rehabilitation of the Akram Wah Canal, part of the Left Bank Canals Area Water Board (LBC-AWB). A detailed design for this canal rehabilitation was completed under the predecessor project (WSIP), which has also financed the rehabilitation of all other main canals managed by the three AWB on the left bank of River Indus. The rehabilitation of the Akram Wah canal will therefore complete the main canal rehabilitation program and allow the three AWB to implement the canal modernization program on their entire command area.

The Akram Wah rehabilitation includes the repair or reconstruction of all cross regulators, removal of the entirely dilapidated canal lining, construction of retaining walls in urbanized areas and modification of canal prism in rural areas to restore the canal capacity, repair or reconstruction of all outlets (head regulators of distributary and minor canals), and rehabilitation or replacement of bridges and other structures. All head regulators will be calibrated for improved flow control.

The project will also finance additional studies related to Left Bank main canal system improvements that have been identified during project preparation, including a feasibility study and designs to use Chotiari

reservoir as a regulating reservoir to improve the distribution of flow between the different branches of the main Nara system and a broader study on the development of more regulating capacities within the systems managed by the three AWBs.

Subcomponent 2.3 – Integrated FO area Agriculture Development / Modernization of Distributary Systems (US$45 M)

Description of Subcomponent Activities

This subcomponent will contribute, together with subcomponent 3.2.1, to the funding of subprojects supporting the improvement of irrigated agriculture development within FO areas (command areas of distributary canals). This subcomponent will finance the modernization of the distributary systems managed by the FOs. It will complement the rehabilitation works already completed under WSIP on the main canals of the three existing AWB and to be completed under this project for Akram Wah Canal. The modernization program would eventually be expanded to the entire irrigation system, including on the right bank of the Indus River.

Under SWAT, activities will be implemented on selected distributaries on the left bank of River Indus, within the three existing AWBs. FOs will be selected based on their willingness to embrace the modernization concept on a pilot basis. They will be guaranteed an improved service (more reliable flow) at the head of the distributary. SIDA and Agriculture Department will accompany the FOs for the irrigation scheduling based on crop water requirements.

A study is being implemented by SIDA (using its own staff) with technical assistance from ITRC to design the modernization works for three distributaries. Cost estimates resulting from that study will be extrapolated to determine the command area/number of FOs that would be benefitting from this subcomponent based on the budget allocated.

Subcomponent activities include:

- Presentation of the modernization concept to various FOs and selection of the most interested ones
- Definition of specifications of water delivery service at the head of distributary and signing of service agreement between AWB and FO
- Training of FO for the implementation of irrigation scheduling process based on crop water requirements
- Installation of groundwater monitoring system at FO level
- Training of FO on groundwater monitoring and management
- Operation and maintenance of modernized infrastructure (implemented by FP using their own resources, but temporary financial support for incremental O&M cost might be required)
- Engineering design and supervision (PIC- Distributaries)

Modernization works include:

- Construction of broad crested weir at the head of the distributary canal (where possible)
- Construction of long crested weirs as cross regulators for upstream level control
- Construction of new outlets to watercourses (including direct outlets within the area of jurisdiction of the FO) with improved flow control
- Construction of regulating reservoirs to improve water distribution efficiency
- Rehabilitation and/or addition of social structures and canal crossings as needed
- Construction of FO offices as needed
- TA from ITRC (for distributary canal modernization design and quality control)

- Preparation of a pipeline of distributary canal modernization studies (for next phases of investment)
- Preparation and Implementation of environmental and social management plans

Subcomponent 2.4 –AWB and SIDA Support (US$10 M)

Description of Subcomponent Activities

Under this subcomponent, the project will strengthen the capacity of AWB to deliver a reliable water delivery service to the FOs,, and the capacity of SIDA to provide the required support (technical, social, organizational) to the AWBs and FOs. This will include the support for the implementation of the institutional reforms to be prescribed by – or as a follow up to – the Sindh Water Policy as well as capacity building on operational and managerial matters.

Activities will include the strengthening of SIDA and three AWBs on the left bank of river Indus, using a mix of training, technical tools, support for institutional development, and behavioral change approach. Two new AWBs will be crated on the right bank. The project would also finance incremental operating cost for SIDA and the AWBs on a declining basis, knowing financial equilibrium needs to be achieved before project closure (transitional funding)..

Left Bank:

- Implementation of institutional reform of SIDA, AWBs (to be specified based on directions defined in Sindh Water Policy – including new structure for irrigation service fee for improved O&M cost recovery)
- Development of tools for irrigation scheduling (at FO, AWB and provincial levels) and related training
- Training of AWB operational staff on upstream control, flow measurement, improved irrigation service, management of DOs
- Establishment of AWB customer relationship department and training of its staff and strengthening of irrigation service fee setting and collection process
- Support for behavioral change: Field Level Leadership (FLL)
- Transitional funding of Incremental Operating Cost for SIDA, AWBs and FOs
- SIDA Outsourcing of Social Mobilization Support for FO Subprojects

Right Bank

- Establishment of two new AWBs and initial training of their staff
- Office refurbishing and equipment
- Transitional funding of Incremental Operating Cost for SIDA and AWBs

2.2.3 Component 3: Agricultural Subsidies and Investments ($135 Million)

Objectives of the Component: Support actions targeting at implementing the agricultural policy reforms introduced in the Component 1. Some of the investment activities will be province-wide, but many of them will be focused on those parts of the province where the irrigation systems have improved , in order to obtain the synergies between agricultural and water improvements.

Subcomponent 3.1 Pilot Smart Subsidy Programs : The GoSindh will introduce direct income support through smart subsidies (e-vouchers) in order to improve allocative efficiency (using the right inputs) and incentivize water economies. The smart subsidies will contain two elements: a) farmers will receive a similar basic amount per acre; b) then if farmers are growing crops with low water requirements (particularly in certain agro-ecological zones), they will receive a bonus payment.

Market Smart Subsidies are mechanisms to provide subsidized goods and services designed both to promote market development and to enhance the welfare of the poor farmer. The studies can be pahsed out once market infrastructure has been developed and fully functional. If the policy aims to increase the food supply, then input subsidies should be delivered to procers whose usage of input has been constrained by market failures. The subsidy programme should therefore target:

I. Those farmers who would either not use inputs in the absence of the subsidy (or use very little); or,
II. Who are likely to use substantially more inputs as a result of the subsidy

Subcomponent 3.2 Solidifying Information and Technology Base

Under this sub-component new practices will be adopted for agricultural research and extension such as establishing the Sindh Agriculture Research Board (SARB) and commercializing the Agriculture Innovation Systems (AIS).

3.2.1 Strengthening the Sindh Agriculture Market Information System

The agriculture marketing had already piloted the agriculture market information system by which the farmers were timely informed and updated on daily auction rates in various wholesale markets. Under the proposed project component main market data information collection stations will be established at Hyderabad under the existing agriculture market setup of Agriculture extension wing with additional satellite stations will be established at district markets where infrastructure, staff, equipment, and mobility as per their cadre will be provided for timely collection of the data of arrival of commodities and enter in the android application or data network systems. The subcomponent will also strengthen the crop reporting system on yield measurements for major crops.

3.2.2 Strengthening Research and Extension System

- **Establish Water Logging and Salinity Applied Research and Extension Program.** The program will undertake applied research to identify genotypes tolerant to higher salinity levels; will identify production systems that overtime help to reduce salinity; as well as developing cultural practices, soil and water management approaches that may reduce water logging.
- **Productivity enhancement and resilience of saline soils of Sindh** through holistic approach**.**
- **Establish Agriculture Training Program**. The project would finance the establishment of Agriculture Training Program for developing and enhancing the capacity and skills of agriculture experts/ officials. Through this component the agriculture extension wing will develop and implement modern training methodologies on high-priority areas (crop management, climate smart agriculture, high value agriculture) through hiring of training consultant/ firm. The existing agriculture extension training institutes will be further strengthened for developing capacities and skills of existing extension services system including training programs on modern agriculture through institutional collaborations nationally and internationally.

- **Capacity Building and Institutional Development** . This component will finance activities around technology dissemination and capacity building in order to compliment the trainings of growers on new technology provided through co-sharing and subsidized rates.
- **Capacity Building** of **Growers:** The project will finance training and capacity building for farmers (on new crops and farming technologies), which will be based on a training needs assessment carried out by the department and its technical assistance providers. This will be done through a mixture of public information campaigns, face-to-face training, and farmer-to-farmer study tours, and exposure visits to other areas within province or elsewhere in the country as well as in other countries in the region as appropriate. For each value chain, the department will sponsor project mobilization workshops to facilitate dialogue with and among value chain actors that will increase the market orientation of departmental activities.
- **Modernization of Extension and Research Facilities.** The agriculture extension and research facilities that are affected due to floods and lack basic infrastructure and basic necessary facilities, project will provide a modest amount of financing to facilitate their infrastructure rehabilitation and modernization of the facilities.
- **Expand use of ICT in Agriculture Extension Services.** The project will finance already established information and communication technology (ICT Center)-based technologies and services for delivery of agriculture extension and marketing for farmers/producers. These would include information going out to small producers and other stakeholders through the use of mobile phone and other ICT tools including 8/5 call center and interactive websites and other communication tools.
- **Sindh Agriculture Improvement Program (SAIP).** SAIP will finance demand driven efforts to improve agricultural systems in those areas where irrigation infrastructure and water service delivery is being improved. The geographic co-location between irrigation and agricultural activities will allow synergies, to be expressed as enhanced productivity as well as more efficient water use. A competitive grant fund to pilot and scale-up innovative activities with high income earning potential per unit of water used (e.g., new crop, new management practices, including HEIS, and new post-harvest handling systems, including cold storage, etc.

3.3 Developing Agriculture Value Chains

The following activities will be implemented on those parts of the province where the irrigation systems have improved, in order to obtain the synergies between agricultural and water improvements.

3.3.1 Improving Sindh Agriculture Value Chains

This component will finance specific subsidized investments in the value chains and targeted investment to reduce post-harvest loss among small-and medium growers through co-sharing. The component would also finance a Sindh Agri Innovation Startups fund to support young, educated farmers and producers with technology innovations in the selected value chains. Selection criteria for farmers and producer to receive project interventions and detailed procedures for funds transfer and managing contributions are included in the Operational Manual.

The Sindh Agriculture value chain component will focus on major commodities i.e., chillies, tomato, rice, citrus, guava, wheat, pulses, oil seeds and cotton. This component will complement the training part of the project imparted through the lead trainers, who are trained and further will be trained through tailored courses for delivering the project.

3.3.2 Sindh Agriculture Innovation Start-ups

Young, educated farmers view agriculture as 'traditional and unattractive', particularly as an employment option. Furthermore, agriculture is not perceived as sufficiently financially rewarding in a context where young people lack access to assets and resources, decision making and ownership. Coupled with factors such as the slow uptake of new technology in agricultural practices, youth are discouraged from establishing start-ups in the sector. It's an opportune time to bring them together and inspire them to devise appropriate solutions for agribusiness issues. Innovations by agri start-ups in form of agri-produce, services or applications can be a meaningful solution across the agricultural value chain. Therefore, the efficient use of this talent pool will be a key driver for improving competitiveness in the sector.

The project will dedicate funds ($3 M) for supporting promising agriculture innovative start-ups identified during the implementation for supplementing the improved productivity, value addition and improved market access on pilot basis. The fund will work on demand from farmers and producers and will address the business development plan. The identification, planning and selection criteria along with procedures to implement the Fund would be worked out by the project implementation consultants on competitiveness.

3.4 Integrated FO Area Agricultural Development:

3.4.1 Improving On-farm Water Management.

a. **Additional lining of already improved water courses**. In Sindh under various projects and programs water courses were improved up to lining length of 30%. Various studies and empirical experiments have proved that optimal benefits of lining could be achieved by attaining the lining length of 50% of water course. SO far around 34000 water courses are improved in Sindh for up to 30% lining length. Under SWAT it is proposed that 2,640 water courses will be taken up for additional lining, which will help in achieving the lining length of 50% for best benefits of lining.
b. **Rehabilitation of 300 watercourses in Sindh**. There are around 8000 water courses improved during various phases dating back to 1977 to year 2004. These water courses have lost their utility due to decades long wear and tear, insufficient maintenance and weathering mega disasters of rain and river floods years after their completion. Under SWAT it is proposed that 300 water courses will be taken up for rehabilitation of the watercourses that have completed their economic life for the water conservation and increased efficiency to supplement the development object of the project.
c. **Water storage Tanks for High Efficiency Irrigation System** (HEIS) operated on solar pumps. As the project is proposing to install HEIS on 1000 Acres, to facilitate participating farmer, Water Storage Tank is essential to be constructed at the HEIS site. Therefore, under this component Water Storage Tanks will be constructed for the provision of 1000 acres HIES.
d. **HEIS System**. Water scarcity and water productivity are two major challenges being faced by Sindh. The age-old system of irrigation practices is further aggravating the situation. At the same time technological innovation are coming forward to rescue us from this situation. High efficiency irrigation system specially Drip, sprinklers and bubblers are being used all over the world. The goal is to place water directly into the root zone and minimize evaporation. Drip irrigation systems distribute water through a network of valves, pipes, tubing, and emitters. Under this component HEIS will be installed on 1000 acres to conserve precious water resource and to grow high value crops and fruits / vegetables in periphery of urban and semi urban areas of the province.
e. **Provision of Precision Laser Land Leveling Equipment**. Uneven soil surface has a major impact on the germination, stand, and yield of crops due to inhomogeneous water distribution and soil

moisture. Therefore, land leveling is a precursor to good agronomic, soil, and crop management practices. Under SWAT it is proposed that 600 Precision Laser Land Levelling Equipment will be providing to farmers.

- **De-siltation, Clearing & Grubbing of already established On Farm Drainage System.** In Sindh, some of the districts like Badin, Tando Muhammad Khan, Sanghar and Mirpurkhas there is a severe on farm drainage problem; especially during the times of monsoon season. The poor drainage conditions on fields highly inflict the yield potential of the agricultural farms. Thus, we can improve and enhance the productivity of irrigated agricultural farms by simply improving the drains around these fields. Under SWAT it is proposed that 50 On Farm Drains for highly affected districts may be selected.

3.4.2 Promoting Climate-Smart Agriculture (CSA) is an integrated approach to managing landscapes, cropland, livestock, forests, and fisheries that address the interlinked challenges of food security and accelerating climate change. CSA aims to simultaneously achieve three outcomes: increased productivity and profitability, enhanced resilience, and reduced emissions where possible. The activity will mainly focus on the research work on System of Rice intensification.

3.5 Agriculture Delivery Support Unit

The component will support the establishment of project implementation units for delivering the agriculture delivery activities in the project.

Project Management Unit: Project Management Unit (PMU), already established under SAGP, Department of Agriculture, Supply & Prices and Department headed by Project Director who is appointed by the Government will continue to implement and carryout the project implementation. The PMU of SAGP with its existing setup would be responsible and continue the overall project management, monitoring and supervision, as well as fiduciary and environmental and social safeguards implementation and compliance. The PMU will have project management and implementation staff with adequate qualification and expertise. The PMU would be provided with additional technical support through consultants.

The PMU will take the lead role in planning, coordinating, and monitoring of project performance in line with the project implementation schedule, and facilitate regular decision making for quality and in time implementation of various components. The PMU will be headed by project director having degree in agriculture and at least 3 years of experience, working on World Bank Projects and who would be responsible for ensuring that resources are budgeted as per approved Project Implementation Plans, which will be developed by the Monitoring and Evaluation Specialist with additional support of the PICs. The PMU will have procurement and financial management responsibilities and will ensure that project accounts are managed and audited on time.

Project Implementation Units: At the divisional level, Project Implementation Units (PIUs) established under Sindh Agricultural Growth Project would be used with appropriate supporting staff, training, and equipment to build capacity and strengthen the arrangements already in place, mainly the existing Research and Extension wings of the Department of Agriculture. The PIUs would be provided with capacity building so that they can access and use a greater range of information products, decision tools, and manage field demonstrations.

A total of four (4) PIUs will be established; for Agriculture Hyderabad, Mirpurkhas, Sukkur & Larkana districts. The PIUs would have adequate staff to ensure all implementation responsibilities are properly resourced. The PIUs will be responsible for the operational management and implementation of the specific sub-components. The PIUs will report to respective PMUs for day-to-day management and

implementation of project sub-components and will be supported by implementation as well as fiduciary staff of the PMUs.

2.2.4 Component 4: Project Coordination and Monitoring ($15 Million)

Objectives of the Component: The Component provides support to the PCMU under the P&D Development. The PCMU is expected to provide overall coordination of project activities to ensure synergy between the different project components. In particular, the PCMU has responsibility for:

- Helping to facilitate water and agricultural policy reforms under Component 1, and managing the PBC process between the Bank and the Sindh Government.
- Implementing Component 2, Water Resources Management, with support from specialized consultants.
- Ensuring collaboration between SIDA and the Agriculture Department on FO Subprojects (Components 3.3 and 4.2)
- Serving as the focal point for World Bank – Sindh Government interactions, including procurement and financial management oversight, and consolidated reporting.

Implementing Arrangements: this component is supported by three sub-components i.e. 4.1 PCMU and PMC (UN-FAO) support, 4.2 PCMU support consultants in safeguards, procurement, financial management etc. and 4.3 Workshops, communication and study visits etc. This may also be added.

2.3 Typology of Subprojects

The typology of proposed subprojects to be implemented under the SWAT project are given in Table 2.1. These subprojects are divided into two categories based on the requirement of civil works (i) Soft Interventions, which don't involve any civil works and (ii) Physical Interventions, which involve civil works. The soft interventions that could lead to future/downstream civil works are also included under the physical interventions category.

Table 2.1: Typology of Subprojects

Component	Sub-Components	Typology of Subprojects	
		Soft Interventions (does not include civil works)	**Physical Interventions (include civil works)**
1: Water Resources Management ($30 Million)	1.1 Support for WRM and Irrigation Policy and Institutional Reforms ($2 million)	A framework on roles and responsibilities of AWB, FOs and Water Course Associations Transforming Irrigation Department into an Irrigation and Water Resources Department. Studies on Sustainable O&M of Canal Network	
	1.2 Sindh Strategic Water Plan ($10 million)	Develop a broad Strategic Water Plan to address key issues in the water sector such as Left Bank Outfall Drain, Manchar Lake, Delta Ecological Restoration, flooding, droughts, etc. (A	

Component	Sub-Components	Typology of Subprojects	
		Soft Interventions (does not include civil works)	**Physical Interventions (include civil works)**
		study on Water and Environment is currently being carried out to identify the key issues in the water sector).	
	1.3 Hydro-Agro Informatics Program ($18 million)	Monitoring water and agriculture (canal flows and levels, and quality, groundwater levels and quality, meteorology, crop production)	
2: Water Service Delivery ($160 Million)	2.1 – Preparatory Studies for Right Bank Main Canals Infrastructure ($10 million)		**Studies** for rehabilitation of 3 Main Canals of Indus Right bank (Dadu, Rice and NW Canals) and Waarah Branch Canal (off-taking from NW Canal.
	2.2 – Left Bank Main Canals Infrastructure ($100 million)	Calibration of regulators at the head of main and distributary canals	**Rehabilitation** of the Akram Wah Canal (reconstruction of regulators, new retaining walls in urban areas, rehabilitation of bridges) **Studies** on rehabilitation of Lower Nara Canal including Chotiari regulating reservoir
	2.3 – Integrated FO area Agriculture Development / Modernization of Distributary Systems ($45 million)	Training on FO on groundwater management and monitoring	**Rehabilitation/Modernization** of selected distributaries on the left of Indus (in three AWBs) – construction of regulators, rehabilitation of and addition of structures for community use (canal crossings) Construction of FO offices as needed
	2.4 – AWB and SIDA Support ($10 million)	Capacity building of AWB and SIDA Establishment of two/three new AWBs on the right bank	
3.**Agricultural Subsidies and Investments** ($135 Million)	3.1 Pilot Subsidy Programs ($35 million)	Providing farmers with similar payment for all crops, with bonus payments for crops that require less water (in pilot districts for 2 to 3 years)	
	3.2 Solidifying Information and	Procurement of equipment and software to strengthen ICT and GIS technologies	**Rehabilitation** of Agriculture Extension offices and training centers

Component	Sub-Components	Typology of Subprojects	
		Soft Interventions (does not include civil works)	**Physical Interventions (include civil works)**
	Technology Base ($25 million)	Institutional Strengthening and capacity building Procurement of Office Equipment and vehicles	
	3.3 Developing Agriculture Value Chain ($25 million)	Provide funding for the promising agriculture innovative start-ups for improved market access on a pilot basis.	**Providing** finances subsidized investments (for equipment) for farmers in improving value chain facilities
	3.4 Integrated Farmer Organization (FO) Area Development ($45 million)	Training of farmers on climate-smart agriculture. Provision of 600 precision laser land levelling equipment to farmers Promoting climate-smart agriculture and research on System of Rice Intensification.	**Improve last-mile water service delivery** (rehabilitation of about 300 water courses, land levelling. Construction of water storage tanks and promote high-efficiency irrigation system in 1000 acres) Rehabilitation and de-silting of about 50 farm drains.
	3.5 Agriculture Delivery Unit ($5 million)	Establishment of Project Implementation Units in 4 districts.	
4. Project Coordination and Staffing ($15 million)		The hiring of staff and consultants for project implementing agencies and capacity building.	

2.4 Project Location

Locations of the canals that will be rehabilitated under the Project are shown in **Figure 2.1,** and locations of three Area Water Boards where the FO subprojects will be implemented are given in **Figure 2.2.**

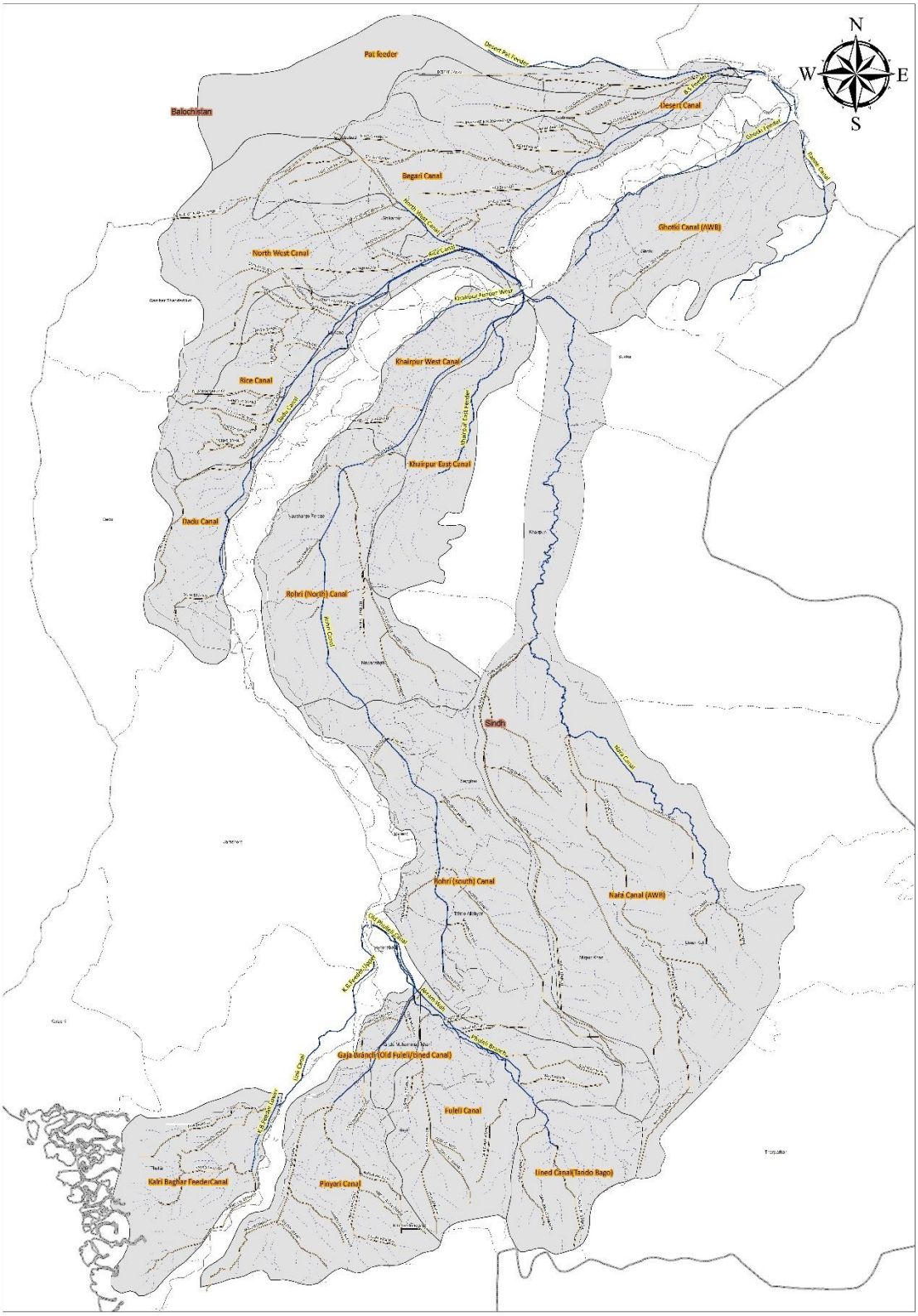


Figure 2.1: Location of Barrages and Canals in Sindh

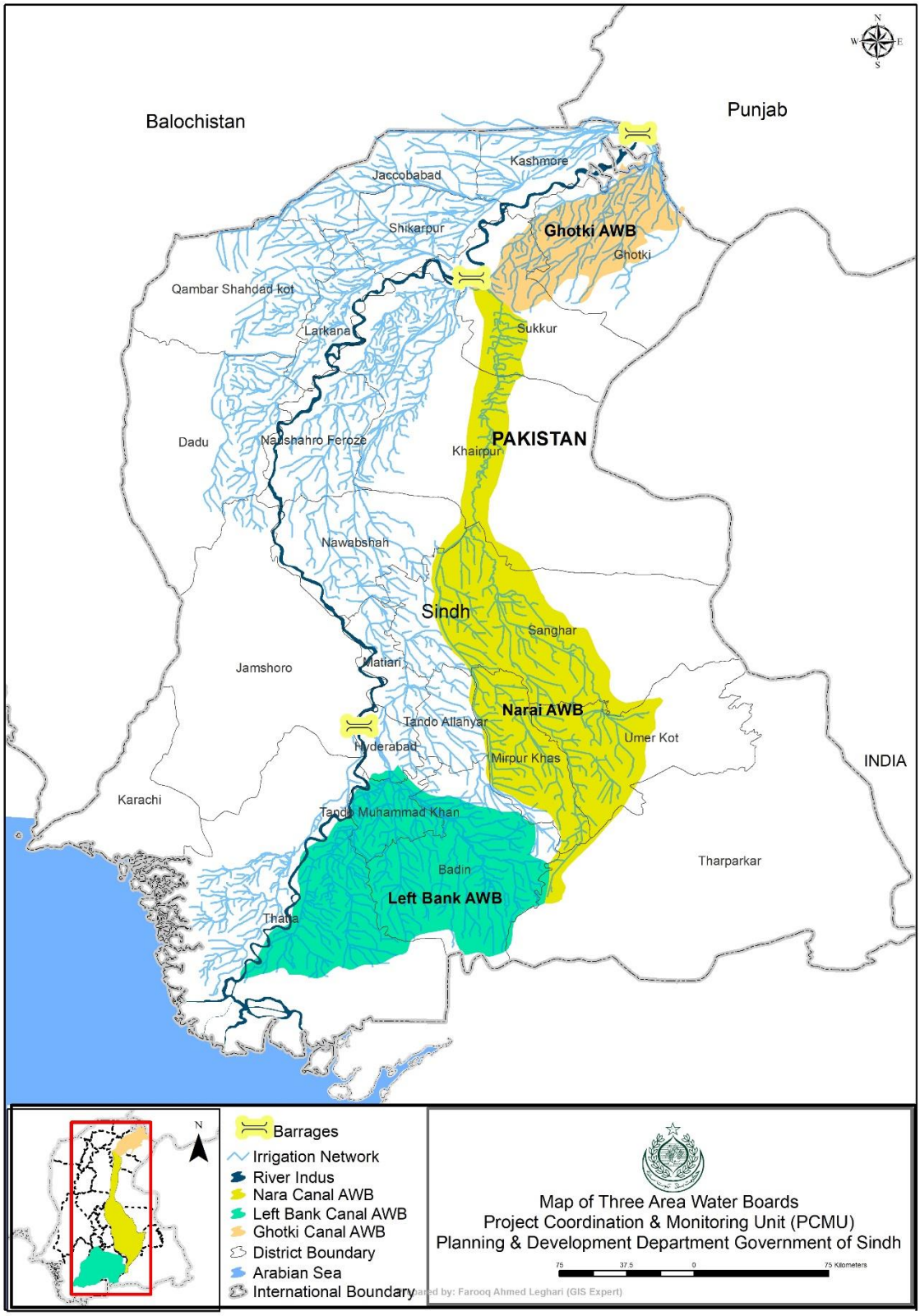


Figure 2.2: Location of Area Water Boards in Sindh

3 Legal, Regulatory and Administrative Framework

This chapter provides an overview of the national and provincial legislation and the World Bank safeguard policies that are relevant to the environmental and social assessment of the SWAT Project.

3.1 Overview of Sindh Water and Agricultural Policies

3.1.1 Sindh Water Policy

The (draft) Sindh Water Policy observes that the largest use of water in Sindh is in agriculture, varying between 26.6MAF and 41.7MAF. It identifies waterlogging and salinity, low water productivity, water pollution, substandard wastewater disposal, water quality and quantity, poor reliability of water services, gender inequality in water access and decision-making, and many others as key concerns of water resource planning and management of Sindh.

Out of the six 'burning issues' identified in the policy, two – overall management of water resources and water management of canal and drainage systems – are directly related to agriculture. The other four relate to serving the dry land zones, wetlands, urban water supply and rural WASH. The policy provides directions to address each of these issues.

For the overall water management, the policy acknowledges that the existing practices focus on water service delivery rather than water management, which has resulted in a legacy of unresolved problems, fragmented water resource management, and a lack of a coherent framework in management. Therefore, it emphasizes that increased pressure on the water system makes integrated management of water resources inevitable.

The policy calls for boosting institutional capacity. It also calls for the establishment of a Sindh Water Commission (SWC), to provide water strategies and review implementation performance, oversee legislative framework development and assess enforcement, set water body quality objectives and effluent discharge standards; decide rules and incentives for pollution control/treatment; oversee water auditing and decide water allocation within the province.

Referring to SIDA and the Sindh irrigation department as separate irrigation entities, it recommends creating a unified entity - the proposed Sindh Irrigation and Water Resources Department (SIWRD). Unified SIWRD would cover Sindh with a mandate for water resource management and sustainable delivery of water services. It could have Water Resources Management Unit (WRMU), Oversight and Support Unit, Sindh Irrigation and Drainage Authority (SIDA – may be renamed to Sindh Irrigation and Drainage Modernization Authority), Barrage Management Unit (BMU), and any Special units.

A new law is needed to replace the Irrigation and Drainage Act and the Sindh Water Management Ordinance. It would create a formal basis for new institutions in IWRM. Besides this institutional realignment and improved legal framework, the policy also directs to introduce Water Sector Planning and to establish a Water Information System and Hydro-Agro Informatic Services.

Regarding canal systems' management, the first policy direction is to respect and optimize the multiple functions: irrigation, drinking water supply, the environment, public health and recreation. The second policy direction is to manage water resources within the canal system – to create more equity; to attenuate the effect of high rain fall and floods, or alternatively to create system storage for dry periods; to reduce water logging and importantly to conjunctively balance the use of surface water and groundwater in the canal system.

The policy underscores that the water agenda needs to be complemented by the agricultural agenda. The aim is to manage water demand and, at the same time, increase water productivity. Water allocations are not updated after Tarbela and Mangla dams though these had modified the entire flow regime for Sindh.

The policy also emphasizes the need to reassess water duties for canal commands. The *abiana* system should be overhauled, and a wider range of functions should be charged to create a healthy financial basis for the system. It points out that in the past, the *abiana* covered all costs of the canal system and even gave a surplus. Also, drainage facilities have no secure financial basis. The collection of the abiana water charges stands at less than 6% of the target. The fees as such are very low. The collection is now reaching the point of being negligible. Low abiana and declining assessment undermine its collection. Abiana needs to be simplified based on land and irrigation duties rather than cumbersome crop assessment. The policy suggests deposits in local banks for ease of collection; a gradual increase in rates in consultation with farmer representatives; proceedings to be retained and autonomously used by the Area Water Boards and/or the Water User Organizations; performance bench marking; and better enforcement. The policy acknowledges that even after these measures, the abiana will only cover a portion of the running costs of the canal and drainage system. Hence, it identifies other possible sources of income from the canal system – tree planting on canal banks, fishery rights, realistic water pricing for urban water supply, tourism charges or waterfront real estate – to create a healthy and vibrant system.

The proposed project is completely aligned with the water policy. Under its Component-1, the project intends to support the formulation of new water law, restructuring of the irrigation department, and pricing reform. Building upon the Sindh Water Policy, the project under its Component-1 will prepare and adopt a new Sindh Water Act and supporting by-laws. It will also support the preparation and institutionalization of a "Strategic Water Plan" on a periodic basis (every 5 to 10 years). The project also envisages establishing a Water Information System and Hydro-Agro Informatic Services, as provided in section 3.1.2 of the Sindh Water Policy. Similarly, under section 3.2.2, the water policy directs to optimize canal system management, improve service delivery and enhance water productivity. The entire Component-2 of the project, amounting to US$ 1605, is devoted to interventions aimed at achieving these policy directions.

3.1.2 Sindh Agriculture Policy

The agriculture policy of the Sindh government was drafted as a component of the World Bank-funded Sindh Agriculture Growth Project (SAGP). It seeks to raise the growth rate by four percent to have overall seven percent growth in Sindh to create jobs and income from agriculture. The key objectives of the policy include achievement of 4 - 5% growth rate in the agricultural sector, reduction of rural poverty to half of the current level, addressing malnutrition, ensuring efficient and sustainable use of natural resources, minimizing negative environmental impacts of the excessive use of fertilizer and fighting climate change.

To achieve these objectives, the policy directs the government to increase credit flows into activities related to agriculture, livestock and fisheries and associated off-farm rural activities. It calls for measures to develop new financial instruments for the agricultural sector, such as warehouse receipts, and build links between the formal and informal sources of credit. The government will ease restrictions on the sale or lease of agricultural land and rural enterprises' establishment and bring reforms in the legal and regulatory system governing agricultural marketing.

The policy asks the government to promote competition, enhance transparency and facilitate new modes of business such as electronic trading and direct sales to private markets and supermarkets. It adds that proper attention will be given to improve legislation, regulation, labelling and quality oversight in the market for seeds, fertilizers, pesticides, animal feed and medicines.

The policy states that the government will attract private investors - both domestic and foreign - to invest in rural areas by offering fiscal incentives. The government will make easier laws for public-private partnerships, establish processing parks and special zones in major production clusters.

According to the policy, the government will provide inputs and services to the poor and those living in remote areas and will encourage nutrition-sensitive agricultural production, in order to reduce poverty. The government will also facilitate the poor through microfinance programmes. The government will introduce clear, transparent and legally enforceable tenancy agreements, to help landless farmers.

In terms of water management, the policy focuses on on-farm issues mostly. However, it also points towards the need to introduce technical and institutional reforms in the water sector from above the farm level up to the main barrages. Such reforms are necessary to halt and reverse the poor maintenance of water infrastructure, and address inequitable and inefficient use. This includes greater coordination between irrigation and agriculture departments/institutions to manage supply and demand.

Currently, many high water demand crops are stimulated under a range of public support measures, e.g., guaranteed procurement prices, export subsidies, cash freight support, fertilizer subsidies, subsidies on farm machinery etc. The Sindh Agricultural Policy directs that such high water demand crops should be replaced with other crops and the public incentive system should support crops that are in line with Sindh's revised agro-ecological zones. The policy points out that reforming any factors hampering free market arrangement, an overhaul of the financial and other agriculture support arrangements, and in some areas, outright bans, are the prerequisites for achieving the required growth of the sector. The policy provides a renewed focus on public goods (quality control and certification of agricultural inputs and outputs through accredited laboratories; research, extension and innovation; surveillance and control of major pests and diseases; and improvements in the supply chain) as opposed to ineffective subsidies.

The steps towards its implementation required regulatory changes, capacity development for departments concerned and technological changes. The policy requires a well-defined procedure and action plan for implementation. It requires investment in research and development to achieve the growth target in Sindh's agriculture sector. The regulatory framework needs to be reviewed to create enabling environment for private sector investment in agriculture. Strategic management has to be systematic and it should also be adjustable in the local context.

Besides the Sindh Water Policy, the proposed project is also aligned with the Sindh Agriculture Policy. The agriculture policy directs for, among other actions, introducing effective or efficient pricing and subsidies. The issue of agriculture subsidies has also been dealt with in detail in the Sindh Water Policy. In line with the directions of these policies, the project under its component-3 will pilot a Smart Subsidies Program. Component 3.3 of the project addresses the agriculture policy direction under section 2.4 to facilitate and promote improvement along the full value chain. Similarly, component 3.4 is totally focused on Agriculture Policy directions regarding on-farm water management and climate-smart agriculture (sections 2.6 and 2.7), respectively.

3.2 Applicable Government Policies and Regulations

3.2.1 Pakistan Climate Change Policy 2012

Climate Change Policy (CCP) predicts that urban areas located in the irrigated plains and coastal areas will be significantly affected by climate changes. It is predicted that due to climate changes, changes in hydrological cycle (intensive and erratic monsoon rains, flash floods, increased availability of water due

to increased melting of glaciers in the short term, and decrease in water availability in the long term due to decrease in glacier flows) and increase in temperature will affect urban areas.

CCP predicts that due to climate change, extreme weather events such as heat and cold waves, heavy or too little precipitation, and strong winds will occur more frequently and will cause health impacts, for example, diarrheal diseases because of insufficient clean water availability for drinking and personal hygiene. Similarly, extreme weather events will express themselves in the form of natural disasters such as floods, droughts, landslides, and urban flooding.

CCP recommends the following actions: prepare and enforce legislation for water resource management in all sectors with special focus on groundwater, adopt water efficiency measures and technologies, adopt rain harvesting measures, avoid excessive groundwater pumping, reuse wastewater after treatment, take flood protection measures, develop proper disaster management system, redesign and upgrade drainage capacity of cities, strengthen early warning systems, develop enabling mechanisms for the adoption of climate change adaptations and mitigation measures; and conduct awareness campaigns to underscore the importance of conservation and sustainable use of water resources.

3.2.2 National Wetland Policy

Pakistan's National Wetlands Policy recognizes the importance of Pakistan's wetlands, which include valuable ecosystem services, such as: water regulation, wetlands and climate, biodiversity importance, human health and livelihoods. Pakistan has no designated definition of wetlands, so for this policy the definition of the Ramsar Convention is used: "…areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres."

The policy has seven objectives, namely addressing the primary threats against wetlands through direct action, implementing a regulatory framework for sustainable use of wetlands, greater coordination between different agencies at provincial and national levels, promoting research, building capacity for sustainable wetland management, raising awareness about wetlands conservation and securing financing mechanism for wetlands management.

3.2.3 Sindh Strategy for Sustainable Development, 2007

The Sindh Strategy for Sustainable Development (SSSD) proposed a ten year sustainable development agenda for Sindh. The focus of SSSD is to promote the sustainable use of natural resources. It targets to reduce poverty and enhance social development through the participation of the people of Sindh. Planning and Development Department Government of Sindh is responsible for the overall coordination of SSSD.

The strategy recognizes that Agriculture is the backbone of Sindh's economy; even the industries that exist in the area are agro-based. The SSSD incorporates many proposals to overcome the issues faced by agriculture sector. The list of recommendations for the improvement of this sector includes increased provision of credit to farmers, efficient water resource management, and a focus on research related to the sector.

The Strategy document states that issues in the distribution of Indus water, lack of groundwater, inefficient cropping patterns, use of outdated irrigation technology, and lack of investment for the re-modelling of the irrigation system are major obstacles in conserving and efficiently managing water resources in Sindh. It suggests that a comprehensive water policy must be devised. It further recommends

to increase the participation of water users in the design, development, operation/maintenance, and financing of water supply systems; increased cooperation among different institutions within other cross-cutting sectors including agriculture, fisheries, wetlands, forests, and the urban environment to ensure collaboration and joint solutions to problems.

3.2.4 Sindh Sanitation Policy, 2017

This policy is relevant to the project because currently most municipal and industrial effluent in Sindh is discharged into irrigation channels. The vision of the policy is to provide the population of Sindh better sanitation service and to make sure that the entire population of Sindh has access to a safely managed sanitation service and sanitary environment that is also nutrition sensitive and hygienic.

The key targets of the policy are to eradicate open defecation from Sindh province by 2025, 100% households in Sindh have access to and use sanitary latrines by 2025, to strengthen and implement liquid waste with sewer lanes and covered/improved drains with 85% coverage of urban areas and 60% coverage in rural areas, to create and develop wastewater treatment mechanisms to cover 75% of urban areas and 40% rural areas by 2025, to implement integrated solid waste management with 100% coverage in urban areas and 60% in rural areas by 2025.

3.2.5 Sindh Environmental Protection Act 2014

The Sindh Environmental Protection Act of 2014 is the provincial version of the Pakistan Environmental Protection Act, 1997 (PEPA) relevant to the Project. Responsibility for PEPA was transferred from the Ministry of Environment to the provincial governments by the 18th Amendment in the Constitution of Pakistan in 2012. The provincial versions continue to remain materially the same as the PEPA except where governmental bodies are referred.

The following are key features of the provincial Acts:

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

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

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

3.2.6 Sindh Environmental Protection Agency (Review of IEE & EIA) Regulations, 2014

This regulation sets out the key procedural requirements for conducting IEE and EIA. It lists the responsibilities of proponents and duties of responsible authorities and provides schedules of proposals for determining whether the project requires IEE, EIA or screening under Schedules I, II, and III respectively. It also lays down the procedures for Environmental Approval and for filing the case with the SEPA to receive the NOC.

The following is a brief step-by-step description of the approval process of an IEE:

1. To determine whether a sub-project is categorized as requiring an IEE based on the screening as per three schedules.
2. An IEE or screening is conducted according to the requirements outlined in the SEPA guidelines.
3. The fee (depending on the cost of the subproject and type of report) is submitted along with the IEE document.
4. IEE is also accompanied by an application in the format prescribed in Schedule V of the Regulations.
5. SEPA conducts a preliminary review of the report and replies within 15 days of the submission. It either (i) confirms completeness; (ii) asks for additional information, if needed; or (iii) returns the report and asks for additional studies, if necessary.
6. The Agency shall make every effort to carry out its review of the environmental checklist within thirty days, and IEE within sixty days of issue of confirmation of completeness under regulation 9.
7. SEPA accords its approval, subject to certain conditions:

    a. Before commencing construction of the subproject, the proponent is required to submit an undertaking accepting the conditions.

b. Before commencing operation of the subproject, the proponent is required to obtain from the EPA a written confirmation of compliance with the approval conditions and requirements of IEE.

8. An EMP is to be submitted with a request for obtaining confirmation of compliance.
9. SEPA is required to issue confirmation of compliance within 20 days of receipt of the request and complete documentation.
10. IEE approval is valid for three years from the date of the operational phase NOC.
11. After completion of construction, a monitoring report is to be submitted to the SEPA, followed by annual monitoring reports during operations.

The classification of SWAT subprojects and their safeguard requirements are given in **Table 3.1.**

Table 3.1: IEE and EIA Requirements of SWAT Subprojects

Reference of Schedule	Project Categories listed in EIA IEE Regulation 2014	Required E&S Safeguard Instrument by SEPA	List of Activities Under SWAT
SCHEDULE I, G (2)	Small-scale irrigation systems and drainage systems with a total cost of less than Rs. 100 million	Initial Environmental Examination (IEE)	Rehabilitation of the Akram Wah Canal ***(under subcomponent 2.2)***, which includes; • Repair or reconstruction of all cross regulators, • Removal of the entirely dilapidated canal lining, • Construction of retaining walls in urbanized areas, • Modification of canal prism in rural areas, • Repair or reconstruction of all outlets (head regulators of distributary and minor canals), • Rehabilitation or replacement of bridges and other structures Rehabilitation of Nara Canal under Sub-component 2.2 Improving On-Farm Water Management ***(under subcomponent 3.4)*** • Rehabilitation of on-farm access drains
SCHEDULE II, F (2)	Irrigation and drainage projects serving 15,000 hectares and above	Environmental Impact Assessment (EIA)	- All the proposed right-bank irrigation works are rehabilitation of existing canals, and no EIA is anticipated. This will be confirmed after the completion of the feasibility studies

Reference of Schedule	Project Categories listed in EIA IEE Regulation 2014	Required E&S Safeguard Instrument by SEPA	List of Activities Under SWAT
SCHEDULE III, b and c	Small scale construction of commercial buildings and reconstruction of small roads	Environmental Screening (through checklist) and generic ESMP	Construction-related activities under **Subcomponent 2.3 -** "Integrated FO area Agriculture Development / Modernization of Distributary Systems" which include; • Construction of new head regulator and its calibration for flow measurement purposes, • Construction of long-crested weir cross regulators for upstream level control, • Construction of new outlets to watercourses (including direct outlets within the area of jurisdiction of the FO) with improved flow control, • Construction of FO offices, • Rehabilitation and/or addition of social structures and canal crossings (required contribution will be waived up to a certain amount and provided women's groups are duly consulted on the type and location of these structures), ***Note:*** *The list of activities identified above are not specifically addressed in EIA IEE regulation Sindh 2014. However, as these activities involve small scale construction and other earth works in dispersed locations, and having limited/ confined impacts, therefore it is envisaged that a generick – ESMP st will serve the purpose.*
SCHEDULE III, d	On-farm dams and fish farms	Environmental Screening (through check list) and generic ESMP	Improving On-Farm Water Management ***(under subcomponent 3.4)*** • Construction of water storage ponds for high-efficiency irrigation
SCHEDULE III, h	Lining of existing minor canals and/ or water courses	Environmental Screening (through check list) and generic ESMP	**Subcomponent 2.3 -** "Integrated FO area Agriculture Development / Modernization of Distributary Systems" ***(Subcomponent 2.3)***, which include; • Canal compaction to reduce seepage, • Earthworks on canal banks to restore minimum freeboard and ensure access to all outlets (as needed),
SCHEDULE III, i	Canal cleaning	Environmental Screening (through check list) and generic ESMP	
-	-	-	Other works under **Subcomponent 2.3 -** "Integrated FO area Agriculture Development / Modernization of Distributary Systems", which include;

Reference of Schedule	Project Categories listed in EIA IEE Regulation 2014	Required E&S Safeguard Instrument by SEPA	List of Activities Under SWAT
			• Installation of groundwater monitoring system (piezometers) at FO level, Improving On-Farm Water Management ***(under subcomponent 3.4)*** • Solarization of lift pumps on watercourses ***Note:*** *Above list of activities are not addressed in EIA IEE regulation Sindh 2014. As per the nature of the work/ interventions there is no need for any E&S screening procedure to comply or NOC from SEPA.*

3.2.7 Sindh Occupational Health & Safety Act, 2017

This Act provides for occupational safety and health conditions at all workplaces for the protection of persons at work against risk of injury arising out of the activities at work places and for the promotion of safe, healthy and decent working environment adapted to the physical, physiological and psychological needs of all persons at work. Under the Act, the employer would be responsible for ensuring the health and safety of the workers at workplaces (construction sites are also considered as workplace under the act). The act mentions health and safety requirements which need to be complied with by the employer/site in-charge and the workers. The Chief Inspector and the inspectors appointed under the act shall be responsible for enforcing health and safety requirements prescribed by the act. Penalties shall be imposed in case of noncompliance with the requirements.

3.2.8 Canal & Drainage Act, 1873

The Canal and Drainage Act 1873 (CDA) focuses on the construction and maintenance of drainage channels and defines powers to prohibit obstruction or order their removal. It also briefly addresses issues relating to environmental pollution. Section 70(5) of the CDA clearly states that no one is allowed to "corrupt or foul the water of any canal so as to render it less fit for the purposes for which it is ordinarily used." In addition, Section 73 of the CDA gives the power to arrest without warrant or to be taken before the magistrate a person who has willfully damaged or obstructed the canal or "rendered it less useful."

3.2.9 Sindh Public Property Removal (Removal of Encroachment) Act, 2010

The Act has been passed by the Provincial Assembly to avoid encroachment and provides measures for removal of encroachment from public property. The law specifies: powers to intervene, grievance redress and review mechanisms, eviction and recovery of cost of eviction in case of non-compliance, punishment for aiding and abetting the act of encroachment, rewards for outstanding performance in removal of encroachment, and setting up of grievance redress tribunals. The project proponents and other relevant line departments will provide continuous oversight and reinforcement to ensure that public spaces remain free from illegal encroachments as outlined in the Act.

3.2.10 Sindh Local Government Act, 2013

Under the Sindh Local Government Act 2013 (SLGA), Chapter VI, land use planning; implementation of building by-laws; management of environmental and health hazards; provision and maintenance of water supply schemes and public sources of drinking water; and mobilization of communities for the upgrade of local infrastructure (transportation, landscaping, and removal of encroachments) are the responsibilities of municipal corporations/committees.

Under Chapter VI, the district council is responsible for the overall welfare of the population (health and safety); improvement and maintenance of district main transportation routes, including removal of encroachments and other local infrastructure (such as open spaces, graveyards, public open spaces); assistance to relevant authorities in the provision of relief services in the case of natural calamities (fire, flood, hailstorm, earthquake, and epidemic); control over land use and spatial planning (including agriculture, industry, commerce, residential, and so on); and enforcement of municipal laws.

Under the Sixth Schedule Part-I and Part-II of the Act, it is an offence, and the Local Government (LG) can take the offender to court for discharging chemicals in any drain, public watercourse, and public land that is likely to cause public health hazards; industry and commercial concerns disposing of affluent in the water supply and sewerage system; cultivation of agriculture produce or crop by irrigating with sewer water or any such liquid; and dumping of solid waste and refuse in a place other than a landfill or dumping site, and damaging or polluting physical environment, inside or outside private or public premises, in a manner to endanger public health.

3.2.11 Land Acquisition Act of 1894

The Land Acquisition Act 1894 provides for the acquisition of private properties for public purposes, including development projects in Pakistan. It comprises 55 sections dealing with area notifications, survey, acquisition, compensation, apportionment awards, dispute resolutions, penalties, and exemptions. The key clauses of the Act are summarized in Table 3.2. A detailed description of the Act is given in RPF. The land acquisition for the subprojects will be carried out in accordance with this act.

Table 3.2: Key Clauses of Land Acquisition Act

LAA Section	Description
Section 4	Publication of preliminary notification and power for conducting the survey.
Section 5	Formal notification of land needed for a public purpose. Section 5a covering the need for enquiry of the concerns or grievances of the affected people related to land prices.
Section 6	The Government makes a more formal declaration of intent to acquire land.
Section 7	The Land Commissioner shall direct the Land Acquisition Collector (LAC) to take order the acquisition of the land.
Section 8	The LAC has then to direct that the land acquired to be physically marked out, measured and planned.
Section 9	The LAC gives notice to all project-affected persons (PAPs) that the Government intends to take possession of the land and if they have any claims for compensation, then these claims are to be made to him at an appointed time.

LAA Section	Description
Section 10	Delegates power to the LAC to record statements of the PAPs in the area of land to be acquired or any part thereof as co-proprietor, sub-proprietor, mortgage, and tenant or otherwise.
Section 11	Enables the Collector to make enquiries into the measurements, value, and claim and then to issue the final "award". The award includes the land's market area and the valuation of the compensation.
Section 11 A	Enables the Collector to acquire land through private negotiations upon request of Head of the acquiring department. Upon receipt of any such request, the collector is empowered to constitute/notify a committee for assessment of the market value of land and verification of title of ownership. On agreement by Head of Acquiring Department, with negotiated market value determined by the committee, the collector shall then direct parties to execute sale deed in favor of acquiring department on stamp paper.
Section 11 B	Provides a time limit of six months to complete the land acquisition process from the date of notification under Section-4.
Section 16	When the LAC has made an award under Section 11, he will then take possession and the land shall thereupon vest absolutely in the Government, free from all encumbrances.
Section 18	In case of dissatisfaction with the award, PAPs may request the LAC to refer the case onward to the court for a decision. This does not affect the Government taking possession of the land.
Section 23	The award of compensation to the title holders for acquired land is determined at i) its market value of land, ii) loss of standing crops, trees and structures, iii) any damage sustained at the time of possession, iv) injurious affect to other property (moveable or immoveable) or his earnings, v) expenses incidental to compelled relocation of the residence or business and vi diminution of the profits between the time of publication of Section 6 and the time of taking possession plus 15% premium in view of the compulsory nature of the acquisition for public purposes.
Section 28	Relates to the determination of compensation values and interest premium for land acquisition.
Section 31	Section 31 provides that the LAC can, instead of awarding cash compensation in respect of any land, make any arrangement with a person having an interest in such land, including the grant of other lands in exchange.
Section 48A (LAA-1986)	If within a period of one year from the date of publication of declaration under section 6 in respect of any land, the Collector has not made an award under section 11 in respect to such land, the owner of the land shall, unless he has been to a material extent responsible for the delay be entitled to receive compensation for the damage suffered by him in consequence of the delay.

3.2.12 Pakistan Labor Policy 2010

Pakistan Labour Policy 2010 aims to revitalize the economy, increase the level of productivity, promotion of investment and maximization of employment. At the same time, the policy recognizes that workers and employers must enjoy reasonable benefits as can be sustained by the economy without suffering set-backs. Keeping these priorities in view, the labour policy is based on the following objectives:

- Workers' right to form unions and unions should be protected and an institutional framework be made available to foster close cooperation between workers and employers at establishment level.
- Equitable adjustment of rights between workers and employers should be ensured in an atmosphere of harmony, mutually beneficial to the workers and the management.
- Consultations between workers and employers on matters of interest to the establishment and welfare of workers should be made more effective.
- Adequate security of jobs should be available to the workers and there should be expeditious redressal of their grievances.
- Conditions should be created that workers and employers are committed in enhancing the labour productivity.
- Promotion to higher jobs be ensured at all levels based on suitability and merit and for this purpose arrangements should be made for inservice training facilities.
- Facilities for proper matching of job opportunities and the job seekers be strengthened and standard procedures be streamlined.
- Social insurance schemes to be further strengthened.
- Just and humane conditions of work be guaranteed to all workers.
- Forced labour in all its forms to be eliminated.
- Provisions relating to the employment of children to be strictly adhered to and be enforced.

3.2.13 Factories Act, 1934 (as amended to 1997)

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

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

3.2.14 Labor Laws

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

Of the 24 labor-related laws that existed in 2014 in Pakistan, those set out in Table 3.3 relate directly to the International Labor Organization's (ILO's) core labor standards and will broadly be applicable to the proposed subprojects.

Table 3.3: Labor Laws of Pakistan

Legislation / Guidelines	Brief Description
Sindh Bonded Labor System (Abolition) Act (2005) and Punjab Bonded Labor System (Abolition) Act (2012)	The Bonded Labor System (Abolition) Acts seek to eradicate bonded labor practices prevailing in the respective provinces. The Acts define the `Bonded Labor System' as a system of forced or partly forced, labor under which a debtor enters or is presumed to have entered into an agreement with the creditor to the effect that: • In consideration of an advance obtained by him or by any of the members of his family (whether or not such advance is evidenced by any document) and in consideration of the interest, if any, due on such advance, or • In pursuance of any customary or social obligation, or • For any economic consideration received by him or by any member of his family.
Sindh Minimum Wages Act 2015 for Unskilled Workers Ordinances (1969)	The ordinances state that every employer shall be responsible for the payment of minimum wages required to be paid under the ordinances to all unskilled workers employed, either directly or through a contractor, in his commercial or industrial establishment: • Provided that where an employer provides housing accommodation to a worker, he may deduct from the wages of such a worker, an amount not exceeding that in the ordinance; • Where the employer provides a worker with transport to and from the place of work, he may deduct from the wages of such a worker an amount not exceeding that specified in the ordinance.
Sindh Industrial Relations Acts (2013)	These Acts seek to regulate the formation of trade unions, regulation, and improvement of relations between employers and workmen and the avoidance and settlement of any differences or disputes arising between them and ancillary matters.

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

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

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

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

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

3.2.15 Pakistan Antiquity Act, 1975

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

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

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

3.2.17 Sindh Prohibition of Employment of Children Act, 2017

According to this Act, "child" means a person who has not completed his fourteenth year of age. The act specifies that no child shall be employed or permitted to work in any establishment.
The act also states that a child not below the age of 12 years may be engaged in the light work, alongside his family member, for a maximum of two hours per day mainly for the purpose of acquiring skills, in a private undertaking or in any school established, assisted or recognized by Government for such purpose. It is also specified that no adolescent shall be employed or permitted to work in any hazardous work included in the Schedule.

The act also stipulates the constitution of committee on child labor and covers the important aspects related to hours and period of work, weekly holidays, notice to inspector, disputes as to age, maintenance of register, and display of notice, abstract of sections and health and safety.

3.2.18 Guidelines for Public Consultation, 1997

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

3.2.19 Other Relevant Environmental Legislation

An overview of other relevant legislation relevant to the environmental and social aspects of the Project is presented in **Table 3.4**.

Table 3.4: Other Relevant Social and Environmental Legislation

Legislation / Guidelines	Brief Description	Relevance to the Proposed Subprojects
Sindh Environmental Quality Standards 2016	Sindh Environmental Quality Standards (SEQS) were notified in 2016. SEQS relevant to the Project include: • Municipal and liquid industrial effluents (32 parameters) • Industrial gaseous emissions (16 parameters) • Motor vehicle exhaust and noise (used and new vehicles) • Ambient air quality (9 parameters) • Drinking water quality (35 parameters categorized under biological, physical, chemical inorganic and organic, and radioactive parameters) • Noise (four zones during day and night).	The proposed project will comply with these standards.
Forest Act (1927) and Forest (Amendment) Act (2010)	The Forest Act of 1927 establishes the right of GoP to designate areas of reserved forest, village forest and protected forest. GoP is enabled to acquire such areas in order to prohibit or restrict the public use of such resources or other activities within them.	It has been confirmed in consultation with the Forest Department that no such areas are present within the study area
Protection of Trees and Brushwood Act (1949)	The Protection of Trees and Brushwood Act of 1949 prohibits the cutting or lopping of trees along roads and canals planted by the Forest Department unless the prior permission of the Forest Department is obtained.	ESIAs will be prepared in consistence with this Act.
Sindh Wildlife Protection Ordinance 1972	The ordinance requires the protection of wildlife species declared as protected and game animals. This ordinance restricts hunting of protected and game animals. Game animals can be hunted under permit from the wildlife department. It declares certain areas as national parks and	No personnel or staff related to the project, including contractor staff, will be allowed hunting or otherwise disturbing wildlife.

Legislation / Guidelines	Brief Description	Relevance to the Proposed Subprojects
	game reserves where hunting and spoiling of its natural landscape and environment is prohibited.	
Wildlife and Biodiversity (Protection, preservation and conservation management act), 2015	The Act has been instated to consolidate the laws relating to protection, preservation, conservation and management of wildlife in KP. It places restrictions on hunting, possession and display of wildlife, trade and trafficking of wildlife or wildlife products, and protected areas. Wildlife offences and penalties for those offences are provided in the Act.	This act will apply to all the project workers
Sindh Solid Waste Management Board Act, 2014	Government of Sindh has established Sindh Solid Waste Management Board (SSWMB) under the Sindh Solid Waste Management Board Act 2014. SSWMB is responsible for the collection and disposal of solid and other wastes in the Province of Sindh.	The project will take the SSWMB onboard wherever the project activities have the potential to generate solid waste
Workers Compensation Act, 2013 Minimum Wages Act 2015	The Act provides for the regulation of minimum rates of wages and various allowances for different categories of workers employed in certain industrial and commercial undertakings and establishments. In the budget for FY 2021-22, the Sindh Government has set the minimum monthly wages in the province at Rs. 25,000/-[4].	The subprojects needs to ensure that all workers are paid at least minimum wages. If this is ensured, the Act will not affect the Project.
Sindh Transparency and Right to Information Act, 2016	The Act provides for ensuring transparency and access to information in Sindh.	Information of proposed projects will be shared on SID's website
Motor Vehicle Ordinance (1965) and Rules (1969)	The ordinance deals with the licensing requirement for driving; powers of licensing authority, Regional Transport Authority and those of Court vis-à-vis disqualification for license and registration requirements to control road transport; compensations for the death of or injury to a passenger of public carrier; powers of Road Transport Corporation; traffic rules, power to limit speed, weight, use of vehicles; power to erect traffic signs; specific duties of drivers in case of accident and powers of police officers to check and penalize traffic offenders.	The contractor will have to comply with these Rules.
Highway Safety Ordinance (2000)	This Ordinance includes provisions for licensing and registration of vehicles and construction equipment; maintenance of road vehicles; traffic control offenses, penalties and procedures; and the establishment of a police force for motorways and national highways to regulate and control the traffic as well as keep the highways clear of encroachments.	The contractor will have to comply with this Ordinance.

[4] https://www.dawn.com/news/1629507/sindh-proposes-20pc-hike-in-govt-employees-salaries-sets-minimum-wage-at-rs25000

Legislation / Guidelines	Brief Description	Relevance to the Proposed Subprojects
Pakistan Penal Code (1860)	The Pakistan Penal Code deals with offences where public or private property and/or human lives are affected due to the intentional or accidental misconduct of an individual or body of people. In the context of the environment, the Penal Code empowers local authorities to control noise, toxic emissions and disposal of effluents.	The contractor will have to comply with this Code.
Regulation of Mines and Oil Fields/ Mineral Development Act (1948)	This legislation provides regulatory procedures for the quarrying and mining of construction material on the public as well as private lands.	The contractor will have to comply with this Act.

3.2.20 Legislation Related to Gender-Based Violence

Legal and Policy Framework of Pakistan. Article 25 of the Constitution of the Islamic Republic of Pakistan, while guaranteeing gender equality, empowers the State to make special provisions for the protection of women. This includes protection of the right to life, liberty, economic empowerment, and education. The GBV is covered under the legal framework of GoS to protect women against harassment in the workplace. The Sindh Protection Against Harassment of Women in the Workplace Act, 2010 requires a number of actions to protect women against harassment in the workplace. As a result, the GoS appointed a woman as the provincial Women's Ombudsperson for receiving and disposing of complaints of working women against harassment in their respective places of employment..

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

3.3 Environmental Approval Requirements of the Proposed Subprojects

According to EIA/IEE regulations of 2014, and as discussed in Table 3.1, the subprojects require either IEE or EIA. The Sindh EIA approval process is illustrated in **Figure 3.1**.

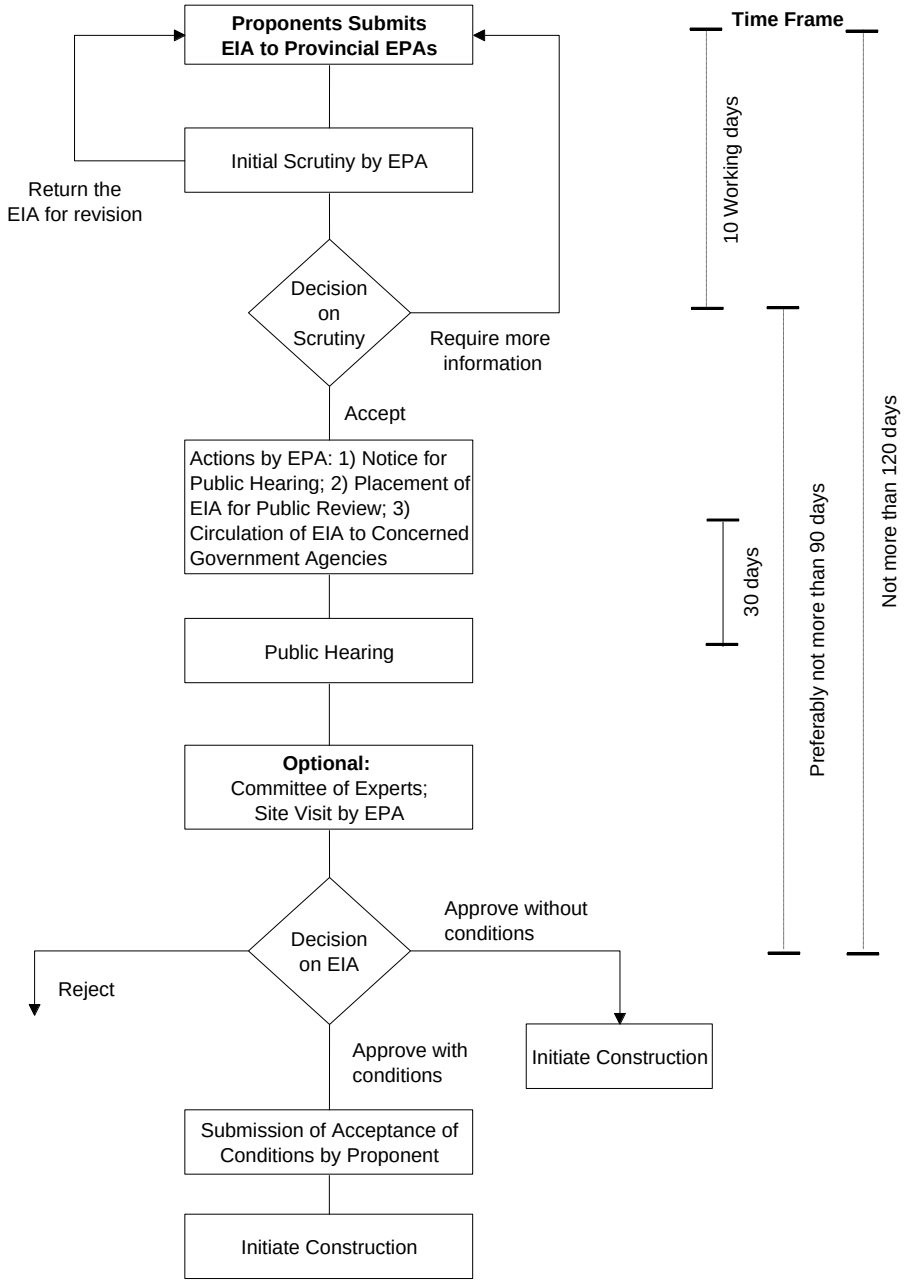


Figure 3.1: EIA Review and Approval Process

3.4 Environmental Regulatory Authorities

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

Statutory functions of the provincial EPAs are to:

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

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

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

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

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

3.5 International Treaties Signed by Pakistan

Pakistan is a signatory to a number of Multilateral Environmental Agreements (MEAs), These MEAs impose requirements and restrictions of varying degrees upon the member countries, in order to meet the objectives of these agreements. However, the implementation mechanism for most of these MEAs is weak in Pakistan and institutional setup mostly non-existent. The following are the relevant international treaties and conventions that have been ratified by Pakistan. Relevance of these will be decided on a case-to-case basis for individual interventions under the project, and accordingly addressed in specific ESMPs:

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

3.6 World Bank Safeguard Policies and Guidelines

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

The Bank requires environmental screening and classification for all investment projects proposed for Bank financing, to help ensure that they are environmentally and socially sound and sustainable. Screening and classification take into account the natural environment (air, water, and land); human

health and safety; social aspects (including especially involuntary resettlement and presence of Indigenous Peoples); cultural property; and trans-boundary and global environmental aspects.

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

The applicable WB safeguard policies are described below**. Table 2.2** provides details of how each policy applies to the proposed investments under the Project.

3.6.1 Environmental Assessment (OP/BP 4.01)

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

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

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

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

3.6.2 Natural Habitats (OP 4.04)

The Policy highlights the importance of conservation of natural habitats, like other measures that protect and enhance the environment, for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank also supports and expects borrowers to apply a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. The Bank- promotes and supports natural habitat conservation and improved land use by financing projects designed to integrate into national and regional development the conservation of natural habitats and the maintenance of ecological functions. Furthermore, the Bank promotes the rehabilitation of degraded natural habitats. The Bank does not support projects that involve the significant conversion or degradation of critical natural habitats.

3.6.3 Physical Cultural Resources (OP 4.11)

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

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

3.6.4 Forests (OP/BP 4.36)

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

3.6.5 Projects on International Waterways (OP 7.50)

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

3.6.6 Involuntary Resettlement (OP/BP 4.12)

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

The overall objectives of the Policy are given below.

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

3.6.7 Projects in Disputed Areas (OP 7.60)

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

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

3.6.8 Safety of Dams (OP 4.37)

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

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

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

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

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

d) periodic safety inspections of the dam after completion.

3.6.9 Environment, Health and Safety Guidelines

The Environment, Health, and Safety (EHS) Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities or projects by existing technology at reasonable costs. In addition, there are also industry-specific EHS guidelines. The guidelines that are relevant to the Project are: General EHS Guidelines[5].

3.6.10 Public consultation and disclosure requirements by World Bank

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

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

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

3.6.11 Applicable World Bank Policies to the Project

The applicable World Bank policies for the proposed investments under the Project are given in **Table 3.5**.

Table 3.5: Applicable World Bank Policies for the Project

OP/BP	Triggered	Explanation	Proposed Actions to be taken up by PCMU
Environmental Assessment (OP4.01/ BP4.01)	Yes	This policy is triggered because the project will involve physical intervention such as rehabilitation/modernization of main canal infrastructure and distributary systems as well as water and agricultural related policies and plans reform and development which might have environmental and social implications through changes in water resources management and water	PCMU has prepared this ESMF and RPF for the proposed Project since the exact locations of the proposed facilities are not yet known.

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

OP/BP	Triggered	Explanation	Proposed Actions to be taken up by PCMU
		management infrastructure. Some project interventions will require land acquisition and resettlement. Furthermore, water and agricultural policy reform and preparation of the Strategic Water Plan and specialized studies would entail potential substantial changes in water resources management and allocation, directions of infrastructure development and zoning system. Hence, the project is classified as Category A. To mitigate the potential environmental and social risks and impacts envisaged from the project, ESMF is prepared prior to project appraisal as the main safeguard governance document. It sets out the principles, rules, guidelines and procedures to prepare the necessary site-specific safeguard instruments, including environmental and social screening. ESMF also outlines an initial assessment of the environmental and social baseline and potential environmental and social risks and impacts envisaged by the implementation of the project, including Component 1 and 2, generic environmental and social mitigation measures, public consultation and institutional and monitoring arrangement. The water policy reform and preparation of the Strategic Water Plan and specialized studies under Component 1 would have environmental and social implications for the long term; the potential environmental and social issues were evaluated and relevant recommendations will be integrated through specific studies to be developed. Component 2 will support rehabilitation and modernization of main canal infrastructure on the right and left bank of the Indus River. ESIAs/ESMPs will be prepared for these canals. Since the scope of work and technical details are only available for Akram Wah Canal before Appraisal, ESIA for Akram Wah Canal will be prepared prior to the appraisal and ESIAs/ESMPs for the other canal infrastructure will be prepared during project implementation. A Gender Action Plan has also been developed as part of the ESMF to identify the impacts on women and marginalized groups and the hurdles faced by these groups to benefit from proposed project interventions. This plan also examines available citizen engagement mechanisms from a social inclusion, gender and conflict management perspective and recommends the most effective social mobilization process and engagement for the Project.	PCMU will prepare ESIAs and A/RAPs for the subprojects during preparatory phases while carrying out the feasibility studies. The documents will be submitted for World Bank clearance prior to starting of any construction activities. PCMU has developed a paper on the Water and Environment in Sindh to identify key issues in the water sector. The identified issues are Left Bank Outfall Drain, Manchar Lake, Delta Ecological Restoration, flooding, droughts, etc. PCMU will develop a Strategic Water Plan to address the key issues identified in this paper and ESMF. The ToRs of the study are included in the ESMF.
Natural habitats (OP4.04/ BP4.04)	Yes	The river stretch between Guddu Barraga and Sukkur Barrage, where Rice and Dadu canals originate, is a Sindh Wildlife Reserve and a Ramsar site since the river stretch is the core habitat of endangered Indus River Dolphin. Rice and Dadu canals are also supplying the water to Manchar Lake, which is the largest freshwater lake in Pakistan.	PCMU will carry out a detailed ecological assessment of the project area during the proposed E&S studies. The subprojects will also be designed to ensure that there will be no

OP/BP	Triggered	Explanation	Proposed Actions to be taken up by PCMU
		While most of the canal rehabilitation and modernization works will be undertaken outside these important ecological habitats, the project will pay due attention not to harm these ecological habitats. In addition, the outcome of the policy reform, the Strategic Water Plan and specialized studies might affect the quality of these ecological habitats as well as riverine forests in river Indus. Hence, the policy is triggered. ESIAs/ESMPs of each physical investment will assess the potential impacts and propose mitigation measures following the mitigation hierarchy. Likewise, long-term ecological impacts due to policy reform, the Strategic Water Plan and specialized studies will also be assessed in respective technical works.	impact on the wildlife-protected areas.
Pest Management (OP4.09)	No	The project will not procure any pesticides. However, the project would change the pesticides application practice through the project activities such as promotion of CSA, application of new crops and agricultural practices. These interventions are expected to have low but positive impacts on pest management. Integrated Pest Management measures are proposed in ESMF.	
Physical Cultural Resources (OP4.11)	Yes	This policy is precautionarily triggered since project locations are unknown for some of the activities. The potential existence of historical and cultural resources will be examined in the course of project preparation and implementation. A chance find procedure and protection measures of cultural resources will be included in ESMF and site-specific ESIAs/ESMPs, and will be reflected in the bidding documents for the construction contracts.	There are no PCRs identified during the initial screening. However, these aspects will be studied in detail during proposed ESIA studies. Further, PCMU will include chance-find procedures in the contract documents.
Involuntary Settlement (OP4.12)	Yes	Rehabilitation of Akram Wah Canal on the left bank will involve resettlement issues, including legacy issues related to people recently displaced by the GOS through an Anti-encroachment drive on Supreme Court orders. Other proposed project interventions, especially in component 2.2 and 2.3, such as improving the irrigation infrastructure in select main canals, including rehabilitation and modernization of regulators and cross regulators (distribution structures), and support for critical control infrastructure to control water levels and flows to outlets to water courses may also involve small scale involuntary resettlement, and/or temporary or permanent economic/livelihood displacement as canal embankments in Sindh are often encroached. Hence, OP 4.12 on Involuntary Resettlement is triggered. As the location of physical interventions under Subcomponent 2.2 is known, site-specific Resettlement Action Plan (RAP) has been prepared. It was consulted upon (involving all stakeholders, including local communities and vulnerable groups). It is an updated version of the previously developed RAP, now covering the entire ROW. It will be approved and	PCMU will prepare A/RAPs for the proposed projects in accordance with the RPF and carry out land acquisition in accordance with the approved RAPs. PCMU has also updated the RAP, which now covers the entire ROW rather than only the COI. Also, PCMU and SIDA have developed the Corrective Action Plan for Akram Wah AED affectees. This plan will be implemented before the project gets approval.

OP/BP	Triggered	Explanation	Proposed Actions to be taken up by PCMU
		disclosed locally and at the Bank's Imagebank before project appraisal. Furthermore, a Corrective Action Plan (CAP) has been prepared based on audit to mitigate impacts on AED affectees along the Akram Wah Canal, in retrospect. This Plan covers the entire ROW (including the COI) on both sides of the canal. For activities where precise locations are not known yet, Resettlement Policy Framework (RPF) has been prepared, spanning all subprojects to be financed. If required, site-specific RAPs will be prepared once the design and location of the sub-project interventions are available.	
Forests (OP4.36)	No	The project activities are not envisaged to affect the riverine forests in Indus River Basin. Therefore, this policy is not triggered. However, the applicability of the policy will be re-examined once all project locations are known. . If the policy is triggered, detailed impact analysis and necessary mitigation measures will be included in ESIAs/ESMPs.	PCMU will develop necessary mitigation measures in compliance with this policy.
Indigenous Peoples (OP 4.10)	No	This policy is not triggered as the only recognized Indigenous People of Pakistan, the Kalash, reside in the Chitral Valley, which is outside the project's geographical area.	No indigenous people as defined in the Policy are known to exist in the Program area.
Safety of Dams (OP 4.37)	Yes	This policy is triggered because the command areas that will be benefited from the project intervention rely on three Barrages on the main course of the Indus River to divert water from the river into main canals: Guddu, Sukkur and Kotri Barrages. These Barrages have a low height (less than 10 meters raising of the water level), but their length (1 to 2 kilometres) and the high flood discharges they allow to transfer downstream (370,000 m3/s) make them fall under the category of large dams. The Akram Wah canal to be rehabilitated under the project is abstracting water upstream of Kotri Barrage, and the project will finance the modernization of distributary and minor canals in the command area of three AWB, which are each abstracting water from one of the three Barrages. Another World Bank-funded project (SBIP, P131324) is currently financing rehabilitation and improvement works on Guddu and Sukkur Barrages. Improved O&M and dam safety plans were already established and will be further improved for these two Barrages, while a safety assessment was conducted for Kotri Barrage and a detailed study is planned to be implemented. A Dam Safety Panel is mobilized under SBIP financing and is actively involved in the oversight of dam safety aspects.	PCMU will take cognizance of the POE recommendations in all the project design and safeguard instruments.
Projects in Disputed Areas OP/BP 7.60	No	The project is not located in disputed territory. Therefore, this policy is not triggered.	
Projects on	Yes	Since Component 2 involves rehabilitation of Canals and distributary systems originating from the Indus River, which is	

OP/BP	Triggered	Explanation	Proposed Actions to be taken up by PCMU
International Waterways		the International Waterway, this policy is triggered. Exception of notification set out in Para 7 of OP7.50 would be considered since Component 2 mainly involves rehabilitation and modernization of the canals and distributaries. Further analysis will be carried out if the project would fall into the criteria of exception for riparian notification.	
Consultations and Disclosure	Yes		PCMU has consulted with various stakeholders, including the affected communities, during the preparation of the ESMF and RPF. The ESMF and RPF (including translated versions of the executive summaries) will be disclosed on the PCMU website and will be sent to World Bank for disclosure on its external website.

4 Baseline Environment

An overview of the existing baseline information for the project area obtained from the secondary literature review is presented in this chapter. Detailed baseline environment of the Project area (covering biophysical and socio-economic environment) will be collected and presented in the subproject ESIAs/ESMPs.

4.1 Influence Area

The influence area of the SWAT covers all irrigated areas located in the command areas of the Sindh province.

The geographical scope of SWAT is determined by its components. Component one: Water Resources Management that includes policy, institutional, and hydro-agro information reforms will be applicable to all districts serviced by the three barrages on River Indus in Sindh: Guddu, Sukkur, Kotri and their extensive irrigation network on the left and right banks through 14 main canals, and numerous water courses. A total of 23 districts of Sindh fall under this irrigation network. **Table 4.1** details the irrigation coverage in relation to the barrages, main canals, and districts.

Table 4.1: Canal Command Areas of Sindh

Barrages	Right Bank	Left Bank	Districts
		Ghotki Feeder	Ghotki, Sukkur
	Beghar Sindh Feeder		Kashmore Khandhkot, Shikarpur
Guddu	Desert Pat Feeder		Kashmore Khandhkot, Jacobabad
		Nara Canal	Sukkur, Khairpur, Sanghar, Tando Allahyar, Umerkot, Mirpurkhas, Tharparker
		Rohri Canal	Sukkur, Khairpur, Naushahro Feroze, Shaheed Benazirabad, Matiari, Tando Allahyar, Badin
		Khairpur Feeder East	Sukkur, Khairpur
		Kairpur Feeder West	Sukkur, Khairpur
	North West Canal		Sukkur, Shikarpur, Jacobabad
	Rice Canal		Sukkur, Larkana, Kambar Shahdadkot
Sukkur	Dadu Canal		Sukkur, Larkana, Kambar Shahdadkot, Dadu, Jamshoro
		Pinyari Canal	Hyderabad, Thatta
		New Fulleli Canal	Hyderabad, Tando Muhammad Khan, Badin
		Akram Wah	Hyderabad, Tando Muhammad Khan, Badin
Kotri	Kalri Baghar Feeder		Jamshoro, Thatta

As for components two and three that cover Water Serviced Delivery and Agricultural Subsidies and Investments respectively, 16 districts that fall under the canal command areas of North West Canal, Rice Canal, Dadu Canal, Nara Canal, New Fulleli, and Akram Wah and through Direct Outlets (DOs)[6], are to be targeted. These districts are included based on planned interventions related to AWB creation on the right bank and rehabilitation of Akram Wah Canal, and modernization of distributary and minor canals managed by the existing AWBs and FOs. The Agriculture component is likely to be implemented in the

[6] DOs are unauthorized outlets from main or branch canals. Water in DOs cannot be closed and they are excluded from rotation

districts under the above-mentioned canal command districts on the left bank to obtain synergies between agriculture and water improvements.

Table 4.2 presents details of districts that are likely to be targeted under components 2 and 3.

Table 4.2: Areas under the SWAT Physical Interventions

Barrages	Right Bank	Left Bank	Districts	Talukas
Ghotki		Ghotki Feeder	Ghotki, Sukkur	Sukkur City New Sukkur RohriSaleh Pat Pano Aqil
Sukkur		Nara Canal	Sukkur, Khairpur, Sanghar, Tando Allahyar, Umerkot, Mirpurkhas, Tharparker	**Khairpur Taluka**, Mirwah, Kot Diji, Kingri, Sobho Dero **Gambat Taluka**, Faiz Ganj, Nara, Jam Nawaz Ali, Khipro. **Sanghar Taluka**, Shahdadpur, Sinjhoro, Tando Adam Khan. **Umerkot**, Samaro, Kunri, Pithoro. **Mirpurkhas**, Sindhri, Hussain Bux Marri, Digri, Jhuddo, Kot Ghulam Mohammad and Shuja Abad, Chachro, Dhali, Diplo, Kaloi, Islamkot, Mithi, Nagarparkar.
	North West Canal		Sukkur, Shikarpur, Jacobabad	**Shikarpur**, Lakhi, Garhi Yasin. Khanpur, Garhi Khairo **Jacobabad**, Thul, Kandhkote and Kashmore
	Rice Canal		Sukkur, Larkana, Kambar Shahdadkot	**Larkana**, Rato Dero, Dokri and Bakrani Qambar, Miro Khan **Shahdadkot**, Warah, Sija Wal Junejo, Nasirabad and Qubo Saeed Khan, **Taluka** Qambar
	Dadu Canal		Sukkur, Larkana, Kambar Shahdadkot, Dadu, Jamshoro	**Dadu**, Johi, Mehar, K.N. Shah Sehwan, Manjhand
Kotri		Akram Wah	Hyderabad, Tando Muhammad Khan, Badin	Hyderabad City, Hyderabad Taluka, Latifabad, Qasimabad Bulri Shah Karim, Tando Ghulam Hyder, Tando Mohammad Khan Badin, Nindo Shaher, Khoski, Golarchi, Matli, Shaheed Fazal Rahu, Talhar Tando Bago

Barrages	Right Bank	Left Bank	Districts	Talukas
				Hyderabad City, Hyderabad Taluka, Latifabad, Qasimabad Bulri Shah Karim, Tando Ghulam Hyder, Tando Mohammad Khan
		New Fulleli	Hyderabad, Tando Muhammad Khan, Badin	Badin, Nindo Shaher, Khoski, Golarchi, Matli, Shaheed Fazal Rahu, Talhar Tando Bago

The locations of districts that fall under the SWAT influence area are shown in **Figure 4.1**.

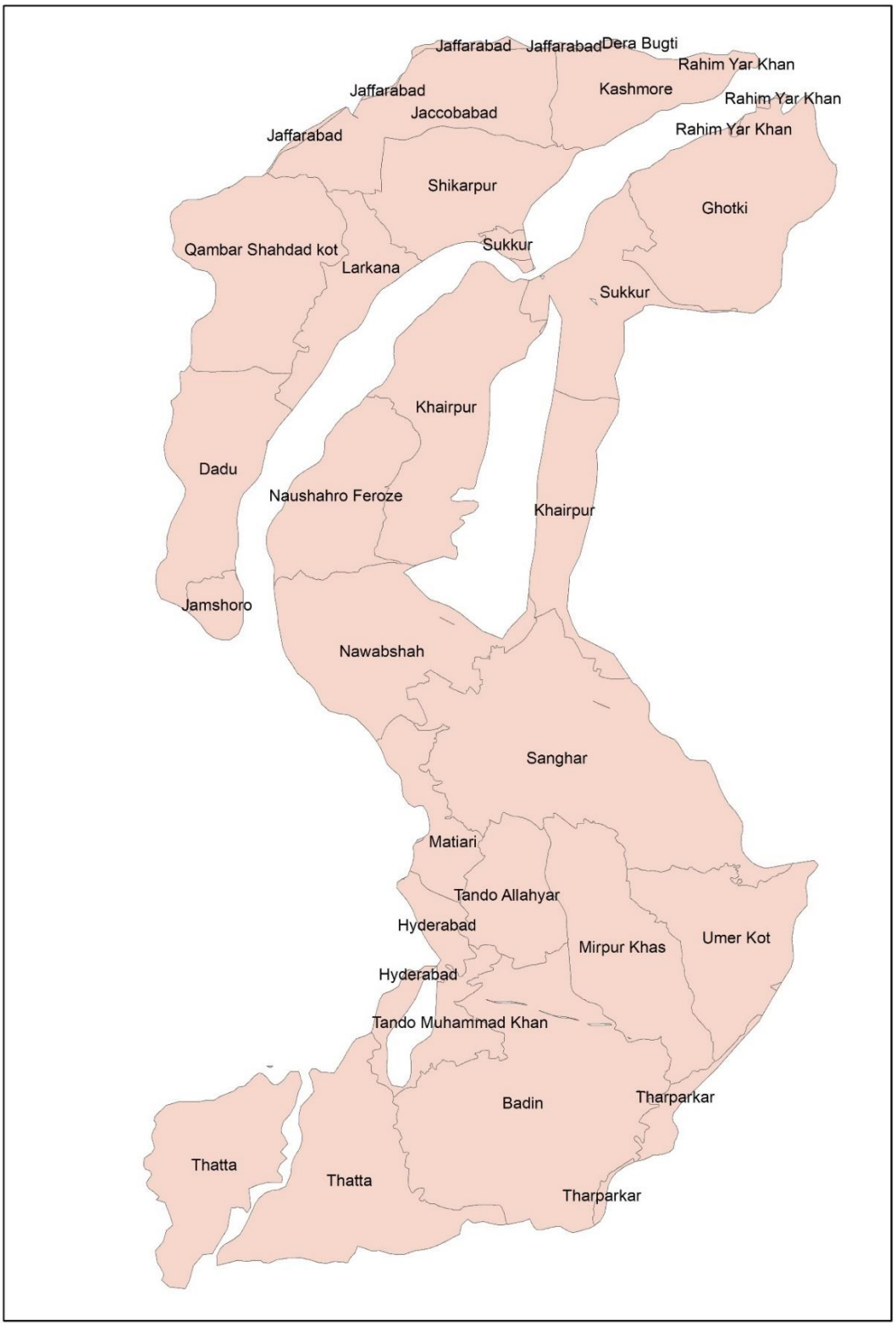


Figure 4.1: Project Influence Area of SWAT

4.2 Physical Environment

4.2.1 Physiography

The Province of Sindh is located on the western corner of South Asia, bordering the Iranian plateau in the west. Geographically it is the third-largest province of Pakistan, stretching about 579 km from north to south and 442 km (extreme) or 281 km (average) from east to west, with an area of 140,915 square kilometres (54,408 square miles) of Pakistani territory. It lies between 23° and 28° North latitudes and 66° and 71° East longitudes. Sindh is bounded by the Thar Desert to the east, the Kirthar Mountains to the west, and the Arabian Sea to the south. In the centre is a fertile plain around the Indus River.

Sindh consists of the Lower Indus Plain, which is very flat, generally sloping to the south with an average gradient of about 95 mm per kilometre. The Lower Indus Plain primarily comprises Indus Delta in the south, meander flood plain and cover fold plan. The area can be divided into five micro-relief land forms: active flood plain, meander flood plain, cover flood plain; scalloped interfluves; and Indus Delta.

Topographically, Sindh can be divided into four distinct parts: (a) Kirthar range on the west; (b) a central alluvial plain bisected by the Indus River; (c) a desert belt in the east; and (d) the Indus delta in the South. These are briefly described below.

- Kirthar Range is consisting of three parallel tiers of ridges that run in the north-south direction and vary in width from 20 to 50 km. The Kirthar range has little soil and is mostly dry and barren.
- Central Alluvial Plain is comprising the valley of the Indus River. This plain is about 580 kilometres long and about 51,800 square km in area and gradually slopes downward from north to south. It is a vast plain, around 100 meters high above sea level. According to the past tradition, it has been divided into three distinct zones: i) Lar or Southern Sindh comprising the area south of Hyderabad; ii). Wichalo or Central Sindh, the area, lying immediately around Hyderabad; and iii) Siro, or Northern Sindh, comprising the area beyond Naushahero Feroze and Sehwan.
- Eastern Desert Belt including low dunes and flats in the north, the Achhrro Thar (white and desert) to the south and the Thar Desert in the south-east. There is a small hilly tract known as the Karunjhar hills. The Aravalli series belongs to the Archaean system, which constitutes the oldest rocks of the earth's crust.
- Indus Delta is consisting of the distributaries of the Indus River, which starts spreading out near Thatta across the deltaic flood plain in the sea. The even surface is marked by a network of flowing and abandoned channels. A coastal strip, 10 to 40 km wide, is flooded at high tide and contains some mangrove swamps.

Except for a small hilly tract (Nagarparkar), in the southeast corner of the Tharparkar District, western Sindh is the only region that is mountainous and includes the hill ranges of Kirthar, Pab, Laki, and Kohistan. There is no vegetation on these ranges due to scanty rainfall. The highest altitude known as Kutai-ji-Kabar is in the Kirthar Range and is about 2,073 meters high. These ranges run north to south like a crescent turned towards the low lands and extended up to the northern extremity of the province. Kirthar has a simple, anticlinal structure with flanks gently dipping towards west and south. The Laki Range, on the other hand, is mainly composed of tertiary rocks and contains a large number of thermal springs. A large part of Sindh lies in the deltaic plain of the Lower Indus Valley. Most of this region consists of plains overlain by alluvium, trenched with river channels in some places and overridden by raised terraces in others. A few isolated low limestone hills are the only relieving features in the plains which are otherwise at one level. The plains may be subdivided into three parts: the western valley, the eastern valley, and the deltaic area. The western valley section is distinguished from the eastern valley by the presence of old alluvium and seasonal stream flowing from the Kirthar mountain range into the Manchhar Lake. The deltaic area largely consists of mangrove swamps and sandbars. The chief characteristic of the region is

the creeks, which serve as the changing outlets of the Indus and as inlets for the sea. The lowland Indus plain merges into this region. The eastern part of Sindh consists of the Thar Desert, which continues into Rajasthan (India). The landscape is sandy and rough, with sand dunes covering more than 56 percent of the area. The relief in the area varies from near sea level to more than 150 meters above sea level. The sand dunes are mostly longitudinal with a north-east-south-west trend and are stabilized by shrub vegetation and grass.

4.2.2 Land use

Agriculture, followed by forestry, is the main land use in most parts of Sindh. Although more than 50 percent of the total geographical area is cultivable, only about 26 percent of it is actually located in the central plain. The land inside the Indus embankments is almost equally employed by agriculture and forestry, while that outside the embankments is more extensively utilized for agriculture in the form of sparsely distributed irrigated plantations. The land use map of Sindh is shown in Figure 4.2.

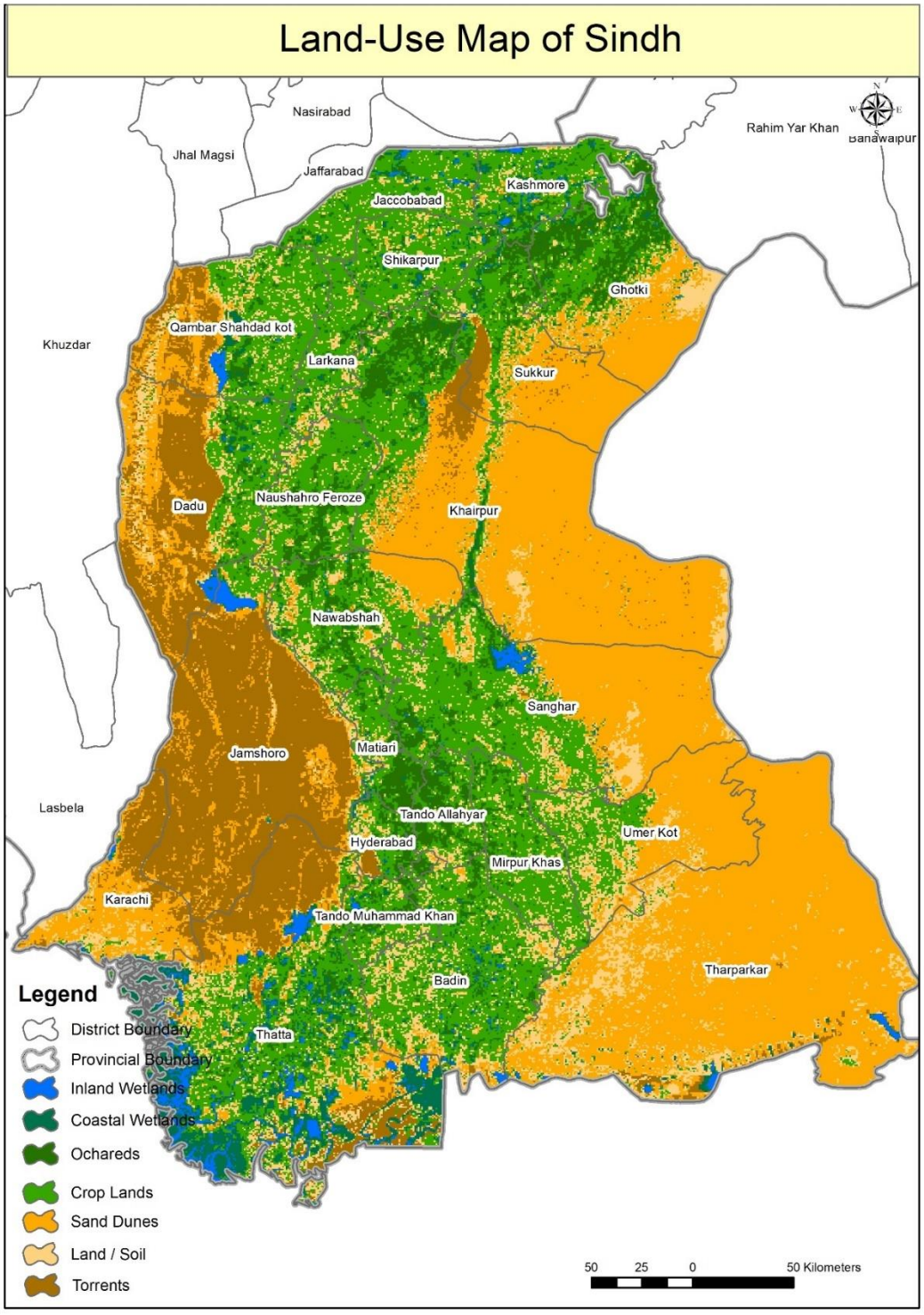


Figure 4.2: Land use Map of Sindh Province

4.2.3 Climate

According to Koeppen's climate classification, the Sindh area can be classified as a 'desert hot climate' because of its low annual rainfall compared to potential evapotranspiration and high temperatures. The average annual rainfall is about 120 mm, with nearly 61 percent of rainfall falls in the monsoon months of July and August. The average annual potential evapotranspiration is 2,216 mm. Between May to September, daytime temperatures exceed 35 °C and during winter months, the night time temperatures may drop up to 2 °C. Climate change is also expected to increase extreme precipitation events, and trigger both extremely high precipitations resulting in floods, and extremely low precipitation resulting in droughts.

Sindh is divided into three climatic regions: Siro (the upper region, centered on Jacobabad), Wicholo (the middle region, centered on Hyderabad), and Lar (the lower region, centered on Karachi). The thermal equator passes through upper Sindh, where the air is generally very dry. Central Sindh's temperatures are generally lower than those of upper Sindh but higher than those of lower Sindh. Dry hot days and cool nights are typical during the summer. Central Sindh's maximum temperature typically reaches 43–44 °C (109–111°F). Lower Sindh has a damper and humid maritime climate affected by the southwestern winds in summer and northeastern winds in winter, with lower rainfall than Central Sindh. Lower Sindh's maximum temperature reaches about 35–38 °C (95–100 F). In the Khirthar range at 1,800 m (5,900 ft) and higher at Gorakh Hill and other peaks in Dadu District, temperatures near freezing have been recorded and brief snowfall is received in the winters.

4.2.4 Hydrology

The Indus drains an area of about 950,000 km2 and generates a mean annual discharge of 6,682 m3/s. The hydrograph of Indus is presented at Sukkur, as a reference, in Figure 4.3 to understand the river flows and their seasonal characteristics. The hydrograph of the river at Sukkur is strongly seasonal with a long low water season between October and May (low flow season) and a high water season between June and September (high flow season) – driven primarily by summer snowmelt in the upper catchment and monsoon rainfall. The river usually peaks in mid-August or early September. River flow upstream of Sukkur barrage varies from a monthly average flow of approximately 22.83 MAF (28.16 BCM) in August to a monthly average flow of approximately 1.44 MAF (1.78 BCM) in January. The corresponding figures downstream of the barrage are approximately 20.06 MAF (24.74 BCM) and 0.29 MAF (0.35 BCM) in August and December, respectively

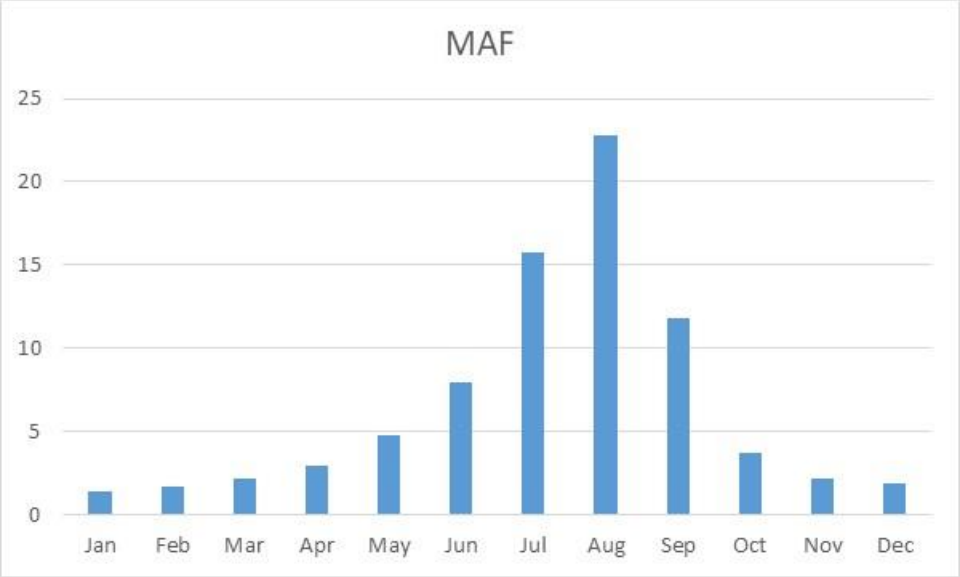


Figure 4.3: Mean Monthly River Discharges at Sukkur

4.2.5 Floods

Floods in Indus generally occur due to heavy and prolonged storms and intensive/extreme glacier and snow melting. High discharges above 0.9 million cusecs (25,485 m3/s) are termed super floods. A number of such floods have been recorded historically (1950, 1956, 1957, 1973, 1975, 1976, 1978, 1986, 1988, 1989, 1992, 1995, 2010 and 2011). Annual maximum flows of Indus at Guddu and Sukkur Barrage, from 1962 to 2010, are shown in **Figure 4.4**.

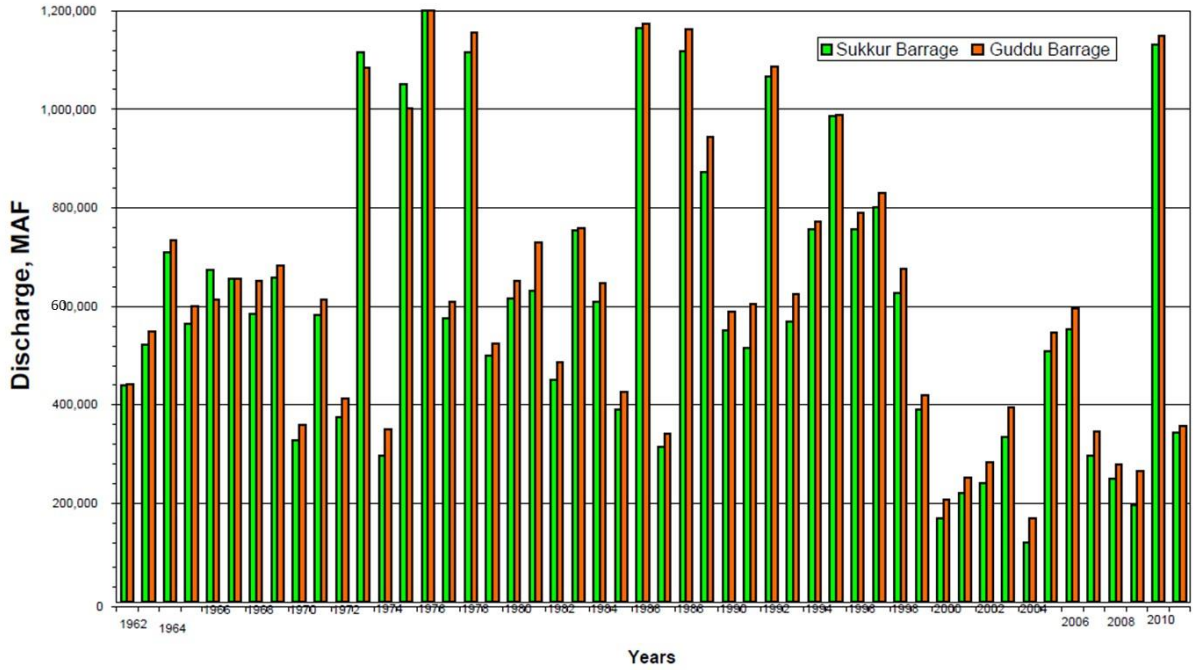


Figure 4.4: Annual Maximum Flow at Sukkur and Guddu Barrage from 1962- 2010

4.2.6 Geology

The prevailing geologic conditions in the region are the results of extensive inundation, depositions, coastal movements, and erosions over a long period of time in the geological ages. The geology of the region is closely related to the formation process of Himalayan ranges resulting in intense deformation with complex folding, high angle strike-slip faults and crust thickening expressed in a series of thrust faults. The important tectonic changes which have had so much influence in the region are feebly visible, particularly in the Indus Plain, and it is only by considering the geology on a broader regional scale, as well as in site-specific detail, that the effects can be appreciated.

Most parts of Sindh are covered either by recent alluvium or wind-borne sand. The principal features of geological significance are to be found in the hilly portions of the province, towards the west of the Indus. Outlying extensions of this hilly tract occur east of the Indus as well, near Sukkur, Hyderabad and Jerruck. The isolated hills of Nagarparkar on the northern border of the Rann of Kutch belong to quite a different system both geographically and geologically.

The soil in the plains of Sindh is plastic clay that has been deposited by the Indus. Combined with water it develops into a rich mould and without water, it degenerates into a desert. Nearly the entire Indus valley has soil that is extremely friable and easily disintegrated by the flow of water. Resultantly, the water always contains a large amount of suspended silt.

Sindh is located in a seismically inactive region with a history of low to medium magnitude earthquakes in its near vicinity. According to the building code of Pakistan Seismic Provisions (2007), the project areas are located in zone 2A with recommended peak ground acceleration of 0.08 to 0.16g.

4.2.7 Water Resources

The water resources available to the people of Sindh are limited. Mean annual rainfall in the province ranges between 100 and 200 mm. The main source of water available to Sindh is the Indus River, which is diverted through the extensive hydraulic infrastructure that has been put in place over the last century in the form of the Lower Indus Basin Irrigation System (IBIS). The river water is supplied to users by diverting it to a canal system through three barrages: Guddu barrage, Sukkur barrage, and Kotri barrage. These barrages divert water to 14 main canals via an intricate system of 117 branch canals, 1400 distributaries and minors, and 44,000 watercourses (GOS, 2018). The canal system in Sindh has an aggregate length of 13,325 miles (21,445 Km), and it serves a gross command area (GCA) of 5.8 million hectares. It was designed to serve the agriculture sector. However, under the recent economic development following rapid urbanization and industrialization and the population increase, the pressures from other sectors are also rising fast. Effectively, the 14 main canals have been transformed into multi-purpose canals serving agriculture, industries, households, and the environment, including wetlands, Indus delta and natural habitats.

Flows into Sindh at Guddu averaged 65.19 MAF between 2004 and 2019, with flows concentrated during June and September. These average flows are subject to significant interannual variability. For 2018-2019 the inflows were, for instance, 49.80 MAF. Of this, 35.66 MAF was consumed – most of it in agriculture (33.80 MAF). Water losses were 6.69 MAF – most of this in the Kharif season. The releases downstream Kotri barrage were 1.76 MAF (which is less than what is recommended to sustain the Indus Delta). For 2018/ 2019, the balance between inflows and outflows was 5.69 MAF. [7]

[7] Sindh Water Policy, Draft, March 2021

Table 4.3: Canal Command Areas under the Project[8]

S.N.	Canals under SWAT	Command Area (acres)	Districts
1	Akram Wah	462,539	Hyderabad, Tando Mohammad Khan, Badin,
2	Dadu Canal	581,057	Naushahro Feroze, Dadu, Qamber-Shahdadkot
3	North West Canal	1,080,891	Shikarpur
4	Rice Canal	575,712	Larkana, Dadu

Outside of the coverage of the IBIS, available surface water resources are more limited. They result from the runoff generated in catchments during rainfall. The 2018/2019 balance estimated these to be in the order of 1.2 MAF.[9] Though smaller, they are important for an important and relatively vulnerable part of the population of the Province. The water resources map of Sindh, including the irrigation network, is shown in Figure 4.5.

[8] SIDA GIS Cell

[9] Sindh Water Policy, Draft, March 2021

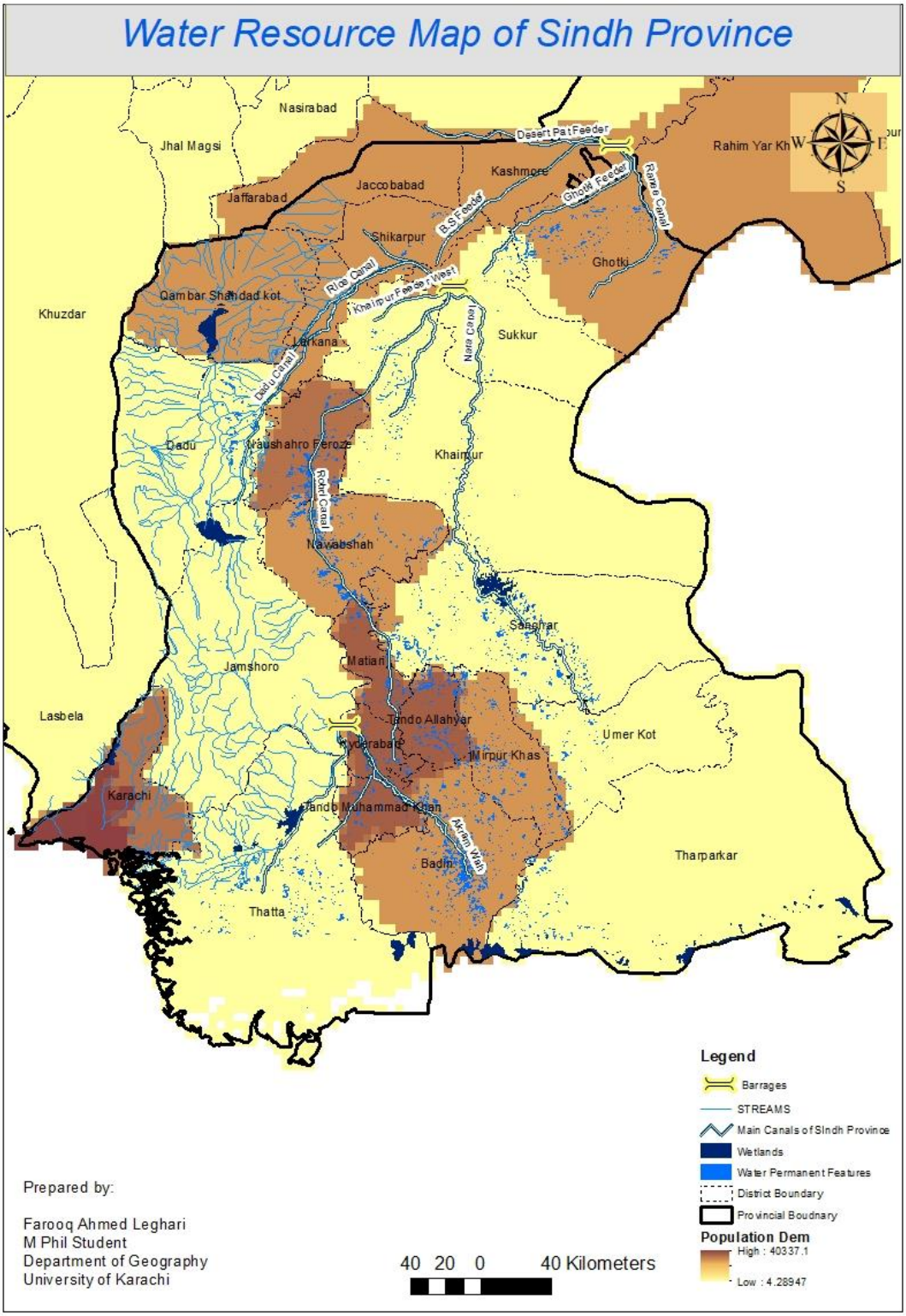


Figure 4.5: Water Resources Map of Sindh Province

4.2.8 Groundwater

Another important and increasingly used source of water – both in the dryland and the canal area is groundwater. Groundwater resources complement available water resources in Sindh and its safe yield has been estimated to range between 4.4 MAF and 8.1 MAF. [10] However, the use of groundwater is comparatively lesser (4.3 billion cubic meters) because of two primary reasons: firstly, most of the area is lying on saline or brackish water; secondly, canal command areas are being provided with surface irrigation supplies[11]. The decade of the 90s and up to 2007-08 witnessed the fastest rate of "tubewellization", though the rate of increase in the number of tubewells has reduced now[12]. Sindh Bureau of Statistics reported a ratio of 4:1 in area irrigated by canal water to the area irrigated by tubewells in year 2007-08[13]. As per the Pakistan Bureau of Statistics Agricultural Statistics of Pakistan 2010-11, the number of tubewells and lift pumps in Sindh is 38,330 and 7,809, respectively[14]. The number of private farms reported as owning tubewells in Sindh is 30,644, according to the Agriculture Census of 2010. More than 19% of these are in the project districts. Interestingly, no private farms from Shikarpur, Larkana and Qamber-Shahdadkot reported owning a tubewell. A further 80,350 private farms reported using rented tubewells in the province, more than 30% of these in the project districts[15].

The Culturable Command Area (CCA) wise groundwater quality of the four canals under the SWAT project is given in Table 4.4; current data is not available; therefore, the available data of 1998 is used. The data for the command area might be outdated, but it gives a fair idea of the ground water quality in the area.

Table 4.4: Culturable Command Area by Groundwater Quality in Thousand Acres[16]

	Fresh	Saline	Total CCA
North West Canal	114.60	649.81	763.99
Rice Canal	114.18	404.81	518.99
Dadu Canal	1420.62	1162.33	2582.95
Akram Wah/ Lined Channel	-	543.99	-

Salinity has always been a feature of groundwater in Sindh, but there is concern it is increasing due to up coning of saline water in areas where groundwater is intensely used and in coastal areas because of the ingression of sea water in the Delta[17].

[10] Ibid

[11] Frank van Steenbergen, F.; Basharat, M.; Lashari, B.K. Key challenges and opportunities for conjunctive management of surface and groundwater in mega-irrigation systems: Lower Indus, Pakistan. Resources 2015, 4, 831–856. (Published: 13 November 2015, Retrieved 20 May 2021)

[12] Hafiz A. Pahsa, *Growth & Inequality in Pakistan*, Freidrich-ebert-Stiftung Pakistan, 2019

[13] http://sindhbos.gov.pk/wp-content/uploads/2013/12/Agriculture-Statistics-of-Sindh-2009.pdf

[14] https://www.pbs.gov.pk/sites/default/files/agriculture_statistics/publications/Agricultural_Statistics_of_Pakistan_201011/tables/Table112-113.pdf; however, the actual data is dated year 2004.

[15] https://www.pbs.gov.pk/sites/default/files/aco/publications/agricultural_census2010/Tabulation%20Sindh-Province.pdf

[16] A. Rehman, G. Rehman, Waterlogging and Salinity Management in the Sindh Province, Pakistan, Volume three, December 1998, Pakistan National Program - International Irrigation Management Institute (Retrieved 20 May 2021)

[17] Sindh Water Policy, Draft, March 2021

In the mid-region of Sindh - Qambar Shahdadkot, Larkana and Khairpur districts – much of the freshwater exploitation occurs between 30 and 60 meters. Fresh groundwater is found in pockets that are aerially extensive between the left bank of the Indus River and Rohri Canal, where river recharge and canal seepage has accumulated. The groundwater increases in salinity with depth, which requires careful management of extraction to avoid upcoming and lateral saline water intrusion. Tube wells supply groundwater for irrigation, which is used conjunctively with surface water. In the coastal regions of Sindh through Thatta and Badin districts, and also including Tharparkar district, saline groundwater is encountered at 10 to 30 m. The surface topography in the eastern area in Tharparkar is about 100 meters higher compared with the surface elevation in the coastal Thatta and Badin districts. As a result, there is very little groundwater use there other than hand pumps and a few bores tapping pockets of freshwater. However, even in this area, some farmers use innovative methods for tapping the freshwater lens, which essentially relies on the transmissive nature of the aquifer and seepage from irrigation return flows. In the long run, this is probably not sustainable as salinity will increase. Parts of this region have thick clay sequences near the surface that overlie deeper water-bearing sand layers and are likely to provide protection from pollutants. However, as saline groundwater is found even at shallow depths, the groundwater in these layers is likely to be highly saline. In this part of the basin, aquifer yields are poor, and groundwater is susceptible to seawater intrusion and upcoming[18].

4.2.9 Water Usage and Quality[19]:

The largest use of water in Sindh is agriculture. Crop consumption is around 95% of total consumption, with actual evapotranspiration varying between 26.6 MAF and 41.7 MAF. At the same time, annual domestic water demand is estimated at 1.2 MAF, industrial water demand at 0.5 MAF, and water use for livestock is relatively low. Flows to the Indus Delta to maintain its ecosystem functions are another important water use, and the Indus River Accord stipulates recommended annual flows of 10 MAF per annum, though actual flows vary between the years and have often been inadequate to meet environmental flow requirements.

Water quality is becoming an issue that is as important as managing water quantity in Sindh. Most drinking water supplies are unsafe for human consumption due to bacteriological contamination, the uncontrolled disposal of effluents from cities and industries upstream of Sindh and inside the Province, the wash-out of agrochemicals or the presence of lead or arsenic.

4.3 Biological Environment

4.3.1 Ecological Screening of the Project Area

An ecological screening exercise is carried out to identify the key biodiversity areas and protected areas around the project area using an Integrated Biodiversity Assessment Tool (IBAT). According to the IBAT assessment, there are 44 protected areas, 15 key biodiversity areas and 129 IUCN red list species in the project area. The list of threatened species that can be found within the project area is presented in **Table 4.5**.

Table 4.5: Threatened Species in the Project area

[18] Information in this paragraph is excerpted from *Lytton, Lucy; Ali, Akthar; Garthwaite, Bill; Punthakey, Jehangir F.; Saeed, Basharat. 2021. Groundwater in Pakistan's Indus Basin : Present and Future Prospects. World Bank, Washington, DC. © World Bank. https://openknowledge.worldbank.org/handle/10986/35065 License: CC BY 3.0 IGO*

[19] Sindh Water Policy, Draft, March 2021

	Species name	Common name	IUCN Category
A	**Mammals**		
1	*Manis crassicaudata*	Indian Pangolin	EN
2	*Platanista gangetica*	South Asian River Dolphin	EN
3	*Axis porcinus*	Hog Deer	EN
4	*Panthera pardus*	Leopard	VU
5	*Prionailurus viverrinus*	Fishing Cat	VU
6	*Ursus thibetanus*	Asiatic Black Bear	VU
7	*Ovis vignei*	Urial	VU
B	**Reptiles**		
1	*Geoclemys hamiltonii*	Spotted Pond Turtle	EN
2	*Hardella thurjii*	Crowned River Turtle	EN
3	*Nilssonia gangetica*	Indian Softshell Turtle	EN
4	*Nilssonia hurum*	Indian Peacock Softshell Turtle	EN
5	*Crocodylus palustris*	Mugger	VU
6	*Pangshura tecta*	Indian Roofed Turtle	VU
7	*Lissemys punctata*	Indian Flapshell Turtle	VU
C	**Birds (Endangered)**		
1	*Vanellus gregarius*	Sociable Lapwing	CR
2	*Gyps bengalensis*	White-rumped Vulture	CR
3	*Sarcogyps calvus*	Red-headed Vulture	CR
4	*Gyps indicus*	Indian Vulture	CR
5	*Oxyura leucocephala*	White-headed Duck	EN
6	*Sypheotides indicus*	Lesser Florican	EN
7	*Rynchops albicollis*	Indian Skimmer	EN
8	*Sterna acuticauda*	Black-bellied Tern	EN
9	*Haliaeetus leucoryphus*	Pallas's Fish-eagle	EN
10	*Neophron percnopterus*	Egyptian Vulture	EN
11	*Aquila nipalensis*	Steppe Eagle	EN
12	*Leptoptilos dubius*	Greater Adjutant	EN

Source: Integrated Biodiversity Assessment Tool on http://www.ibat-alliance.org

4.3.2 KBAs and Protected Areas

Key Biodiversity Areas (KBAs) in the project area given in Table 4.6 and are shown in Figure 4.6.

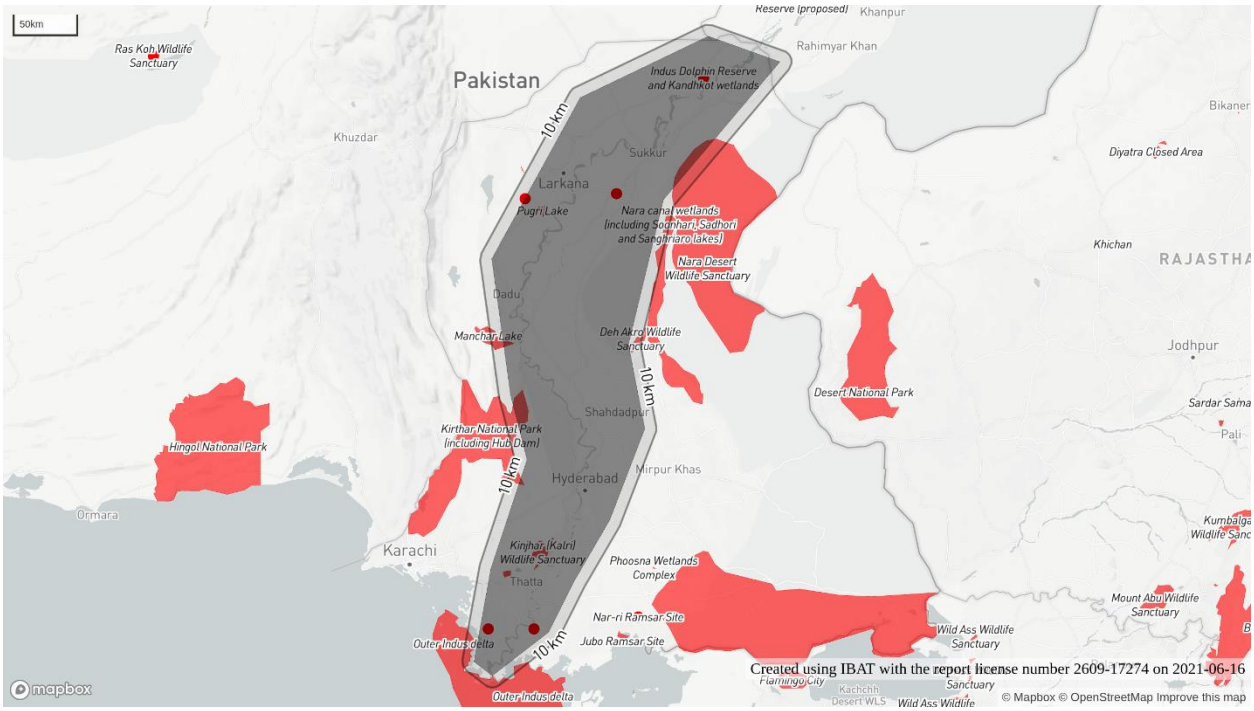


Figure 4.6: KBAs in the Project Area

Table 4.6: KBAs in the Project Area

	Key Biodiversity Area	Significance
1	Mehboob Shah Lake	CR/EN, VU, migratory birds/congregations
2	Nara Desert Wildlife Sanctuary	VU, migratory birds/congregations, other
3	Kinjhar (Kalri) Wildlife Sanctuary	CR/EN, VU, migratory birds/congregations
4	Keti Bundar North Wildlife Sanctuary	CR/EN, VU, migratory birds/congregations
5	Hammal Katchery Lake	VU, migratory birds/congregations
6	Mehrano Reserve Lake and Rohri canal wetlands	VU
7	Outer Indus delta	migratory birds/congregations
8	Indus Dolphin Reserve and Kandhkot wetlands	CR/EN, VU, migratory birds/congregations
9	Kirthar National Park (including Hub Dam)	CR/EN, VU, migratory birds/congregations, other
10	Manchar Lake	CR/EN, VU, migratory birds/congregations
11	Nara canal wetlands (including Soonhari, Sadhori and Sanghriaro lakes)	CR/EN, VU, migratory birds/congregations
12	Pugri Lake	CR/EN, VU, migratory birds/congregations
13	Drigh Wildlife Sanctuary	CR/EN, VU, migratory birds/congregations
14	Deh Akro Wildlife Sanctuary	VU, migratory birds/congregations
15	Haleji Wildlife Sanctuary	CR/EN, VU, migratory birds/congregations

Protected Areas in the project area given in Table 4.7 and are shown in Figure 4.7.

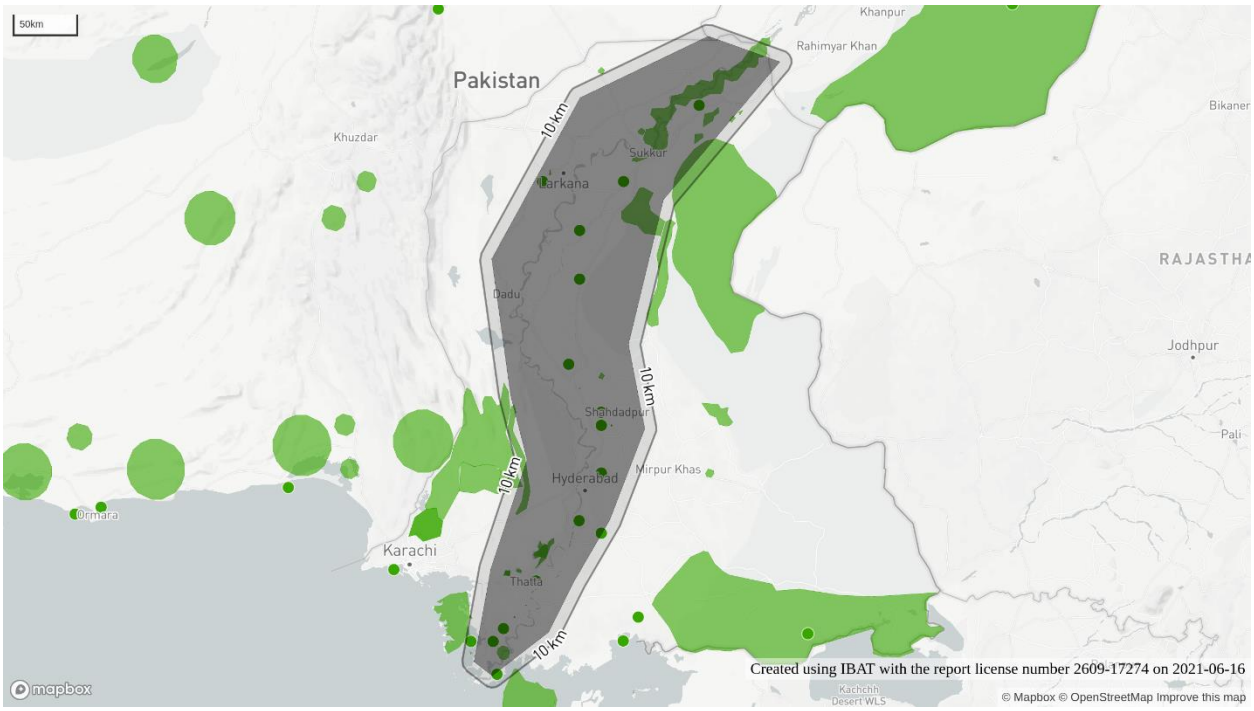


Figure 4.7: Protected Areas in the Project Area

Table 4.7: Protected Areas in the Project Area

	Protected Area	Type	IUCN Designation
A	**International Importance**		
1	Deh Akro-II Desert Wetland Complex	Ramsar Site, Wetland of International Importance	
2	Indus Dolphin Reserve	Ramsar Site, Wetland of International Importance	
3	Indus Delta	Ramsar Site, Wetland of International Importance	
4	Drigh Lake	Ramsar Site, Wetland of International Importance	
5	Haleji Lake	Ramsar Site, Wetland of International Importance	
6	Kinjhar (Kalri) Lake	Ramsar Site, Wetland of International Importance	
B	**National Importance**		
1	Takkar	Wildlife Sanctuary	IV
2	Keti Bunder South	Wildlife Sanctuary	Not Reported
3	Sadnani	Wildlife Sanctuary	IV
4	Marho Kotri	Wildlife Sanctuary	Not Reported
5	Langh (Lungh) Lake	Wildlife Sanctuary	Not Reported
6	Munarki	Wildlife Sanctuary	IV
7	Mirpur Sakro	Game Reserve	Not Reported
8	Shah Lando	Wildlife Sanctuary	IV
9	Kirthar	National Park	II
10	Dosu Forest	Game Reserve	Not Reported
11	Lakhi	Wildlife Sanctuary	IV
12	Haleji Lake	Wildlife Sanctuary	IV
13	Gulsher Dhand	Wildlife Sanctuary	IV
14	Kinjhar (Kalri) Lake	Wildlife Sanctuary	IV
15	Samno Dhand	Wildlife Sanctuary	IV

16	Khadi	Wildlife Sanctuary	IV
17	Surjan, Sumbak, Eri and Hothiano	Game Reserve	Not Reported
18	Hadero Lake	Wildlife Sanctuary	IV
19	Gullel Kohri	Wildlife Sanctuary	IV
20	Drigh Lake	Wildlife Sanctuary	IV
21	Keti Bunder North	Wildlife Sanctuary	IV
22	Pai	Game Reserve	Not Reported
23	Nara Desert	Wildlife Sanctuary	IV
24	Deh Jangisar	Game Reserve	Not Reported
25	Khat Dhoro	Wildlife Sanctuary	IV
26	Kot Dinghano	Wildlife Sanctuary	IV
27	Miani Dhand	Wildlife Sanctuary	IV
28	Mando Dero	Game Reserve	Not Reported
29	Bijoro Chach	Wildlife Sanctuary	IV
30	Deh Sahib Saman	Game Reserve	Not Reported
31	Mohabat Doro	Wildlife Sanctuary	IV
32	Norange	Wildlife Sanctuary	IV
33	Goleen Gol	Game Reserve	Not Reported
34	Cut Munarki Chach	Wildlife Sanctuary	IV
35	Dhoung Block	Wildlife Sanctuary	IV
36	Indus River#1	Game Reserve	Not Reported
37	Majiran	Wildlife Sanctuary	IV
38	Nara	Game Reserve	Not Reported

4.3.3 Flora

There are around 6000 plant species in Pakistan, of which 300 are endemic (5% of the total flora). Wetland plants are specially adapted to waterlogged soils and are an important resource for people living in wetland environs. Wetlands plants are highly productive in waterlogged conditions. Wetlands plants can be divided into emergent, submerged and floating leaves plants.

Riverine and associated shallow wetland habitat is a transitional habitat between deep water aquatic systems and terrestrial systems. The varied hydrological regimes are associated with a diverse set of environmental conditions that require plants to tolerate different degrees of wetness. Some plants are characteristics of aquatic as they show their climatic conditions and habitat type. Hydrophytic vegetation is a major determinant of regulated wetlands. Aquatic habitat normally consists of two types of plants; hydrophytes (with submerged organs) and helophytes (on wet soil). Hence plants growing in water like ponds, lakes, and rivers are unquestionably hydrophytes. It is the hydrological regime of aquatic habitat with varying wet and drier periods that make them different from terrestrial and deep aquatic ecosystems. Even slight changes in hydrology may result in significant alteration of wetland processes, species composition and ecological functions.

Most of these plants belong to Potamogetonaceae, Nymphaeaceae and Najadaceae families. *Hydrila verticillata* is the abundant species that prevailed in the stagnant area of the river as recorded by visual observations. The river Bella and marginal area is dominated by *Phragmites kerka - Saccharum spontaneum* that grew on moist soil with puddles of water and made it a reasonable habitat for many of wader bird species. These aquatic plants supported macroinvertebrates and birds of that habitat and diversity and are the habitats for most macroinvertebrates.

Aquatic Flora

Aquatic plants play a significant role in fresh water, brackish or marine aquatic ecosystems. They help to remove the nutrients and other pollutants from streams and provide a habitat for fish, shrimp and other aquatic species and provide forage for waterfowl. According to a broader definition, "all those plants that at least spend part of their life cycle in partially submerged conditions are regarded as aquatic species." In our survey, aquatic flora was found completely out of the picture. However, plant scientists reported few aquatic species previously from the Indus River. Any catastrophe gravely affects the biotic and abiotic components of the ecosystem and consequently results in the loss of aquatic flora, as the floating / partially sub-merged plant species are washed out by the floods. This is not only a matter of concern for flora, but fauna does suffer by the unavailability of the hydrophytes, which they utilize primarily for their food purpose and secondarily for their breeding ground. After any disturbance, it took time to re-assemblage and colonized again to form an ecosystem.

Marginal Flora

The province of Sindh comprises many wetlands, which are either connected with the Indus River or other seasonal rivers and streams. Wetlands are more diverse and more productive than any other terrestrial ecosystems due to their diverse ecological services and useful living resources such as reducing silt load from incoming waters, reducing erosion by buffering wave action and harbouring fish medicinal and edible plants and maintaining a healthy web of life.

In contrast to aquatic flora, marginal flora is found flourishing quite well. Noteworthy marginal plant species include *Typha angustata* (Pollens of *Typha angustata* are used in traditional medicine "Silsosangami." Leaves are used for mating). *Phragmites karka* (Decoction of the root is orally given acts as diuretic and used in kidney, gall bladder's stones and bleeding piles), *Persicaria glabra, Tamarix indica*, *Tamarix dioica* (the leaves form an ingredient of an effective herbal drug, "Icterine" used against jaundice). Both the species of Tamarix are locally referred to as *Lai. Polygonum effusum* and *Kohautia retrorsa*.

Bukan Booti Phyla nodiflora is frequently observed creeping branched herb at the margins of the River Indus. It was found dominant not only downstream but also in the upstream region. Its leaves and young shoots are sometimes used in curing indigestion in children; its decoction is considered as a cooling agent and used as a demulcent.

Indus Riverine Forests

In the central alluvial plains of Sindh province, forestry is the major land user after agriculture. The Sindh forest department is the custodian of only 2.3 % of forest resources which possesses 8% of its total land area. It spread over 0.6 M acres (0.24 M ha), and it receives inundation waters received during high flood season. From 1860 to 1960, earthen embankments were constructed on both sides of the Indus River. These embankments are one of the significant parts of the riverine belt and restricted the uncontrolled flooding/inundation of the Indus River. Therefore, the sustainability of the forest ecosystem solely depends on the regular inundation supplies. The dominant tree species of Indus Riverine Forest are *Acacia nilotica (babul), Prosopis cineraria (Kandi), Tamarix aphylla (Lawa), Tamarix dioca (Lai)* and *Populus euphratica (Bahan)* restricted to well drain high silt containing stabilized Kacho areas (riverine belt).

Forests in Sindh can be categorized into two distinct types; one that is situated inside flood embankment along river Indus are called riverine forests, and those which are situated outside embankment are called inland forests. The Sindh province owns 0.272 m ha riverine forests, which is about 82% of the total Riverine forest area in the country, which clearly shows that the Sindh province is rich in riverine forests. Riverine forests are one of the important ecosystems of Sindh. These forests along river Indus get annual

inundation during monsoon. The vegetation in riverine forests is much influenced by the frequent change in erosion and deposition due to changing course of the river Indus. Riverine forests of the project area have a canopy of *Populus euphratica (Bahan), Prosopis cineraria (Kandi), Acacia nilotica (Babul), Tamarix dioica, Tamarix indica (Lai), Salvadora persica (Pilu),* and *Salvadora oleoides (Khabbar)* etc. *Bahan Populus euphratica* is one of the pioneer indigenous tree species of Pakistan, but over the past few years, this tree species showed a great decline. Shah Belo is the place where *Bahan Populus euphratica* was found dominant. Its wood is used for fuel in Sindh. Kandi Prosopis cineraria is a versatile species, providing fodder, fuel, food, timber, and shade, as well as enhancing the fertility of the soil and sand dune stabilization. The flowers are pounded and mixed with sugar and eaten by women during pregnancy to safeguard them against miscarriage. The flowers are also valuable in honey production. *Babul Acacia nilotica* is a good soil binder and increases soil fertility through nitrogen fixation. Good quality Babul gum is used in calico-printing and dyeing, as a sizing material for silk and cotton, and in the manufacture of paper. Pods are reported to be effective in urinogenital disorders; the unripe pods are used to make ink, a decoction of the bark is used as a substitute for soaps.

Irrigated Forests

The 81,200 ha of riverine forests exist on both sides of River Indus, but now these forests have drastically reduced after the construction of earthen embankments (bunds) with the construction of three barrages on the Indus River for providing river water for agriculture. The canal water is also used for many inland forests for converting these into irrigated forests. Inland forests falling in command of each barrage are as under: Guddu Barrage command area: 0.02 million ha (0.05 million acres), Sukkur Barrage command area: 0.04 million ha (0.09 million acres) and Kotri Barrage command area: 0.03 million ha (0.07 million acres) with of total 0.08 million ha (0.20 million acres). These irrigated forests were supported to supply firewood to the railway, ships, fuel wood for cantonments. The idea of the irrigated plantation was initiated during the British Rule in Sindh. The dominant tree species of irrigated plantation are *Dalbergia sissoo, Acacia nilotica, Salmalia malabaricum* and *Eucalyptus camaldulensis*.

Current Management Practices of Riverine Forests

In order to generate/regenerate *Acacia nilotica*, the management objective of these forests was set, which is the most stable tree species with short rotation period and high economic value. *Acacia nilotica* takes a longer time to grow or regenerate in its natural succession as it follows a growth cycle that is preceded by *Tamarix, Saccharum* and *Populus euphratica* growth*. Acacia nilotica* regenerates when favourable conditions and new soil formation are created in the riverine tract (Panhwar, 2004). In order to speed up the process and grow Acacia in a shorter period, broadcast sowing is done in muddy waters during the recession of floods each year. Management practices have been simple and time-tested. The forest areas on attaining rotation period are marked for clear felling in the form of 64 ha (one compartment) or smaller coupes for felling operations. Clear felled coupes/areas and newly stabilized kacha areas are regenerated as inundation recedes after the peak flood season.

Population Pressure on Riverine Forests

Sindh is the second most urbanized and populous province of Pakistan. 72 percent of the population in Sindh province is dependent on agriculture which is mostly practiced in the central zone, which is resulted in thickly populated irrigated tracts and puts direct pressure on riverine forests. Due to the increasing population, the destruction of riverine forests has accelerated. All the biodiversity of riverine forests has been damaged, particularly trees are badly affected due to population pressure. In order to meet the need for domestic fuel, wood and livelihood, the indiscriminate tree cutting has exacerbated the condition of an already fragile ecosystem. People have also encroached upon forestland for agriculture purposes. More than 40,000 ha of riverine forests of Sindh have been encroached (Anon, 1986).

Such practices have resulted in the total destruction of ecosystem biodiversity, i.e., loss of wildlife habitat, soil degradation, the disappearance of associated fauna and flora, decrease in the gene pool and change of micro climate has changed over all environmental scenarios of the area. This has ended in decreasing the horizontal and vertical structures of riverine forests (Sirhindi and Keerio, 1987). The population living in Kacho area (Riverine Belt) and adjoining areas depend either directly or indirectly on the riverine forest resources. It is generally observed that the people living within riverine forests or their vicinity mostly depend on riverine forests for meeting their domestic needs. According to an estimate (IUCN, 1991), people living within 5 km of forests are dependent on riverine forests to the extent of 50 percent, whereas 30 percent needs of the people residing up to 10 km are met from riverine forests. In the past, Forest Department leased some portions in the riverine forests for developing and harvesting *Acacia nilotica*, however, people started to use these tracts for agriculture. Recently on Supreme Court orders, the lands have been reclaimed by the Forest Department, which now needs afforestation.

4.3.4 Fauna of Indus River Plains

Indus is one of the largest rivers in the world, originates in the Tibetan mountains, flows west across northern India and south through Pakistan. The Indus River plain is a vast expanse of fertile land, covering about 200,000 square miles (518,000 square km), with a gentle slope from Himalayan Piedmont in the north to the Arabian Sea in the south. The average gradient of the slope is no more than 1 foot per mile (1 meter per 5 km). Except for the micro relief, the plain is featureless. It is divisible into two sections, the upper and lower Indus plains, on account of their differing physiographic features. The upper Indus plain is drained by the Indus together with its tributaries, the Jhelum, Chenab, Ravi, Beas, and Sutlej Rivers.

The lower Indus plain, the course of which goes through Sindh province, is flat, with a gradient as slight as 1 foot per 3 miles (1 meter per 10 km). The micro relief is quite similar to that of the upper Indus plain. The valley of the Indus and its banks have risen higher than the surrounding land as a result of the aggradation work of the river; and though the river is lined with flood-protecting bunds along its course, the alluvial sands and clays of the soil tend to give way before floods, leading the river to change course frequently. The level surface of the plain is disturbed at Sukkur and Hyderabad, where there are random outcroppings of limestone. These gradients and different compositions of soil act together with the influence of temperature and other physical factors to create a habit for different species and when they combine, they form an ecosystem.

The Indus River is the home to one of the few species of freshwater dolphin worldwide, the Indus river dolphin (*Platanista gangetica minor*) and numerous species of distinctive fishes, many of which live in or migrate through the waters of the Indus River. The river Indus is the main source of freshwater in supporting the freshwater biodiversity as well as the freshwater supply. The other most significant fish species are found in Indus Plains are Hilsa (*Tenualosa ilisha*) which is anadromous (migrates from sea to freshwater) and the Barramundi (*Lates calcaifer*), a catadromous fish (migrates from freshwater to sea); but the movement of these species are restricted to below Kotri barrage.

The Indus is also home to a number of endemic fishes, including Indus baril (*Barilius modestus*), Indus garua (*Clupisoma naziri*) and catfish (*Rita rita*). Several snakehead fishes also live here, including giant snakehead (*Channa marulius*). The Riverine forest of Indus has highly valuable as wildlife habitats for mammals. Hog deer (*Axis porcinus*), Jungle cat (*Felis chaus*), fishing cat (*Felis viverrina*,) mangoose (*Herpestes edwardsi*, *H. auropunctatus*,) porcupine (*Hystrix indica*), hedgehog (*Hemiechinus spp*.), fox (*Vulpes bengalensis*) and Jackal (*Canis aureus*).

More than 150 species of birds were reported from the Indus River system, in which 4 are threatened, namely Marbled Teal, Sociable Lapwing, Greater Spotted Eagle and Long-tailed grass warbler. Two of them Greater Spotted Eagle and Long-tailed grass warbler were recorded near the barrage area. Beside these

4 some others are near threatened. During survey we have observed total 86 species of birds from the river and its associated areas.

The freshwater turtles found in the Indus River can be categorized in to 3 groups; the Brown River turtle (*Kachuga smithi*), The Indian Saw backed turtle (*K.tecta*) and Brahminy River turtle (*Hardella thurgi*). Soft Shell Turtles including Indian Flapshaped turtle (*Lissemys punctate*), Spotted pond turtle (*Geochlemys hamiltoni*), True Soft Shell Turtle including narrow headed soft shell turtle (*Chitra indica*), Indian soft shell turtle (*Trionyx gangeticus*). Among snakes found in the Indus River and its surroundings are; Chequered keel back snake (*Natrix piscator*), dark bellied marsh snake (*Xenochrophis cerasogaster*), striped river snake (*Enhydris pakistanica*), Indian python (*Python molurus, Dhaman Ptyas mucosus*), striped keel back (*Amphiosma stolata*), Indian cobra (*Naja naja*), these are inhabitants of muddy banks of rivers and canals, where thick grasses with other natural vegetation like Typha, Tamarix and Prosopis are available. The Indian monitor lizard (*Varanus bengalensis*) not only shares the same habitat but is also widely distributed in the surrounding areas.

4.3.4.1 Aquatic Fauna

A 170 km stretch of the River Indus between two irrigation barrages Guddu and Sukkur, is designated as a national protected area for Indus dolphins and is also known as Indus Dolphin Game Reserve. The total area of the reserve is 125,000 ha and has a 3 km buffer zone on the floodplains. This dolphin game reserve was also declared as Ramsar wetland of International Importance in the year 2000. According to recent estimates in 2011, the reserve holds a population of 918 dolphins. Whereas in 1975, only 150 dolphins were recorded from this reserve, signifying the conservation efforts carried out so far.

4.3.4.2 Avifauna

River Indus and its associated tributaries provide critical habitats for birds. Shallow and deep water habitat is the major attraction for waterbirds, both resident and migratory species. Vegetation on both sides of the river provides ample habitat to forest birds, and associated agriculture areas are the source of food for many species. The migration of water birds occurs in the north-south direction and vice versa. The birds breeding in central Asia migrate to various destinations in Pakistan, following the Indus valley and plains down to the Indus delta. This flyway of migratory birds is a corridor of international importance, the so-called “Central Asian – South Asian Flyway.” Large numbers of water birds and other birds like teal, pintail, mallard, gadwall and houbara bustard follow the Indus on their way towards the wetlands of southern Sindh, which are the most important major wintering grounds of migratory water birds in the region.

Ten wetlands of Sindh have been designated as Ramsar Sites to provide safe refuge to these migratory birds. Upstream and downstream of Sukkur Barrage and its pond areas also provide an ample opportunity for migratory birds to roost and use as a staging ground in winter, but due to its location within urban areas very small number of migratory birds can be observed in these areas. The shallow ponds are the attraction for ducks and waders, while deep water areas provide food for fish-eating birds. A total of 41 migratory bird species were recorded in the Game Reserve area. Since the barrage is Located within the city limits and continuous traffic movement causes disturbance. Due to this disturbance, it is not attractive to migratory birds. Out of recorded species from the Indus Dolphin Game Reserve, 13 are abundant to the area, 23 are common, 2 are less common and 3 are rare. Two threatened bird species, Greater Spotted Eagle (IUCN vulnerable) and Long-tailed grass warbler (IUCN Pakistan vulnerable), were recorded in the game reserve.

4.3.4.3 Ichthyofauna

The fish fauna of River Indus is poor as compared to other rivers of Asia viz. Brahmaputra, Ganges, Mekong, Salween, Hwang Ho and Yandtze. All are originated from the same geographical location of the Tibetan highland Plateau except the River Ganges. The length, drainage area, mean water discharge, slope, water temperature and sediment load of each river is variable, hence directly influencing the diversity of the Riverine ecosystem. Human activities threaten the productivity, diversity and survival of fresh water resources.

The fish fauna recorded from the river between Sukkur and Guddu barrages belongs to a family of carps (*catla catla, Aspidaoparia morar, chela cachius, cirrhinus reba, cirrhinus mirgala, L. calbasu, L. gonius and Labeo rohita)* sanke heads (*Channa marulias*), catfish (*mystus cavasius*), knifefishes (*Notoptreus. Chitala and N. chitala*), and prawns (*palaemon carcinus*). Most of the fish species are commercially important. None of these fish species are in the IUCN Redlist.

4.3.4.4 Invertebrates

Invertebrates are far more diverse and numerous in inland waters than plants. Apart from fishes, invertebrates form an important group. The important groups include sponges, flatworms, mollusks, polychaete worms, oligochaete worms, crustaceans, insects and numerous parasitic species in various groups. As on land, insects are the most diverse group of organisms in inland waters. Unlike terrestrial faunas, where beetles (Order Coleoptera) are the most diverse, flies (Order Diptera) appear to be by far, the most abundant group in inland waters. The invertebrate diversity of freshwater ecosystems of Pakistan is not properly documented.

4.3.5 Description of the Delta Ecosystem[20]

The Indus Delta is the landmark of Pakistan's coastline extending up to 150 km along the Arabian Sea. The Indus Delta occupies an almost 600,000 ha area located mainly in the Badin and Thatta districts of Sindh Province. It comprises 17 major and numerous minor creeks, an extensive area of mud flats and mangrove forests. The outer Indus Delta stretches South East of Karachi to the Indian border. In the south-east, mangrove forest brooders the vast salt flats at the western edge of Rann of Kutch. The Indus River and its tributaries bring an immense load of urban, industrial and agricultural effluents into the coastal wetlands. The declining water level and increasing salinity due to effluent disposal are major concerns.

The delta holds 97% of the total mangrove forests of Pakistan. Mangrove forests of the Indus Delta were notified as "Protected Forests" in 1958. Indus Delta mangroves, one of the largest tracts of arid mangroves in the world, used to cover an approximate area of 250,000 to 283,000 ha till the early 1980s, but the area dropped drastically to 160,000 ha in the 1990s. A study by WWF - Pakistan estimated the cover of the Indus delta mangroves around 73,000 ha in the year 2006. Historically, there used to exist eight species of mangroves which have declined to four species at present. Nearly 95% of the total mangrove cover in the delta is comprised of *Avicennia marina*.

Ecologically, the Indus Delta mangroves constitute a complex ecosystem with the following outstanding significance:

- Providing habitat, shelter and breeding ground for economically important marine plants, animals and migratory birds;
- Protecting coastline and sea ports from storms, cyclones and Tsunamis;

[20] Indus Delta – A Vanishing Ecosystem; WWF-Pakistan Indus for All Program

- Meeting fuelwood requirements of local communities and fodder for their livestock;
- Sustaining livelihoods of the coastal population of more than 1,00,000 people;
- Serving as a laboratory for marine research;
- Serving as a nursery for fish, shrimp and crabs, those spend at least a part of their lives in mangroves.

The Indus Delta and the surrounding habitats constitute diverse ecosystems, including; riverine forests, irrigated plains, fresh water and brackish wetlands. The land along the main course of River Indus is very fertile and supports a diversity of agricultural crops like wheat, maize, cotton, sugarcane, rice and a multitude of fruit orchards such as Bananas, mangoes, Date palm, Ber and Coconut palm. Fisheries include Indus Baril, Indus Garua, Golden Mahasheer and famous Palla fish.

Riverine forests along the banks of River Indus comprise species like *Tamarix* (Lai), *Prosopis cineraria* (Kandi), *Acacia nilotica* (Babur) and *Saccharum s*p. These forests provide an abode to a variety of birds, mammals, reptiles and amphibians. Keenjhar and Haleji are the two important freshwater lakes lying at the apex of the coastal region. These lakes are wildlife sanctuaries and have been declared as wetlands of international importance under the Ramsar Convention.

The riverine, irrigated and wetland ecosystems in the deltaic region are subject to several anthropogenic pressures causing severe damage to the coastal and inland ecosystems and their biodiversity values. Mangrove vegetation in the Indus Delta has declined significantly from the period between 1960 and 1990. Some of the important factors responsible for this degradation are:

- Reduced river flow
- Sea water intrusion
- Gradual increase in sea level
- Marine and coastal pollution
- Meandering and erosion of creeks

4.3.6 Description of Manchar Lake Ecosystem[21]

Manchar Lake (Figure 4.8) is the largest single wetland unit on the right bank of the Indus. Water enters the Manchar system from three sources: a) through surface run-off from hills, notably from Gaj Nai; b) from Indus, mainly via the Aral Wah and to a lesser extent by reversible flows through the Aral Lakhi; and c) from the Main Nara Valley Drain. Lake level varies in the total area. At an elevation of 113 ft above mean sea level, it is about 100 square miles or nearly 26,000 ha. The open water area also varies with lake level and typically occupies about 9,000 ha.

There are extensive belts of emergent reeds around the open water area. The most widespread plant appears to be the reed mace (*Typha angustata*), used as source material for constructing temporary houses and shelters. Other emergents include *Juncus articulates, Scirpus literalism*, and small patches of the true reed *Phragmites karka*. Emergent and water rooted plants spreading on the water surface include Nymphaea lotus, water lilies, and *Potamogeton pectinatus*. Submerged aquatic vegetation dominates the open water area filling the whole water profile from bottom to top.

[21] Environmental Conservation of Wetlands in Pakistan; Engr Dr Izhar-ul-Haq, Engr. M. Arshad, Javaid Zaheer Iqbal; Paper # 212 PEC Congress; https://pecongress.org.pk/images/upload/books/Paper212.pdf

The ecosystem of Manchar seems to be an extremely resilient one. The submerged vegetation survives and regenerates quickly after the lake dries out completely. Scattered phreatophytic trees, mainly *Tamarix dioica* and *Acacia nilotica* occur in some places within the overall wetland complex. Manchar Lake also supports a major fishing industry in addition to feeding/nesting areas for waterfowl.

Manchar Lake requires environmental management regarding the potential of their conservation, productivity and degradation. The impact of drainage disposal is an important factor.

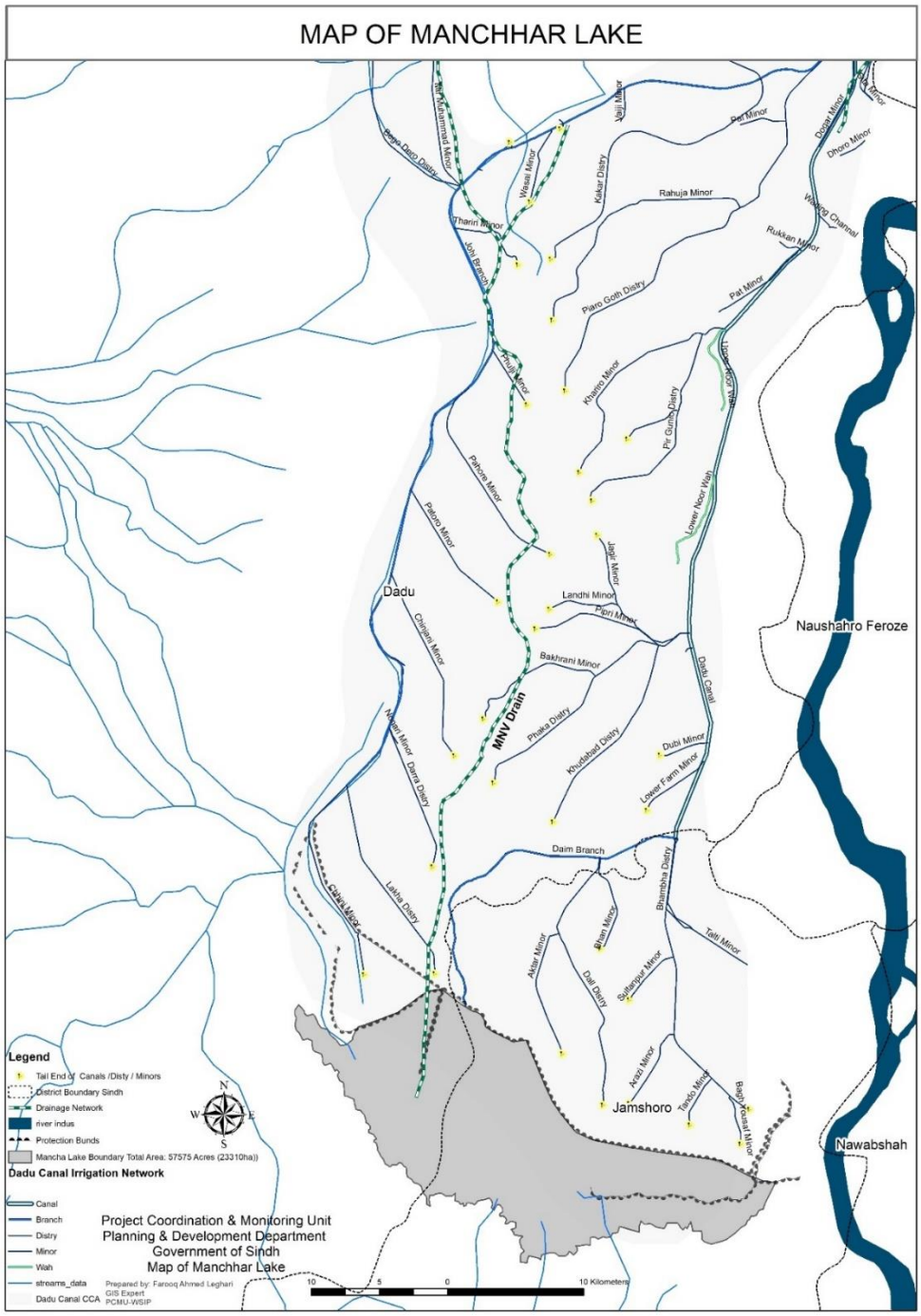


Figure 4.8: Map of Manchar Lake

4.4 Socio-Economic and Cultural Profile

4.4.1 Administrative Profile

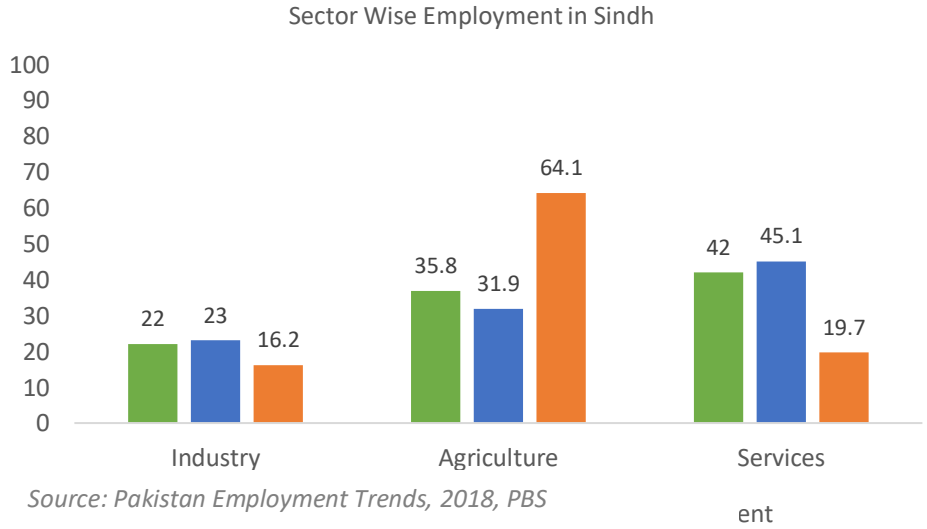
Administratively, Sindh consists of six divisions: Karachi, Hyderabad, Sukkur, Mirpurkhas, Larkana, Shaheed Benazir Abad. Each division comprises districts, of which there are a total of 29. These districts are further subdivided into 138 talukas. Karachi, the provincial capital of Sindh, is the largest city in Pakistan and the main contributor to the national Gross Domestic Product (GDP). The province is the most urbanized and industrialized in the country, with a mixed economy ranging from heavy industry and finance to commercial agriculture. It is also strategically located on the coast and carries 95 percent of Pakistan's external trade. Whereas financial and industrial sectors of the province are concentrated in the provincial capital of Karachi, the main agricultural base is found along the Indus River. The agriculture sector in Sindh contributes x % to GDP, and the sector's share in total employment is 35.8 percent.

While Pakistan clearly made substantial progress in lifting about 32 million people out of poverty between 2001 and 2015, progress has been heterogeneous and substantial inequality persists, especially between Pakistan's urban and rural areas. Social indicators in Sindh, as in the rest of Pakistan, have improved over the past decade but still lag behind those of comparable countries and regions. Urban Sindh is similar to the urban national levels for most indicators, but, in contrast, rural Sindh is well below rural national levels across most indicators.

4.4.2 Population and Demographics

Around 48 million people live in Sindh, out of which 52 percent reside in urban areas and the rest in rural areas[22]. The overall labor force participation stands at 50 percent, out of which male participation is 81.9 percent, and female participation remains at dismal 14 percent[23].

The share of agriculture in total employment stands at a significant 35.8 percent, which is less than the services sector but more than the share of the industry. Women's labor participation is the highest in agriculture, with 64.1 percent of the total female labor force employed in this sector[24].



Source: Pakistan Employment Trends, 2018, PBS

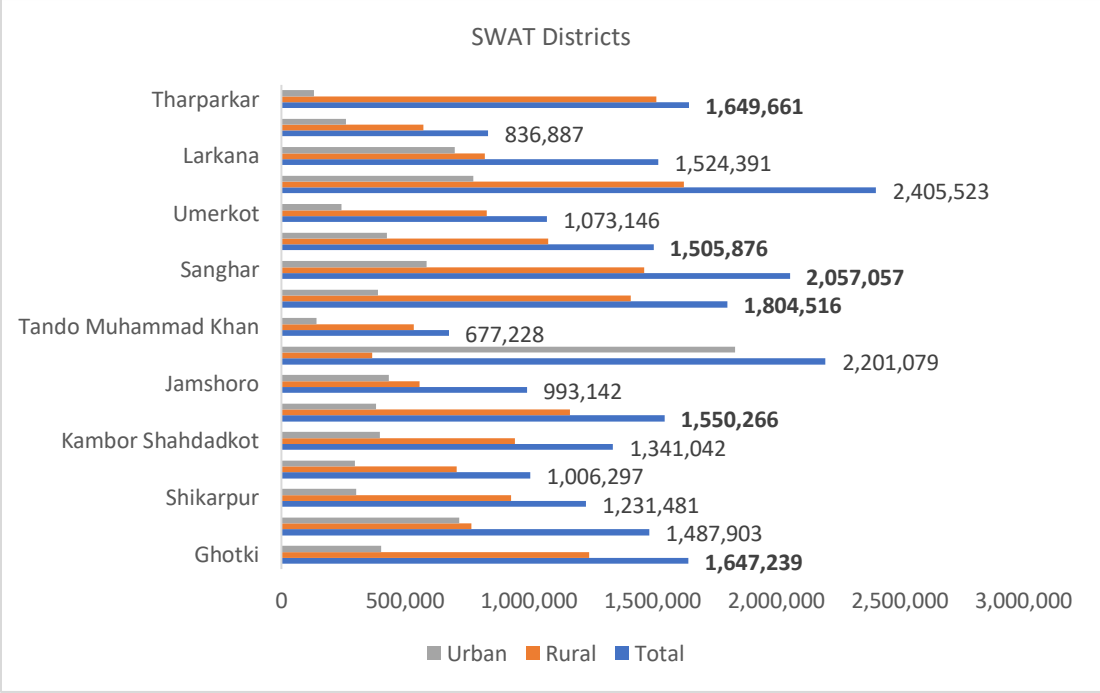
[22] Development Statistics of Sindh 2019, Sindh Bureau of Statistics
[23] Pakistan Employment Trends 2018, PBS
[24] Ibid

Figure 4.9: Sector-wise Employment in Sindh

Pakistan is currently in the midst of a demographic transition that is bringing a growing number of youth into the labor market. The declining fertility rate in Pakistan has created a potential demographic dividend, also in Sindh. This 'youth bulge' is an opportunity only if working-age individuals can be fully employed in productive activities. The working-age population in Sindh increased by about 800,000 people in net terms annually in the past few years. In contrast, between FY09 and FY15, the number of jobs in Sindh increased by less than 1 million, reflecting an average annual growth rate of just 1.4 percent[25].

Although the fertility rate has declined, Sindh's population is estimated to be growing at around 2.8 percent, faster than the national average of 1.6 percent, in part due to internal migration Inter-regional and inter-provincial migration are contributing to a rapidly growing population of young people in Sindh. Peri-urban communities are growing as migrants from rural Sindh and other parts of the country (who make up the bulk of the migrant population) pursue livelihood opportunities. However, labor market trends indicate that most jobs have been created in low productivity sectors/activities, and even if they provide a minimum level of income to often avoid poverty, they remain low-quality jobs providing little or no protection to workers against shocks. In addition, female participation rates are very low and there are large income disparities between rural and urban areas and across sectors

With SWAT's focus being on the rural areas, Figure 4.10 gives the details of the rural/urban divide of the population in the selected SWAT districts. Amongst the 17 SWAT districts, the ones with the highest rural population are Tharparkar, Mirpurkhas, Khairpur, Sanghar, Badin, Ghotki, and Dadu.



Source: Population and Housing Census 2017, Pakistan Bureau of Statistics (PBS)

Figure 4.10: District-wise Population in the SWAT Project Area

[25] Overview of Sindh Growth Strategy, August 2017, World Bank

4.4.3 Social Indicators

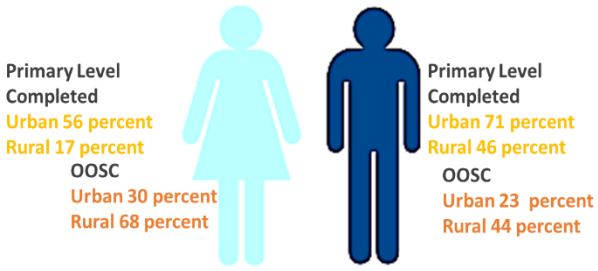
Sindh has the second-highest poverty rate in Pakistan. In 2015, the poverty gap between rural and urban areas was 33.6 percentage points in the province, whereas corresponding figures in Punjab and Khyber Pakhtunkhwa were 16.3 and 9.8 percentage points, respectively[26]. Within the rural poor, there is a sub-group of ultra-poor, particularly in the southern districts of Sindh. Being the most urbanized province in Pakistan, Sindh has relatively better access to tap water and better access to assisted births for expectant mothers, but other development indicators are not so positive. Inadequate public service delivery, from education, health, water and sanitation to poor infrastructure maintenance, degradation of land, lack of modernization, and improper maintenance of public assets, continue to thwart human capital accumulation and sustainable development for the people of Sindh.

The Multidimensional Poverty Index 2014-15 shows a high incidence of poverty in most of the project districts. The low levels of human development are also evident in agricultural practices and water delivery systems. In Sindh, average yields are lower than—as low as about 50 to 70 percent— the yields in other countries with similar agro-climatic and water conditions, such as Turkey, Egypt and, in the case of cotton, Uzbekistan[27]. Slow or stagnated progress in key social development indicators and the agriculture sector is likely to put the province at a higher poverty risk.

The sub-sections below give the socio-economic context against which SWAT will be implemented.

i) Education

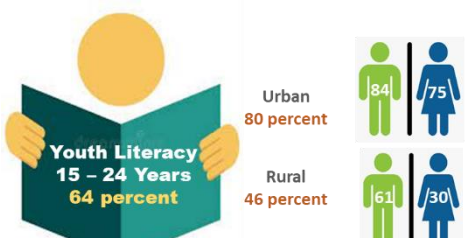
Human Development in Sindh is hampered by poor indicators in education. Primary enrolment and retention rates have only marginally improved in Sindh over the decade. They drop drastically at the middle and high school levels.



Source: PSLM 2018-19 Survey

Pakistan is reported to have the world's second-highest number of out-of-school children (OOSC), with an estimated 22.8 million children aged 5-16 not attending school[28]. The Pakistan Social and Living Standards Measurement (PSLM) 2018-2019 Survey states that 44 percent of OOSC belong to Sindh, with a disturbing majority of girls in rural areas. At the district level, school participation rates vary but are low for most districts. The indicators for primary education show an overall 49 percent of attainment with high urban/rural and extreme gender disparities.

[26] Pakistan@100 From Poverty to Equity, Policy Note March 2019, Silvia Redaelli. World Bank
[27] Overview of the Sindh Growth Strategy, August 2017, World Bank
[28] https://www.unicef.org/pakistan/education



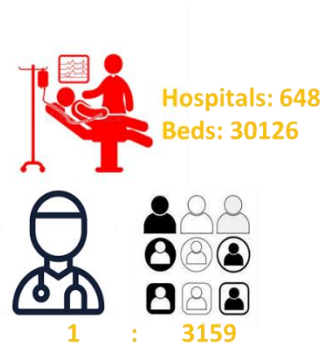
Source: PSLM 2018-19 Survey

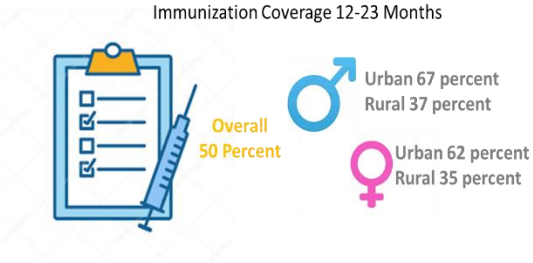
The persistent gender gap in both early and secondary levels of education is reflected in literacy too, with a low incidence of literacy in rural areas and the lowest amongst females.

Many factors discourage children and in particular girls, from attending schools. Inadequate access to water and toilets in schools are among the top reasons. The 2019 Profiling of Schools by Sindh Education and Literacy Department (SELD) shows that only 47 percent of public schools have water, 60 percent toilets, and only 13 percent have hand washing facilities.

ii) Health, Nutrition, and Food Insecurity

In Sindh, access to health care is skewed in favour of urban centers. Overall, the private sector takes the lead in providing health services. According to the Health Profile of Sindh 2016, Sindh Bureau of Statistics, there are a total of 648 hospitals, out of which 502 are private hospitals. 165 private hospitals are based in Karachi alone. This makes rural coverage extremely inadequate, which is further exacerbated by the non-availability of qualified staff.





Source: PSLM 2018-19 Survey

Young children from poor households are particularly exposed. Immunization, though improved, universal coverage remains low.

Average infant mortality in the province is 82 per 1,000 live births, but higher in rural areas. The chances of a child from a poor household in a rural area not surviving to its fifth birthday are 14 percent[29].

Malnutrition remains a serious issue in the province. More than four out of ten children under the age of five in Sindh are underweight (42 percent) and 17 percent are classified as severely underweight. Almost half of the children under five years (48 percent) are stunted or short for their age and one quarter (24 percent) children are severely stunted[30]. Micronutrient deficiencies remain overall high in rural areas of Pakistan. National Nutrition Survey (NNS) 2018 shows that almost one in eight adolescent girls is underweight. Adolescent boys are more affected than adolescent girls, with one in five underweight.

In Pakistan, Women of Reproductive Age (WRA) 15–49 years bear a double burden of malnutrition. One in seven (14.4 percent) is undernourished. At the provincial level, 22.6 percent of WRA[31] are undernourished, which is the highest in the country.

[29] Multiple Indicator Cluster Survey 2014, Sindh Bureau of Statistics
[30] Ibid
[31] NNS 2018

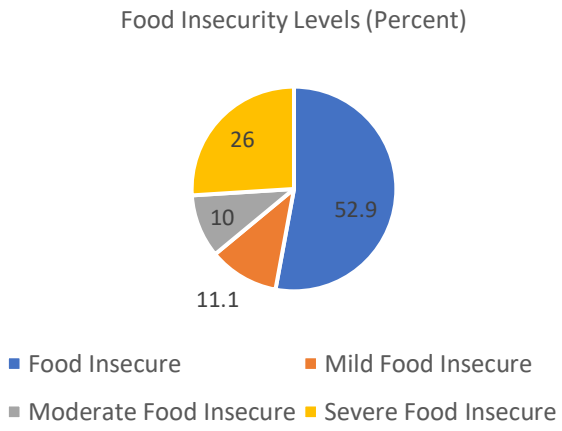


Figure 4.11: Food Insecurity Levels in Sindh Province

The same survey states that half of the households (63.1 percent) in Pakistan are "food secure" on the Food Insecurity Experience Scale (FIES) measure, however over a third (36.9 percent) remain food insecure. The highest number of "severe food insecure" households are in Sindh.

The Integrated Food Security Phase Classification (IPC) 2019 declares that all 8 drought-affected districts of the Sindh province have very high levels of acute malnutrition, making it a major public health problem. Districts included are Jamshoro, Kambar Shahdadkot, Badin, Dadu, Sanghar, Thatta, with Tharparkar and Umerkot experiencing extremely critical levels of acute malnutrition[32]. The major factors contributing to acute malnutrition include very poor quality and quantity of food, high food insecurity, poor sanitation coverage, and high incidence of low birthweight.

iii) Water and Sanitation

[32] http://www.ipcinfo.org/fileadmin/user_upload/ipcinfo/docs/IPC_Sindh_AcuteMalnutrition_2019MayDec.pdf

Sindh Multiple Indicator Cluster Survey (MICS) 2014 shows that 90 percent of the population has access to improved sources of drinking water. In urban areas, the majority have access to tap water, whereas in rural groundwater through hand pumps is the main source of drinking water. However, an improved source does not necessarily mean safe drinking water. 3 percent of households using drinking water indicated Arsenic contamination, and 39 percent indicated E.coli contamination in Sindh.

Overall 42 percent
Urban 67 percent
Rural 37 percent

Overall 37 percent
Urban 8 percent
Rural 69 percent

Overall 3 percent
Urban 1 percent
Rural 7 percent

Overall 8 percent
Urban 10 percent
Rural 7 percent

Other studies and reports claim that underground water that is supplied to many households in the province has turned brackish and hence unfit for human consumption. Lack of sanitation, excess withdrawal of groundwater, low precipitation, encroachments on drainage outlets, and use of pesticides, the release of untreated water from urban communities and industries are some causes behind the degradation of underground water.

Whereas 65 percent of the population of Sindh is using improved sanitation facilities, the use of flush is 29 percent in rural areas and 98 percent in urban. Non-flush systems stand at 47 percent, and no toilet facility is 24 percent respectively in rural Sindh, indicating severe sanitation issues.

In 2018 Saaf Suthro Sindh program was launched in 13 districts to make the province free of open defecation by 2025 under the Sanitation Policy 2017. The progress on this remains slow, as reported by various media sources.

4.4.4 Gender Analysis

The Global Gender Gap Report 2021 by the World Economic Forum (WEF) ranks Pakistan 153rd out of 156 countries on the gender parity index. Economic participation and opportunity remain severely limited for women because of their lack of educational attainment, poor health, little or no ownership/control of land and restrictive cultural norms. Though Employment Trends 2018, PBS on labor participation rate states overall female participation to be 22.8 percent, there is a growing debate that women's work in agriculture remains largely unrecognized, unpaid or underpaid. It is argued that their economic contribution is not properly reflected in official statistics.

A 2015 FAO publication, Women in Agriculture in Pakistan, states that in Sindh, women's involvement is actually more than men in crop production, livestock and dairy production, forestry and fisheries. Empirical evidence also suggests that women are increasingly getting involved in agriculture as men migrate to urban centers for more lucrative earning opportunities. This has been reaffirmed at length in **Rural Women in Pakistan, Status Report 2018** by National Commission on Status of Women, a statutory body.

Despite women's overwhelming participation in the agriculture sector of Sindh, the enabling environment for rural women remains abysmally weak to help them transition to more progressive means of farming.

The analysis below is a brief overview of rural women of Sindh. For the purpose of the ESMF of SWAT, the gender analysis section draws heavily from the findings and commentary of the Rural Women Status

Report, together with other sources and feedback of social mobilization personnel of SIDA and agriculture departments as well as consultations with different stakeholders.

i) Labor Participation in Agriculture

As stated in the previous section, women's labor participation is the highest in agriculture. In Pakistan, overall, only 1 percent of women are engaged in entrepreneurship. Typically, rural women are engaged more in dairy and livestock management. However, their actual work is more than what is generally estimated. The Status Report claims, "Rural women's multidimensional work that spans productive, reproductive, care, and community and social work does not get captured as the lines between work for economic gain, and work as an extension of household chores (livestock management) and on the family farm are blurred. *Augmented labor force participation*, which takes all the above into account, raises rural women's participation rates to 52 percent and even as high as 60 percent when the right questions are asked of the women themselves."

ii) Division of Labor and Monthly Wages

Most rural women are involved in livestock management. In agriculture, their participation is characterized by low-paid work that is usually repetitive and very time-consuming with low returns. The average wage of skilled agricultural, rural women is PKR 5,811[33] , which is significantly lower than men. The FAO report on Women in Agriculture mentions that rice and cotton cultivation in Sindh jointly account for more than one-third of women's annual agricultural activities. Women's participation is the highest in cotton production in Sindh as this is considered to be a women-led activity. They are involved in various primary and secondary cotton operations, including weeding and thinning, applying manure, hoeing, cotton cleaning, stick removing and storage of cotton seed for domestic use.

iii) Land Ownership by Women

Estimates of landholding by women in Sindh vary from 2 percent to 20 percent. Whatever the case might be, decisions regarding the use of land and its management are usually made by male relatives, despite women's growing but unrecognized role in agricultural productivity.

iv) Technical Skills

The Rural Woman Status Report 2018 notes that there are 165 TVET centers in Sindh with 1650 females enrolled, that too in vocational training courses. Not a single woman is enrolled in a three-year technical diploma as compared to 22,610 males. The majority of rural women are trained as tailors and another 17 completed embroidery and knitting courses.

In the past, social and market development projects by public and private sectors included skills enhancement for women in agriculture, but data is scattered and limited to project documents. Such kinds of projects have happened in rural pockets with varying degrees of success. They have yet to be evaluated for successful scale-up

v) Health Issues Due to Bad Agricultural Practices

Pakistan Agricultural Pesticides Ordinance 1971 and Pakistan Agricultural Pesticides Rules 1973 regulate the distribution and use of pesticides. However, it is a known fact that farmers in Pakistan use excessive chemical sprays on their crops. Occupational exposure to pesticides and their associated impact on human

[33] Labor Force Statistics 2017-2018

health is well-evident. Skin irritation, headache, nausea, gastroenteritis, general weakness, dizziness, vomiting, blisters, fever and stomach pain are some of the common symptoms seen due to pesticide exposure.

In rural Sindh, pesticides are typically sprayed manually with limited protective clothing. Excessive spraying is usually reported in cotton-growing areas. As this particular crop is dominated by women, it is possible that female cotton pickers' health is more at stake due to their long hours in cotton fields. They are also exposed to pesticides in the form of inhaling in a polluted environment when the adjacent fields are sprayed. Although regulations exist ensuring training and the use of plant protection equipment by farm workers including pickers, however, such regulations are rarely practiced. Off-field, pesticides are not stored properly and empty containers of pesticides used for carrying water are commonly observed.

vi) Role of Women in Water Management

Women are crucial stakeholders in irrigation management. As users, their decision on water delivery schedules, the quantity and quality of water and the type of water infrastructure constructed are crucial because women's daily household activities and well being of their livestock depend on it. Despite women's significant role in agriculture, such as in crop production from sowing to harvesting stages and livestock rearing, they have traditionally been excluded from decision-making in irrigation management. Reasons other than restrictive social norms include timings of irrigation water, which is often released in very early hours. Even if women attend FOs meetings, their opinions may not be considered (Junaid et al., 2019).

Then historically too, irrigation remained exclusively male-dominated. Prior to the 1990s, the irrigation network along the Indus Basin involved large-scale public works with little participation by the community. These were carried out exclusively by male engineers and the male labor force. To date, not a single female engineer is employed in the irrigation department. As the system moved more towards devolution and participatory management of irrigation works, water rights became generally associated with land ownership. This put women at a disadvantage. In the past two to three decades, irrigation development projects have tried to be more inclusive of women but limited their scope to components covering mostly domestic use of water and their associated civil works. In Sindh, there are Women Farmers Groups (WFGs) that are formed by female water professionals working at SIDA that provide women farmers with introductory trainings. However, these WFGs are not recognized by any law like the Sindh Water Management Ordinance (SWMO).

In 2017 Strengthening Participatory Organization, a local NGO conducted a policy gap analysis of the Sindh Irrigation and Drainage Authority Act 1997 and SWMO 2002 where it found that women were not part of any structure such as AWBs, FOs, or WCAs despite their being directly involved in agriculture and water management at the local level**.** In January 2021, the SWMO made it mandatory to include women in different tiers in Water Management Institutions like AWBs and Farmer Organizations under SIDA. This has created a legal and institutional space for women to participate, but there is a growing need to fully understand the invisible role of women in agriculture and the associated use of water, especially for livestock and agriculture.

vii) Infrastructure with Improved Safety

Women in Pakistan collect water from various sources such as hand-pumps, bore-wells, tankers, etc. There are safety, health, and accountability issues impacting women in this regard. One, several of these collection areas are not well lit with no security and safety measures in place. Fetching water during the night can be daunting as it puts women at risk of violence. Two, the physical characteristics of the

surrounding terrain for water sources may increase the difficulty of collecting water or access to washing ghats/platforms are located far from the villages or in isolated areas. Carrying it over long distances can have lasting health effects (IFAD, 2012). Third, as there are no monitoring mechanisms, these water collection areas and/or washing ghats/platforms take a long time to be fixed if damaged. Hence, it is important for women's recommendations to be included in infrastructure designing.

4.4.5 Gender-Based Violence (GBV)

i) Legal Framework

Though gender-based violence is widespread and grossly underreported/documented, in recent years, the Government of Sindh has passed progressive laws for women's rights. These pro-women laws have been a success in criminalizing honour killings, penalizing the holding of *'jirga's and panchayats'* bartering women for settling criminal and civil liability in the form of *'badleh-e-suleh'* (in exchange of compromise), criminalizing customary practices of exchanging women and girls into marriages as *'Watta Satta'*, popularly known as *'Daiwat*' in Sindh, prohibition of forced marriages and protection of women against harassment at workplace. The most significant laws enacted in recent years are i) Domestic Violence (Prevention and Protection) Act 2013 ii) Sindh Child Marriages Restraint Act 2013.

Domestic Violence Act 2013 includes a broader and gender-sensitive perspective by acknowledging not only physical but psychological abuse as criminal acts in the law. The law provides a wide range of remedies to victims of domestic violence, including protection orders to restrain the perpetrator of domestic violence from harassing the complainant, entering her residence or place of employment. The law further allows protection for senior citizens, differently able-bodied persons, mentally disabled persons, and transgenders.

Sindh Child Marriages Restraint Act has raised the legal age of marriage for women from 16 years to 18 years. It has also made child marriage a non-bailable, non-compoundable and cognizable offence. The provincial monitoring committee can take suo moto in case of violations of law.

Another noticeable act has been the Sindh Commission on the Status of Women (SCSW) Act in 2015 that created a provision for establishing a provincial chapter of SCSW. The body works for promoting social, economic, political and legal rights of women in Sindh. The SCSW primarily operates as a watchdog body and provides input on legislative and policy matters.

ii) Institutional Framework

There are several departments and agencies that have been working to assist women in development and safeguarding their rights. Though the outreach is limited and needs to be expanded, but the acceptance of the need for addressing serious women's rights violations is gradually increasing. Below is a brief description of organizations working on the prevention of GBV:

- **Women' Development Department** is a small wing in the Planning Department of the Government of Sindh. The WDD manages a series of women crisis centers, women complaint cells and a toll-free helpline for women
- **Women Crisis Centers:** There are four Women Crisis Centers run by the WDD in Karachi, Hyderabad, Shaheed Benazirabad and Jacobabad. The crisis centers provide relief to women in the form of legal, medical and counselling support and were envisioned to provide shelter to women for a brief period of 24 to72 hours

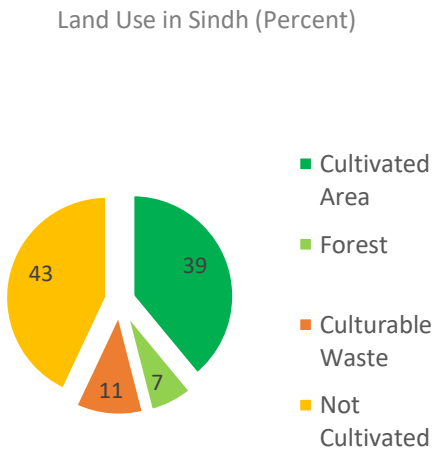
- **Shelter Homes**: There are at present eight functioning shelter homes in Sindh which are run either by the Government's Social Welfare Department or local NGOs. Of these, four are located in Karachi and there is one Dar ul Aman (shelter home) each in Sukkur, Larkana and Hyderabad, and a private shelter home in Hyderabad
- **Child Protection Units and Children Shelters:** There are 29 child protection units across Sindh that facilitate child victims. There are several children shelter homes being run by the Social Welfare Department and private civil society organizations, including SOS and Sweet Homes
- **Women and Human Rights Help Desks**: Women and Human Rights Help Desks with different levels of functionality exist in different police stations across Sindh. The Sindh Police is in the process of expanding these to make them more effective and efficient and be able to better cater to female victims of violence
- **WhatsApp Group and Online Help**: A WhatsApp group comprising of senior police officials and members of civil society also focuses on SGBV cases and provides prompts to the police for quick action in critical cases cutting through reporting and procedural red tape
- **NGOs** such as Lawyers for Human Rights and Legal Aid (LHRLA), Legal Aid Society (LAS) and War Against Rape (WAR) also provide legal aid to different groups of people. Private and civil society has played a critical role in augmenting the range of protection and essential services provided by the state. The SCSW is in the process of developing a prototype for a seamless protections system that works towards a more effective, integrated and streamlined service delivery

4.5 Agriculture Sector in Sindh

i) Land Use in Sindh

The total land area in Sindh is 14.1 million hectares (ha). The cultivated area (includes net area sown and fallow) is 5.18 million ha, forest area is 1.03 million ha, culturable waste 1.60 million ha (*Culturable Land includes land available for cultivation, but not cultivated during the last five years or more in succession including the current year for some reason or the other), and land not available for cultivation 6.29 million ha.

Out of the total cultivated area, the net area sown is 2.38 million ha, whereas fallow land is 2.80 million ha, which is the highest in the country[34]. Shortage of water, water logging and salinity are primary reasons for land being fallow. Table 4.7 illustrates land use status in project districts



[34] Land Utilization Statistics 2013-2014, PBS

Table 4.8: Land use in the Project districts

District	Cultivated Area	Net Area Sown	Fallow	Percent Fallow
Ghotki	237,068	185,326	51,742	21.8
Sukkur	162,090	73,347	88,743	54.75
Shikarpur	112,440	98,664	13,776	12.25
Jacobabad	109,256	95,322	13,934	12.75
Kambar Shadadkot	311,677	85,844	225,833	72.46
Khairpur	266,661	190,291	76,370	28.63
Dadu	318,681	141,404	177,277	55.63
Sanghar	387,677	212,909	174,768	45.08
Larkana	45,436	49,410	3,947	8.67
Mirpurkhas	253,393	141,363	112,030	44.21
Umerkot	296,663	72,995	223,668	75.40
Tando Allahyar	105,502	66,304	38,198	36.20
Hyderabad	57,566	29,469	28,097	48.80
Tando Muhammad Khan	143,297	50,940	92,357	64.45
Jamshoro	88,891	64,210	24,681	27.76
Tharparkar	352,197	154,542	197,655	56.12
Badin	566,859	279,294	287,565	50.73
Source: Land Utilization Statistics 2017-18, Department of Agriculture				

ii) Sindh's Share in Major Crops

Major crops grown in Sindh are rice, cotton, wheat, and sugarcane. Wheat occupies the largest cropped area (2,693,000 acres), followed by rice (2,047,000 acres) and cotton (1,512,000 acres)[35]. Large landowners dominate the production of these major crops in Sindh. These crops are heavily regulated and receive extensive government subsidies through price support structures.

Minor crops that are grown include bananas, mangoes, citrus, vegetables and oilseeds. Livestock rearing is also an important livelihood strategy for many farming communities in Sindh, which is largely managed by women. Table 4.9 below shows the share of Sindh's in the above-mentioned crops in the total production systems.

Table 4.9: Major Crops and their Production in Sindh

	Overall Production in Pakistan (Tons)	Production in Sindh (Tons)	Share in Production (Percent)
Wheat	25076.1	3639.5	14.5

[35] Agriculture Marketing Information Service 2018-2019

Rice	7449.8	2850.5	38.3
Sugarcane	82127.8	20611.9	24.75
Cotton	2031.83	642.23	31.6
Source: Agriculture Statistics of Pakistan 2018-19			

iii) Agro-Ecological Zones

Currently, the irrigated areas of the province are divided into three major agro-ecological zones where main cultivation takes place. Two of the zones are further divided into sub-zones.

Current Agro-Ecological Zones (Figure 4.12)

Zone A: Rice/wheat zone on the right bank of river Indus (upper Sindh). It covers districts Shikarpur, Jacobabad, Larkana and the northern *taluka* of Dadu district. There are six main canals (three from the Guddu Barrage and three from the Sukkur Barrage) feeding Zone A, three of which are perennial

- *Zone A1:* Covers the districts of Shikarpur, Larkana and the northern *taluka* (Mehar and Khairpur Nathan Shah) of Dadu district. Dadu, Rice and NWC Canals of Sukkur Barrage irrigate the zone. Rice is the major crop of the zone, followed by wheat while *Rabi* pulses and oilseeds are *dubari* crops. Wheat, sugarcane, oilseeds, *Rabi* and *Kharif* vegetables as well as guava and dates are also grown under the command of Dadu and NWC perennial canals
- *Zone A2* covers the regions of Jacobabad and Larkana districts. Here the soil is richer in clays than the soil of Zone A1, potentially more fertile and less prone to salinity. However, it is slower to drain. The major crop of the zone is rice in *Kharif*, followed by wheat, *Rabi* pulses and oilseeds as *dubari* crops

Zone B: This covers the left bank of river Indus in districts Ghotki, Sukkur, Khairpur, Naushero Feroze, Sanghar, Hyderabad, Mirpurkhas and Tharparkar. The entire zone is Indus flood plain. Saline soils are encountered throughout the zone. The problem tends to be more acute in the east of Ghotki and Sukkur Districts (Zone B1) and in eastern Sanghar and Mirpurkhas District (Zone B2). Cotton and sugarcane are the main *Kharif* crops of Zone B1. Oilseeds like sesame and sunflower are also being cultivated increasingly in the zone due to water scarcity. Wheat, oilseeds and vegetables follow the Kharif crops.

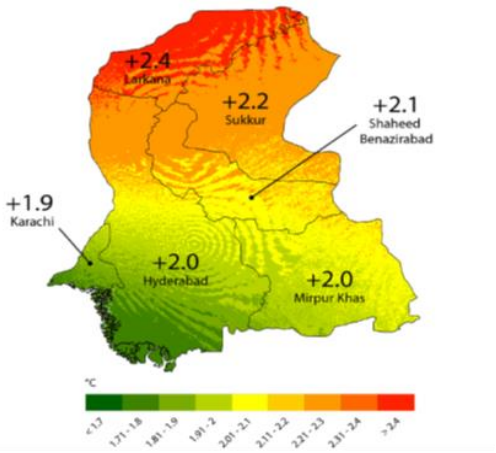
- *Zone B2* lies in the command area of four perennial canals (Rohri, Khairpur Feeder East and West and Nara) of the Sukkur barrage covering districts Khairpur, Naushero Feroze, Sanghar, Hyderabad, Mirpurkhas, and Tharparkar. The major *Kharif* crops of the zone are cotton and sugarcane, followed by sesame, sunflower, and groundnuts. In the *Rabi* season, wheat is the major crop followed by rapeseed, mustard, sugarcane, *Rabi* vegetables, and onion. The zone also produces mango, banana, chiku, papaya, citrus, and jujube

Zone C: This consists of lower Sindh and is fed from the Kotri Barrage. It includes the Indus Delta and covers the districts of Thatta, Karachi, Badin (except taluka Matli and northern parts of Tando Bago) and taluka Tando Mohammad Khan of District Hyderabad. Zone C is more saline than any other area in Sindh. Salinity and waterlogging are most severe in this zone, where drainage is difficult due to an absence of a gradient

In addition to the above three zones, there are two more zones in Sindh. Zone D is a desert area in the east of Sindh, and Zone E is the western hilly zone. Main agricultural activity is, therefore, concentrated in Zones A, B and C.

With climate change, these zones are also experiencing changes in weather patterns with projected Increases in temperatures, leading to longer summers and shorter winters. However, farming practices largely remain nonaligned with predicted changes in the climate and its possible implications for the forced maturity of crops and lower yields. An FAO study on Climate-Smart Agriculture for Disaster Risk Reduction in Sindh lays down a comprehensive strategy as to how Sindh can better gear itself by adopting more climate-resilient practices and redefining the current agro-economic zones to adjust to increasing in temperatures and for more efficient use of water.

Projected Change in Temperature by 2050



Source: Climate Smart Agriculture for Disaster Risk Reduction, Sindh, FAO

iv) Production Systems by Season

Pakistan's production systems are defined by the two growing seasons. The cropping season from October to December generically referred to as *rabi*, is when winter crops like wheat are sown and later harvested between March and April. The summer crop-sowing season, called *kharif* is typically longer, starting in February with sugarcane, March to May for cotton, and June to July for rice. The harvesting of these crops begins in September and continues up to December, except sugarcane, which may extend to March or later. Orchards and other trees are planted from February to March or during the monsoon season from July to August. Table 4.10 presents major and minor crops grown in the project districts

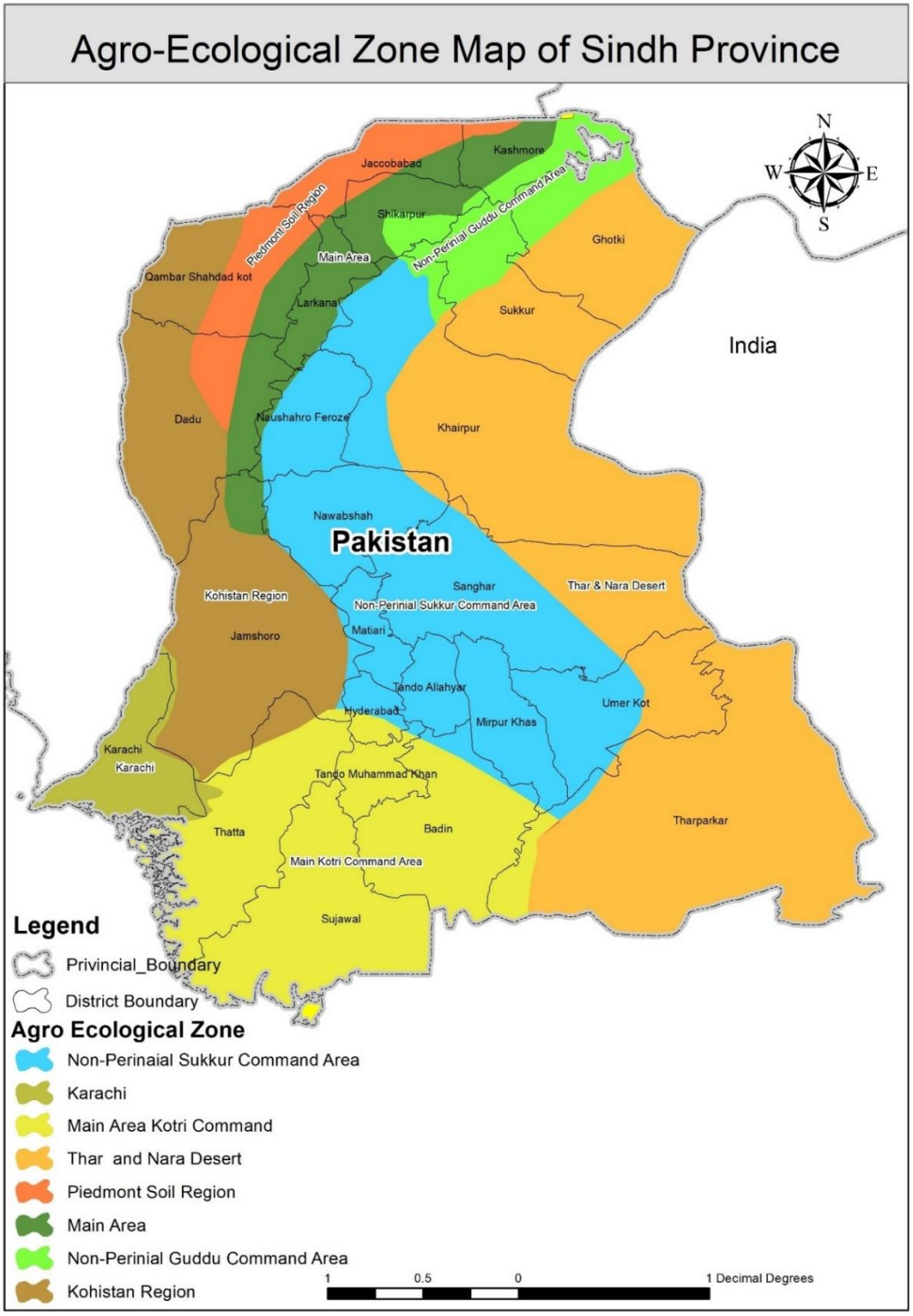


Figure 4.12: Agro-Ecological Zones of Sindh

Table 4.10: Major Crops grown in Project Districts

Districts	Major Crops		Minor Crops	
	Kharif	Rabi	Kharif	Rabi
Ghotki	Cotton, Sugarcane	Wheat, Sugarcane	Fodder, Vegetables	Fodder, Vegetables
Sukkur	Cotton, Sugarcane	Wheat, Sugarcane	Fodder, Vegetables	Fodder, Vegetables
Khairpur	Cotton, Sugarcane	Wheat, Sugarcane	Fodder, Vegetables	Fodder, Vegetables
Jacobabad	Rice	Wheat	Fodder, Vegetables	Fodder
Larkana	Rice	Wheat	Fodder, Vegetables	Fodder
Qambar Shahdadkot	Rice	Wheat	Fodder, Vegetables	Fodder
Sanghar	Cotton, Sugarcane	Wheat, Sugarcane	Fodder, Vegetables	Fodder, Vegetables, Oil Seed
Shikarpur	Rice	Wheat	Fodder, Vegetables	Fodder
Dadu	Cotton	Wheat	Fodder, Vegetables	Fodder, Vegetables
Umerkot	Cotton	Wheat	Fodder, Chili, Vegetable	Fodder, Oil Seed
Mirpurkhas	Cotton, Sugarcane	Wheat, Sugarcane	Fodder, Chili, Vegetable	Fodder, Vegetables, Oil Seed
Tharparkar	Fodder	Nil	Nil	Nil
Tando Allahyar				
Hyderabad	Cotton, Sugarcane	Wheat, Sugarcane	Fodder, Vegetable	Fodder, Vegetables, Oil Seed
Tando Muhammad Khan	Rice, Sugarcane	Sugarcane (still crop)	Fodder, Vegetable	Fodder, Vegetables
Jamshoro	Cotton	Wheat	Fodder, Vegetable	Fodder, Vegetables
Badin	Rice, Sugarcane	Sugarcane (still crop)	Fodder, Cotton, Vegetable	Fodder, Vegetables

v) Land Holding

Rural poverty in Sindh is rooted in the asymmetrical distribution of land, which is an important asset in an agricultural economy. Land holdings are categorized as small, medium and large based on their acreage. The average farm size in Sindh is small. Official Government of Sindh definitions of small and medium producer are used to present the baseline data. For crops and horticulture following are the categories:

- Small Holder 1 to under 12.5 acres
- Medium Holder 12.5 to 49 acres
- Large Holder 50 acres plus

Agriculture Census 2000 shows that the majority of 82 percent of farms in Sindh are small, 15 percent are medium, and 2 percent are large. However, overall the total farm area under small holdings is 37 percent. Whereas medium to large holdings covers 39 percent and 23 percent of farm area, respectively.

Table 4.11 shows details of land holding in the project districts of SWAT. The highest numbers of farms are in Khairpur. In the Upper Sindh districts, the overwhelming number of farms is small.

Table 4.11: Land Holding in Project Districts

		No. of Farms Percent			Farming Area Percent		
Districts	**Total Farms**	**Small**	**Medium**	**Large**	**Small**	**Medium**	**Large**
Ghotki	94305	90	9	1	58	35	8
Khairpur	122395	95	4	1	74	21	5
Sukkur	37195	88	10	1	46	26	27
Shikarpur	32718	86	12	2	44	40	17
Jacobabbad	33570	86	11	2	45	33	22
Kambar Shadadkot	39946	92	6	1	67	24	7
Dadu	57404	91	9		70	26	4
Larkana	41745	93	6	1	59	21	22
Tando Allahyar	33339	75	20	5	28	39	33
Hyderabad	16641	65	31	4	23	54	22
Jamshoro	27054	69	14	1	52	36	13
TMK	14809	81	13	6	36	23	42
Badin	72701	67	28	5	25	51	24
Sanghar	73149	75	21	4	30	44	26
Mirpurkhas	74308	80	16	5	23	37	39
Umerkot	90617	85	13	2	30	38	31
Tharparker	35529	69	27	4	31	49	20
Source: Agriculture Census 2010							

vi) Incomes and Living Standards of Farmers

A small farmer usually grows rice on fifty percent of his land holding in the rice belt area and makes approximately PKR 25,000 to 27,000 per acre income[36]. As for wheat, too, a small farmer is likely to farm half his land and makes about PKR 14,500 to 17,200 per acre[37] in the cotton belt area. Growing rice in the cotton belt area is prohibited.

Tenant/sharecroppers (landless farmers) are dependent on their agreements with landowners for different seasons, crops, and shares, as the case may be. But mostly, two patterns are common (i) half basis (ii) quarter basis. The inputs and outputs are distributed between both parties as per the agreement. Agreements are mostly unwritten but are witnessed by some respectable persons of the area. Mostly, landowners provide residency to tenants free of cost on their farms and support in emergencies. Tenants usually belong to the same caste as landowners. Incomes of tenants depend on the number of acres cultivated by them. If a tenant has more family workers and has their own equipment, he is able to cultivate more land. If he has fewer workers and no equipment, he cultivates less area, hence earns less. Landless farmers have been reported to face evictions on unproven charges.

The living standards of small, medium and large farmers vary based on their location along the irrigation system divided into the following three categories as presented in Table 4.12.

Table 4.12: Living Standards of Farmers in Sindh

	Small Farmers	**Medium Farmers**	**Large Farmers**

[36] Bi-Annual Crop Season Report Rabi 2017-18, Management and Development Center Hyderabad
[37] Ibid

Head	Comfortable	Rich	Very Rich
Middle	Poor	Comfortable	Rich
Tail	Below Poverty	Poor	Comfortable
Source: Consultations with PCMU			

vii) Agriculture Extension Services

The agricultural extension system in Sindh is fragmented and obsolete, with poor capacity of public service providers. District level extension services exist, but are usually accessible to those with references and approach in the department. They are mostly provided through face-to-face methods by the extension agents. The ratio of public extension agents to farmers is 1: 6,881[38]. There are private sector players too, but because there is no coordination among private and public service providers, the end result is disjointed standards and practices. Whereas large farmers have the means to procure extension services on their own, smaller farmers have to fend for themselves.

The key constraints related to extension services in Sindh are:

- Limited use of ICT-based technologies for agricultural information and service provision
- Lack of information on modern agricultural practices
- Absence of a centralized and reliable agricultural management information system
- Low capacity of extension workforce in public sector
- Limited outreach of private sector extension and advisory services providers
- Common use of sub-standard, banned, and counterfeit input supplies

Under the Sindh Agriculture Growth Project (SAGP), Directorate General Agriculture Extension Sindh has established an ICT Extension Services Center to provide online extension services to the farming community. Key activities of the center include Farmer Helpline, Text and voice SMS, Facebook live program, android applications, YouTube channel, Mobile Cinema Shows, youth Agriculture and IT Hybridization internship.

viii) Agriculture Subsidies

The majority of small farmers in Sindh are in no position to secure key agriculture inputs on their own. Rural finance remains imperfect for small landholders to invest in advanced technologies, which is manifested in low yields. Despite this, there is no direct agricultural subsidy on inputs, while indirect subsidies on fertilizers, land leveling, water management are available, to which tenants are usually equal beneficiaries. In 2014 the Department of Agriculture started implementing Sindh Agriculture Growth Project (SAGP), under which some free inputs were given to farmers in selected commodities.

ix) Markets for Agriculture Produce and Issues

Vegetable markets are present in all districts, but Hyderabad and Karachi are considered high-end markets for vegetables and fruits. Brokers and middlemen are spread out all over, and farmers sell their produce to them. Sugarcane is a profitable crop, mostly grown by large farmers and purchased by sugar mills. The government offers support prices for wheat procurement. It is observed that mostly large farmers sell their wheat to the food department, whereas targeted support price hardly reaches small- and medium-

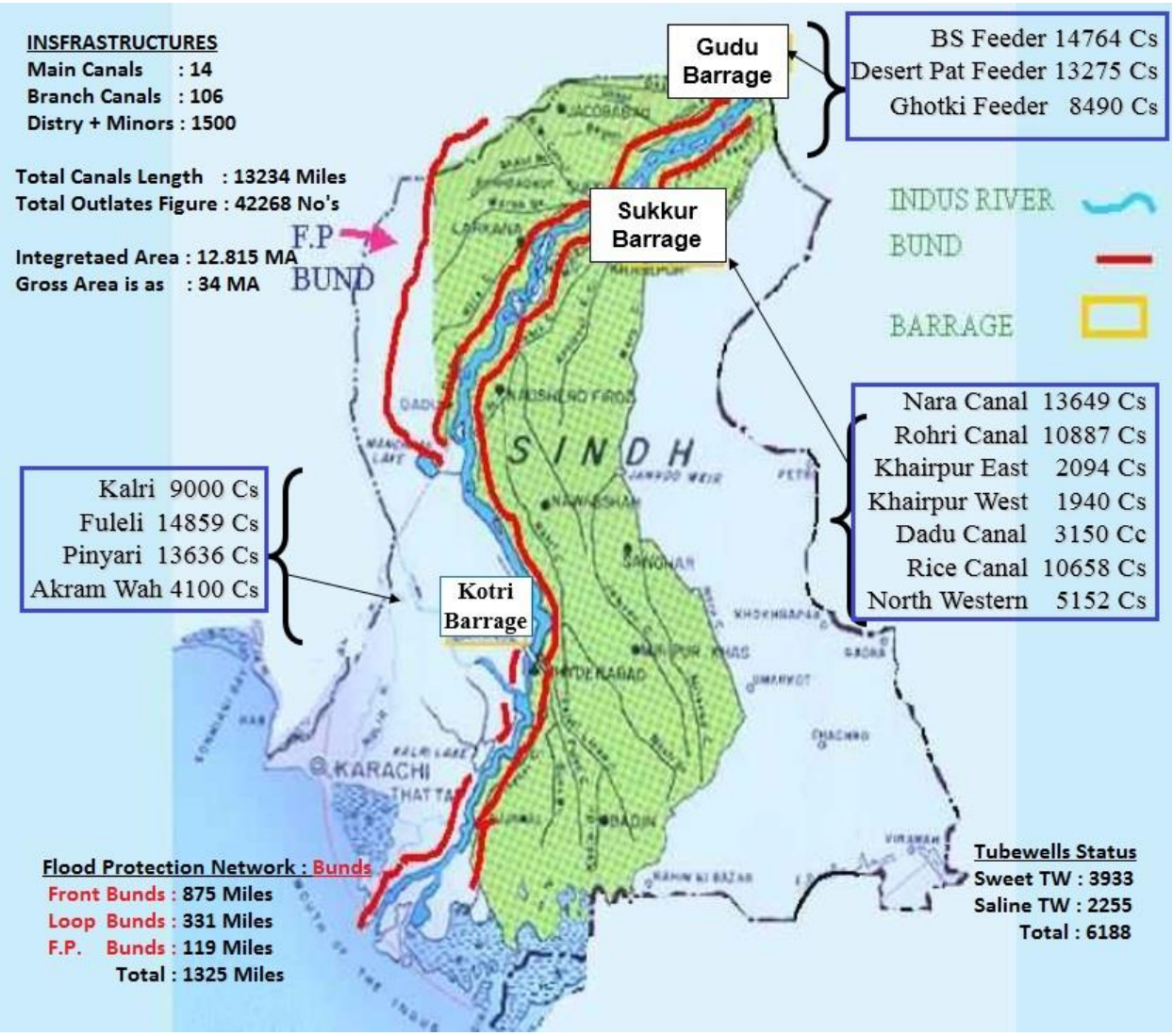
[38] https://www.ictagrisindh.gov.pk/

sized growers. Many local *chakkis* also buy wheat from small farmers. A large number of raw cotton is reported to be sold directly to middlemen, brokers, and factories.

Though some agricultural commodities are thought to have a competitive advantage, but poor value chains and lack of agriculture business services, in general, have hindered in realizing the true market potential of the agriculture produce in Sindh. Poor market information systems result in either commodity shortages, resulting in soaring prices for consumers or oversupply, reducing incomes of farmers. Wasteful harvesting practices and high post-harvest losses result in food loss and reduction in quantity and quality of food in the production and supply chains from producers to the market. With limited on farm storage capacity agricultural produce are stored openly or on private premises, exposed to contamination and diseases. Unacceptable levels of aflatoxins are present in agricultural produce, because of which foreign markets in the past had put bans on agricultural imports, like chilies from Pakistan. SAGP had been designed with the goal to address major issues in productivity and competitiveness of small and medium producers in commodities of dairy, rice, onions, chilies and dates value chains to sustain sectoral growth.

4.6 Irrigation Sector in Sindh

i) Irrigation Network



Source: Irrigation Department, Government of Sindh

Sindh is mainly a dry region and is relatively more arid than the upcountry areas. Irrigation is therefore critical for agriculture in the province, as the contribution of rain towards crop water requirements is negligible. About 75 percent of the agricultural land of Sindh is cultivated through a controlled irrigation system.

The three major barrages on the Indus River in Sindh divert approximately 48 million acre-feet (MAF or 59.0 billion cubic meters- BCM) of water annually to the 14 main canal commands in the province. These canal systems have an aggregate length of 13,325 miles (21,445 Km), which serve a gross command area (GCA) of 14.391 million acres (5.8 million ha). There are about 42,000 watercourses (tertiary channels), which have an aggregate length of about 75,000 miles (120,000 km). Over half of the Sindh command area is supplied from Sukkur Barrage through four left-bank and three right-bank

canals. Guddu supplies around one-quarter of the Sindh command area, and Kotri supplies less than one-quarter.

There are 13 existing surface drainage systems in Sindh, which serve a total area of over 6.2 million acres (2.5 million hectares), which is almost half of the irrigated area and has an aggregate length of about 3,811 miles (6,133 Km). In addition, there are two sub-surface drainage systems, which serve an area of 0.10 million acres (0.04 million ha), which is 2 percent of the irrigated area. However, the Sindh drainage system is neither contiguous nor integrated, and waterlogging is widespread due to high surface water delivery.

ii) Water Sharing System and Distribution to Farms: *Warahbundi*

The irrigation system in the Indus basin is primarily based on a gravity system and has historically remained supply-limited. Each farm within the command area of the irrigation system is allocated certain time slots for receiving water based on the size of land owned. This is called *Warahbundi,* a practice of predetermined water rationing. Accordingly, for each watercourse, the total delivery of water is established, and the size of the outlet is determined. Each farm is to receive its share after a certain time period. In most cases, this period is defined as one week or 10 days. However, inequities exist in the volumes supplied, which are further compounded by mismanagement of allocation and water shortages due to droughts. Farms at the head of the system receive higher supplies compared to tail-enders. The location factor at the distributary/minor and watercourse levels in terms of head, middle and tail positions is manifested in farm incomes, where tail-enders are unable to make good incomes.

iii) Institutional Reforms in Irrigation

The Sindh Assembly passed the SIDA Act in 1997. As a result, the Sindh Irrigation and Drainage Authority (SIDA) was established in 1998, followed by one Area Water Board (AWB) on Nara Canal in 1999. As part of the reforms, AWB for each canal command area was to be developed. However, SIDA's role could not evolve as enshrined in the 1997 Act. In 2002 another attempt was made to decentralize the Irrigation Department by promulgating Sindh Water Management Ordinance (SWMO). The process involved the formation of four distinct bodies: SIDA, AWBs based on the command area of all 14 canals originating from three barrages of the province, FOs that would control water management (including the collection of *abiana*) within the command area of the tertiary channels, and the Watercourse Associations (WCAs) at the watercourse level. Table 4.13 presents institutional arrangements of the above-mentioned bodies at different levels as envisaged in SWMO 2002.

Table 4.13: Management Structure of Water Delivery Organizations in Sindh

Body	Main Responsibilities	Management Structure
SIDA	This institution is to look after the overall Irrigation and Drainage operations in the province as well as control, operate and manage all three barrages in Sindh and the drainage system assigned to it, including spinal drains and the inter-AWB drains	Five members nominated by the Government of Sindh, including the Chairman and four academicians ii) Five elected members – one each from FOs receiving water from Guddu and Kotri Barrages, and three from amongst the FOs receiving water from Sukkur Barrage. iii) Six Ex-officio members including ACS (Dev), Secretaries I&P, Agriculture and

		Finance Departments, the Provincial Coordinator NDP and the MD SIDA
AWBs	The AWBs will be responsible for operation and maintenance of the canal, branch canals, and related infrastructure under the AWB jurisdiction, including the drainage system as well as the collection of their share of *abiana* from respective FOs	The AWBs are to consist of 12 members: i) A nominated member from SIDA, ii) A nominated member from local Chamber of Agriculture, iii) Four elected representatives of the FOs, iv) Four academicians as co-opted members, v) Naib Nazim or his nominee of the Taluka having largest area within AWB jurisdiction – Ex-Officio, and vi) Director of the AWB - Advisory Member and Secretary
FOs	The FOs are to be responsible for the operation and maintenance of their respective minors/distributaries as well as collection of *abiana*, equitable water distribution within minors is the responsibility of the FO apart from carrying out the flood protection works and drainage and sewerage system conferred on it	**The Board of Management** of the FO is to consist of nine members as follows: a) Members elected by the General Body: this includes the chairman, vice-chairman, secretary, treasurer, and two elected members. It is required that three members out of the above six should be the representatives of WCAs or DBGs at the tail-end of the distributary or Minor or small farmers. **Ex-Officio, Advisory and Co-opted Members are to include** Nazims of Taluka having the largest cultivable command area, Senior most staff member of FO, Technical Expert from Irrigation & Drainage
WCA	Watercourses are the joint property of the Irrigation Department and landowners. Traditionally, they have been informally managed by farmers. The Ordinance calls for the establishment of WCAs to institute joint operation and management of the watercourse and making it an integral and functional part of the overall irrigation water management system	WCAs are to be formed at the grassroots level and include at least two-thirds of landowners and leaseholders on that particular watercourse. They need to be registered with their relevant FOs. WCA is to consist of a Chairman, Secretary and a Treasurer. The WCA is responsible for the operation and maintenance of the watercourse as well as equitable distribution of water within the command area of the watercourse
Drainage Beneficiary Group (DBG)	DBGs could be formed by non-elected farmers who are interested in undertaking voluntary, proactive and self-help initiatives in drainage. The DBG could be formed if at least two-thirds of the number of users of the drainage system, whether landowners or	The DBG is to be registered with the relevant FOs. Its Board is to consist of three to five elected members from amongst the members of the WCA and one or more appointed officials without voting rights

	leaseholders agree to form it, and the boundary of the area under DBG falls in the catchment area of the drainage system.	

These reforms were expected to be completed by 2005 as per SWMO 2002. However, even with the passing of the latter ordinance, a dual institutional arrangement continues to exist in the irrigation sector. The irrigation department has an irrigation minister, whereas SIDA is a corporate body. To date, other than Nara AWB, 2 more AWBs have been established in Ghotki Feeder and Fuleli/Akram Wah canals. The three AWBs on the left bank are responsible for the operation and management of the 4 canals, where farmers are represented on the Boards. Farmer Organizations (FOs) were established at the distributary/minor canals level to take over the responsibility of O&M and to collect water charges under formal irrigation and drainage management transfer (IDMT) agreements.

As of now, SIDA controls only 30 percent of the irrigation system through four out of 14 main canals. This amounts to 1.837m ha of total irrigated area in Sindh as per the Water Sector Improvement Project (WSIP) Phase-I document. Amongst the 3 AWBs, Nara AWB and FOs have demonstrated better institutional and successful participatory management practices. In other AWBs, the management of distributaries and minors is marred by weak FOs and their poor capacity to contribute to the O&M of the irrigation works under their control.

Whereas success stories of distributary/minor management by FOs are reported in Nara AWB, the overall participatory framework continues to lack in the irrigation sector that has a direct implication on crop production and yields. It needs strengthening by creating more AWBs, strengthening existing ones, and ensuring the participation of female and landless farmers at different tiers.

iv) Issues in the Irrigation Sector

Improper *Abiana*: Water delivery charges or *abiana* does not reflect supply and demand. *Abiana* rates bear no relation to the amount of water consumed. Water is supplied based on overall agricultural land but charged only for crops cultivated as reported by farmers, who tend to underreport. Typically, very low flat rates are charged per acre for crops. This imposes no costs for excessive water use or for crops that may be thirstier than others. Rice and cotton, for instance, are both charged at the same rate, even though rice requires 60 percent more water than cotton. This prevents users from paying for the actual usage and discourages the adoption of water conservation techniques.

Wasteful Use of Water: Inefficient cropping patterns and agronomic practices result in wasteful water use. This is particularly high in the rice-growing districts of Larkana, Dadu, Shikarpur, Kambar-Shahdadkot, Jacobabad, and Kashomore districts in upper Sindh, while Thatta, Badin, and Tando Muhammad Khan are major areas in lower Sindh. Water is also wasted because of poor scheduling. Canal deliveries are not made as per crop water requirements. In the *Kharif* (summer crop) season, when river supplies are plentiful, the water deliveries in canals often exceed crop requirements. There being few escape structures in the canal system, once water is diverted in a canal, it is delivered to watercourses and to the farms, regardless of whether the crops need it or not. This practice in some areas results in flooding problems during extreme monsoon

Inadequate O&M: Drainage infrastructure is in a state of disrepair and rapid deterioration due to utilization beyond design capacities, tampering of control structures, damage to canal banks caused by human and cattle trespassing, and inadequate routine and preventive maintenance

Water distribution Inequities: Poorly maintained watercourses and distributary/minor canals have the highest incidence of illegal diversions. Direct outlets (DOs) from main and branch canals further

contribute to inequitable distribution due to withdrawals in excess of authorized discharges. DOs do not have regulating structures and receive water even during periods of water shortage when normal outlets receive water by rotation. This accentuates the inequities in water distribution by concentrating water shortages in the tail reaches of channels, sometimes forcing rotation to the distributaries/minors even when full design discharge is available at the head of the main canal and river

4.7 Cultural Environment

Sindh has a historical individuality of its own. The Indus valley civilization is the farthest visible outpost of archeology in the abyss of prehistoric times. The project districts are rich in the cultural heritage of ancient times and of the early Islamic period, reflected through specimens of art, craft, literature, and architecture.

The prehistoric site of Kot Diji in Sindh has furnished information of high significance from about 2,500 BC. One of the most developed urban civilizations of the ancient world that flourished between the year 2,500 BC and 1,500 BC was in Moenjodaro. The people were endowed with a high standard of art and craftsmanship and a well-developed system of quasi-pictographic writing, which despite ceaseless efforts, still remains un-deciphered. The remarkable ruins of the beautifully planned Moenjodaro town, the brick buildings of the common people, roads, public baths and the covered drainage system envisage the life of a community living happily in an organized manner. The Arab rule brought Sindh within the orbit of the Islamic civilization. Ruins of Mansura, the medieval Arab capital of Sindh (11 km southeast of Shahdadpur) testify to the grandeur of the city and the development of urban life during this period. The old tombs and buildings in Thatta, Sehwan, Hyderabad, Sukkur and the excavations at Bhambore, Brahmanabad and Debal bear ample evidence that these places fostered some of the best cultural values.

Sindh is a repository of varied cultural values. Sindh's cultural life has been shaped, to a large extent, by its comparative isolation in the past from the rest of the subcontinent. As a result, the people of Sindh developed their own exclusive artistic tradition. Their arts and craft, music and literature, games and sports have retained their original flavour. Sindh is rich in exquisite pottery, variegated glazed tiles, lacquer-work, leather and straw products, needlework, quilts, embroidery, hand print making and textile design. Melas (fairs) and malakharas (wrestling festivals) are popular. Falconry, horse and camel breeding and racing are characteristic pastimes. Bullock cart racing and cockfighting are also typical of the province.

Sindhi is the native language and is spoken widely, particularly in rural areas. However, other languages like Urdu, Balochi, Saraiki and Punjabi are also spoken in certain areas. The Sindhi language has a pure Sanskrit basis and is closely related to the ancient Prakrit. Its alphabet contains fifty-two letters.

Today the province of Sindh is an amalgam of various sub-continental and middle-eastern cultures. It was especially after the independence that millions of Indian Muslims from the minority province migrated to Sindh and made it their permanent home. The amalgamation of their culture into the rich Sindhi traditions has progressively assumed a new complexion.[39]

[39] https://sindh.gov.pk/dpt/History%20of%20Sindh/historyofsindh.htm

The Directorate General of Antiquities, Government of Sindh, has listed 137 archaeological sites in the province. Out of these, 22 are located in the project districts, as presented in Table 4.14:[40]

Table 4.14: Archaeological Sites in Sindh

S #	Name of Sites/ Monuments	Location
1	Taheeman Ja Qubba / Bohi Ja Qubba	Deh Sanghi, District Shikarpur
2	Lakhmir-ji-Mari	Deh Nang, Opposite Police Post Sehwan, Dist. Jamshoro
3	Damb Bhutti (Mound)	Deh Narpivar, Taluka Sehwan, Dist. Jamshoro
4	Masum-ji-Bhuti (Mound)	Deh Kerchat Mahal, Dist. Jamshoro
5	Kohtrass Bhuti	Deh Kirchat Tehsil Kohistan, Dist. Jamshoro
6	Otham-jo-Bhutti	Deh Kerchat, Taluka Mahal Kohistan, Dist. Jamshoro
7	Sehwan Fort	Taluka Sehwan, Dist. Jamshoro
8	Fort Rani Kot	Mahal Kohistan, Deh Rani Kot, Dist. Jamshoro
9	Mound Amri	Village Amri, Right side of Indus Highway Kotri, Dist. Jamshoro
10	Tomb of Yar Muhammad Khan Kalhora and Mosque	Deh Khudabad, Dist. Dadu
11	Jamia Mosque	Village Khudabad, Dist. Dadu
12	Piyaro-ji-mari (Mound)	Deh Shouk, Taluka Johi, Dist. Dadu
13	Ali Murad Village Mound	Deh Behlil Shah, Taluka Johi, Dist. Dadu
14	Loham-jo-Daro	Deh Palah, Dist. Dadu
15	Pandhi Wahi (Mounds)	Village Wahi Pandhi, Taluka Johi, Dist. Dadu
16	Archaeological site of Mohenjo Daro	
17	Jhukhar Mound	Taluka and Dist. Larkana
18	Tajjar Building	Larkana
19	Tomb of shah Baharo	Near Fruit Market at Larkana City
20	Square Tower	Larkana
21	Three groups of Mounds known as Dhamrao jo Daro	Badah Mehar Kucha Road, Dist. Larkana
22	Daran Ji Takri	Kohistan, District Qmaber -Shahdad Kot

The most important of these sites is Moen Jo Daro, which is a UNESCO World Heritage Monument. Moen Jo daro is located in the Larkana District of Sindh, Pakistan, on a Pleistocene ridge in the middle of the flood plain of the Indus River Valley, around 28 kilometers from the town of Larkana. The ridge was prominent during the time of the Indus Valley Civilization, allowing the city to stand above the surrounding plain, but the flooding of the river has since buried most of the ridge in deposited silt. The site occupies a central position between the Indus River and the Gharr-Hakra River. The Indus still flows to the east of the site. But the riverbed of the Gharr Hakra on the western side is now dry. Mohenjo-Daro was most likely one of the largest cities of the ancient Indus Valley Civilization (after Harappa. Another important IVC site, which is located to the north of Mohen Jo daro in Punjab. Pakistan).

[40] https://antiquities.sindhculture.gov.pk/index.php/sites/list-of-archaeological-sites-in-sindh

Besides the above, there are 1690 buildings that are protected under the Antiquities Act 1975. Eight of these buildings are located in the project districts, four each in District Naushehro Feroz and Qamber-Shahdad kot. List of these buildings are given in Table 4.15.

Table 4.15: Heritage sites in Sindh

S. NO.	NAME OF BUILDING	ADDRESS	REASON FOR ENLISTMENT AS HERITAGE
1	Ganoo Mal Mention / House Of Muhammad Ashraf Malik	Taluka Kandiaro District Naushahro Feroze.	Architectural Value
2	Old Hostel Of Madarisa School	Noshahro Feroz Town Distt: Noshahro Feroze.	Architectural Value
3	Mehrab Masjid Halani	Near National Highway Halani, Taluka Kandiaro District Noshehro Feroz	Architectural Value
4	Pitambar Hostel	Govt: Boys High School Kandiaro, Taluka Kandiaro District Noshoushro Feroz	Architectural Value
5	Sain Rasta Ram	Shaikh Mohalla Kambar,	Architectural Value
6	Haji Marri Jo Qubo	Qubo Saeed Khan, Village Ghazi Khan Chandio Taluka Qubo Saeed Khan	Architectural Value
7	Dhinghan Jo Daro	Dhing Shareef, village Dhing, Taluka Shahdadkot	Archaeological & Architectural Value
8	Ghafoor Shah Tomb	Qubo Saeed Khan, Village Ghazi Ghafoor Shah, Taluka Qubo Saeed Khan,	Architectural Value

5 Screening of Projects, Potential Impacts and Risks

This chapter presents an overview of potential activities involved during the construction and operational stages of the proposed subprojects and identifies typical environmental and social impacts and risks. The objective of this exercise has been to develop clear guidelines for the preparation of ESIAs, ESMPs, and other detailed studies for the proposed projects. Procedures for the preparation of RAPs of the subprojects are given in the RPF. An Environmental Code of Practices (ECPs) has also been prepared to address all general construction-related environmental and social risks of the proposed subprojects and presented in **Annex 1**.

5.1 Screening of Impacts Associated with Soft Interventions

The typical environmental and social impacts and risks likely to be caused by the proposed developments due to the soft interventions are given in **Table 5.1**.

Table 5.1: Potential E&S Impacts and Risks due to Soft Interventions

Project Activities	Risk & Impacts	Mitigations
Component 1: **Water Resources Management**		
Component 1.1: Water Resources Management and Irrigation Policy and Institutional Reforms		
– Formulate new Water Management Legal Framework	– Revised legal framework and bylaws may create ambiguity in the roles and responsibilities of different departments and may also create coordination issues and inter-departmental conflicts. – Provincial government is reluctant to bring policy reforms and strengthen the regulatory framework. – Policies developed under the project might fail due to a lack of adaptation to local conditions. – Departments other than irrigation and agriculture might not be fully involved	– Take the provincial government, especially top management of irrigation, agriculture and other relevant departments onboard from the very outset. – Policies and tools to be developed based on extensive consultations. – Written consent of all relevant departments to be obtained for all documents in the framework – Awareness-raising within the various departments (other than agriculture and irrigation) about the relevance of this activity with their mandate.
– Transform the Irrigation Department into an Irrigation and Water Resource Management Department.	– Lack of commitment, competency of Irrigation department, SIDA and/or AWBs. – Restructuring and capacity-building plans may have gaps or loopholes. – Create temporary disruption in ongoing projects as departments are reorganized, staff reshuffled, and reporting lines changed	– Carry out a detailed assessment of capacities and roles of various wings within the Irrigation Department, SIDA and AWB – Provide clear roles and responsibilities for all functions in the new proposed structure of the IWR Department – Develop resource management plans for ongoing projects

Project Activities	Risk & Impacts	Mitigations
– Comprehensive Water Pricing Reform	– Lack of meaningful engagement of all stakeholders for reform on Abiana system. – Exclusion and discrimination of vulnerable groups during consultations. – High prices/ Abiana set to be paid after reforms may affect the small farmers. – Political opposition and protests over water pricing reforms – Pricing reforms might be challenged in the court of law – Risk of COVID-19 spread during consultations with stakeholders.	– Consultations with users' representative organizations, political parties, media, and members of the judiciary to agree on fair policies – Legal coverage and endorsement by the provincial assembly of the new laws – Develop effective PR strategy to counter anticipated protestations Ensure representation of all stakeholder groups through careful planning in the form of SEP – Consider slab system for Abiana based on landholding size, crops grown, and actual water use. – Observe all precautions for COVI-19 as prescribed by the Government and WHO. – Pricing reforms to be based on proper research studies, conducted through well-known research entities using the foolproof methodology and taking into account all water users of the canal systems
Component 1.2: Sindh Strategic Water Plan and Specialized Studies		
– Preparation of a "Strategic Water Plan" on a periodic basis (every 5 to 10 years)	– Lack of meaningful engagement of all stakeholders for the preparation of the plan. (If it can be changed into "impasse/conflict/disagreement among stakeholders on water needs of different user groups/sectors and allocation for them) – Elite capture by land owners and/or industrialists to ensure disproportionate water allocation for them and/or infrastructure development for their own benefits. – Strategic Water plan preparation frequency may need to be changed due to the climate change effects. – Risk of COVID-19 spread during consultations with stakeholders.	– Ensure meaningful consultations and apply the concept of FPIC – Ensure representation of all stakeholder groups through careful planning in the form of SEP – Unbiased analysis of major water users, their existing and projected needs, and capacity to pay for water delivery services – Observe all precautions for COVI-19 as prescribed by the Government and WHO. – Vetting of the strategic plan by a broad-based panel of national and international experts from different relevant fields. – Align the strategic water management plan with the upcoming Sindh Climate Change Strategy
– Preparation of provincial-wide	– Climatic unpredictability may render the "Drought Risk	– Align the strategic water management plan with the

Project Activities	Risk & Impacts	Mitigations
"Drought Risk Management Plan", as an ancillary to the Strategic Water Plan.	Management Plan" ineffective or need revision earlier due to changing scenarios. – Lack of coordination between departments and lack of interest/understanding by some departments. – Social factors and communal relationship/conflicts not reflected in DRM Plans which can impact materialization of the plan into action	upcoming Sindh Climate Change Strategy – Awareness raising within the various departments (other than agriculture and irrigation) about the relevance of this activity with their mandate. – Engage Community Based Leaders and Influencers in consultations and development of mitigation action plans and activities
– Updating the Right Bank Master Plan.	– Elite capture on water resources of Right Bank. – Intra and inter-community conflicts on the use of canal water. – Communities on the Right Bank are more divided along caste lines and characterized by regressive feudal customs	– Comprehensive stakeholder engagement – A proper GRM to be developed as part of the master plan – Engage Community Based Leaders and Influencers to derive win-win solutions through mediation by a neutral party
Component 1.3: Hydro-Agro Informatics Program		
– **Development of System** (including collection, digitization and standardization of available data sets; development of central data repository; web-based portal; knowledge-based data tools).	– Instances of fake collection or errors in data entry – Lack of engagement of all stakeholders for standard data management and sharing plan. – Lack of competency or coordination for data management and systems maintenance within the departments. – Procurement of poor-quality ICT hardware/ equipment, i.e., servers, hard drives etc., for the central data repository. – E-waste issues – Software tools developed or procured may be inadequate to serve the purpose. – The database/ website is not user-friendly. – Misuse/hacking of the website.	– Institute robust and multi-level quality controls and back cross/checking systems for data collection and entry – Hire/train relevant personnel for data and system management – Develop and implement relevant e-waste procedures – ICT equipment procurement through standard and transparent procedures
– **Monitoring *& Data Generation*** (Remote Sensing and GIS; Canal Flow and Level Monitoring; Groundwater	– Usage of inappropriate or uncalibrated tools or malfunctioning of tools used for monitoring. – Lack of competency of staff engaged for monitoring, record	– Select monitoring points on the scientific basis – Hire/train relevant personnel for data and system management – Develop and implement a user-friendly system for data generation

Project Activities	Risk & Impacts	Mitigations
Monitoring; Water-Environmental Monitoring; Agrometeorological Monitoring).	keeping, and data entering in web portal or server. – Interdepartmental/interprovincial frictions due to data inconsistencies. – The conflict between departments on ownership of monitoring network. – Selection of inappropriate monitoring points. – Tempering of meters (that is, if any physical meters are expected to be installed)	and recording, and assign specific staff for this purpose in each relevant department – Clearly define roles and responsibilities
Component 3.1: Pilot Smart Subsidy Programs		
– **Agricultural Subsidies and Investments**.	– Grievances regarding bonus payments for growing crops with low water requirements – Delay in developing or extending all essential business support services necessary for effective value chains – Farmers reluctant to shift to new crops – Inadequate marketing and delivery channels or poor returns on investments might discourage small farmers from continuing with water-thrifty crops.	– Strengthen the grievance management systems – Develop a strong extension service program for selected value chains – Develop a robust marketing strategy for new crops

5.2 Potential E&S Implications of Sindh Agricultural and Water Policies

Potential E&S implications of the Sindh Agricultural Policy (2018 to 2030) and proposed draft Water Policy are given in Tables 5.2 and 5.3, respectively.

Table 5.2: Potential E&S Implications of Sindh Agricultural Policy

Policy Objective	Action Points	E&S Implications
Agriculture growth	Increase credit flows into crop through the development of new instruments, such as warehouse receipts	Whereas warehouse receipt systems are to address issues of storage, pricing, and distribution. However, warehouses tend to be located in high production areas belonging to medium to large farmers. Warehouse receipts are likely to benefit large and medium farmers but might not be easily accessible to small or sequestered farmers.

Policy Objective	Action Points	E&S Implications
		Due to low literacy rates, warehouse receipts are perceived as complicated and tedious process by small farmers who tend or are likely to rely on middlemen for immediate payments and other credit facilities. Middlemen who are also traders can discourage small farmers from using new instruments due to their sway on small/tenants/sharecroppers. The warehouse system also relies on standardization. Given current grading and phytosanitary issues in agricultural commodities and other transaction costs, the shift to the compliances of the new system might be slow and discourage farmers from using the new financial instruments and systems. They might continue to rely on old methods WHR system involves diverse actors: public authorities, farmers, processors, and banks. Conflicts can arise in cases of warehouse defaults, liquidation or competing claims. Farmers, especially, small ones might be at greater risk and disadvantage. There is a chance that they might not be adequately compensated.
	Simplify the procedure for land use, land transfer and lease for the establishment of rural enterprises	Land use and transfer need to be voluntary, and appropriate safeguards need to be ensured that there are no forceful possessions or evictions for commercial establishments/enterprises. Clashes and conflicts can arise over the transfer and lease of disputed properties or to which there are multiple claimants
	Reform the legal and regulatory system governing agriculture and livestock marketing. Redesign the price support system into one that promotes competition and enhances transparency, market integration and competition, such as electronic trading and direct sales to private markets and supermarkets	Changes in regulatory and pricing systems, especially those related to deregulation and free markets, can be resisted and lead to political protests and social unrest. Large farmers also hold political clout in their rural constituencies; they can disrupt the regulatory, pricing and market integration efforts if they feel they are undermining their own monetary, social and political standing. Secondly, some agricultural commodities are highly and disproportionately subsidized by government schemes. Landless farmers are employed in preparing and harvesting activities. Moreover, a substantial part of agriculture services and offshoot businesses employs landless labor around these agricultural commodities (transportation. Loading, unloading). Changes or withdrawal in subsidies can impact tenant/sharecropping farmers' incomes if yields are not high.
	Attract private investors – both domestic and foreign- into rural	Whereas export markets offer better returns, but they can also become suddenly volatile. This can make farmers,

Policy Objective	Action Points	E&S Implications
	areas through fiscal incentives; a better legal/regulatory environment for commercial farming and for medium and large scale storage including cold chain and agro-based industry; and promoting public-private partnerships, including through the establishment of agro-processing parks and special zones in major production clusters	especially small farmer groups, monetarily vulnerable to sudden price swings in case of dependency on exports for certain agricultural commodities There is a possibility that it might lead corporates to concentrate control in both upstream and downstream processes. Such a situation can lead to faceoff situations between businesses and farmers, creating social, political, and economic disruptions Agro-processing parks and facilities require land acquisition. In some cases, owners or tenants of ideal site areas might be coerced to vacate or sell their land. The establishment of new processing zones can also lead to an influx of labor that might cause community-level conflicts. As child labor is rampant in the rural economy, there is a possibility of it extending to agro-processing parks or rural enterprises too
	Promote exports of high-value food production, including crops, horticulture products, and livestock and fisheries products	If not balanced properly, it can lead to domestic shortages of agricultural commodities and price hikes, making affordability of important sources of nutrients difficult for domestic consumers
Poverty, Food and Nutrition Security	Enhanced use of Agriculture & Livestock yields preservation techniques	Food spoilage also contributes to food insecurity. However, synthetic preservatives such as sulphites, benzoates, sorbates etc., for food preservation are linked with health problems.

Policy Objective	Action Points	E&S Implications
	Small-scale food preservation, storage and processing units	Hygiene and sanitation are major issues in Sindh. Improper food handling and excessive additives can lead to cross-contamination and degradation of the nutritional value of food
	Homestead-scale poultry rearing and aqua-culture	If not managed properly, homestead birds can expose other animals and farmers to various diseases and infections. Women, in particular, have less immunity and are more likely to be impacted
	Update the Sindh Tenancy Act to align it to the internationally agreed Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests (May 2012) and ensure adequate enforcement mechanisms	Land ownership and share in it remain a contentious issue. Changes in it are likely to be resisted, contested, and create community-level conflicts. Since tenants don't have documentary evidence, efforts for fair settlements can be difficult and contentious
Natural Resource Use	Regulate and control groundwater resources, coastal lands and water, and grazing areas.	New regulations that often aim at controlling and tightening resources that have been used unfettered in the past will result in communal outcry and protests. Water fronts are considered high-value lands, and development for natural resources can be thwarted by "land mafias"

Table 5.3: Potential E&S Implications of Sindh Water Policy

Policy Objectives	Action Points	E&S Implications
Managing Sindh's Water Resources	Towards integrated water resource management	The success of IWRM is dependent on synchronization between multiple stakeholders. Poor/underperformance by core institutions can create disruptions that can impact the availability of water for users and reduce the trust of users in service providers. Communal buy-in for IWRM can be daunting. Disagreements over "perceived legitimate water needs" of different users, especially in drought-like conditions, are likely to lead to clashes and protests, especially if the resource becomes further scarce in drought seasons.
	Creation of Water Users Associations	As farmers lack education and management skills, WUAs might not be very effective at cost recovery. Also, with class and gender differences, they might not be very participatory either. In fact, in some cases, WUAs might

Policy Objectives	Action Points	E&S Implications
		further perpetuate class and gender differences endemic to rural communities
Multifunctional integrated management of the canal and drainage system	There is a need to reconsider the cropping patterns in Sindh	Rice and sugarcane are 2 main cash crops of Sindh. Rice is also a staple crop after wheat. At present, a substantial part of the rural economy is structured around it. Preference for water-thrifty crops over traditional cash crops can have economic and associated social repercussions. It can include lower agricultural output as it can take time for farmers to unlearn old cultivating practices and learn new ones. Secondly, the shift to new cropping patterns can be disruptive as input markets and output markets might also take time to develop. With reduced domestic production, there can be a price hike for these commodities Rice and sugar growers are likely to resist and contest regulations that can also result in farmers' protests and unrest
	Upgrading the financial management of the canal and drainage system.	Incremental revision in abiana can lead to the outcry by farmers as it would increase their input costs and subsequently output. If the increase in abiana is not balanced out by high yield, it can further lower profit margins for farmers, adversely impacting their incomes Water charges in the form of abiana or other levies by AWBs on probably rural food processing units and warehouses can inflate prices of food commodities, making them unaffordable for poor consumers Other forms of levies on embankments by AWBs can be perceived as extortion by local communities and can lead to clashes and rifts Giving fishing rights in canals can bring in outsiders into communities that can lead to intercommunal conflicts and clashes and a rise in harassment of women and children Ground water for the most part is considered a free resource and an entitlement. Regulation on its use may be received with contempt. There can be resistance and protest too (both in rural and urban areas) as in some areas people either through self-help or with support from NGOs, installed tube wells or dug wells
Water management in dryland areas	Institutional home for integrated dryland development	Institutionalizing of dryland and water tenure may lead to complications in determining and settling land and water titles for its long time users as such entitlements are not recorded in the revenue rights Developing water recharges in the drylands of Sindh might require relocating the population or acquiring communal land.

Policy Objectives	Action Points	E&S Implications
Wetlands and Indus Delta as buffers and reservoirs	Wetland Water User Groups will also be supported by a review and strengthening of regulatory provisions, in particular in controlling illegal occupation or unauthorized use as in grazing or logging	It would be difficult to determine who the genuine users of wetlands are. Different communal groups for dominance might undermine other groups by declaring them, fraudulent claimants. Controlling illegal occupation might translate into eviction notices, undermining poor wetland communities. Clashes with Wetland User Groups and authorities might occur if these communities (illegal) are stopped from grazing. They will become quite vulnerable
Urban Water Supply and Sanitation Services: Creating Safe Places	Private service suppliers play an important role in the provision of urban water services. They provide an important service in closing the gaps and in delivering high-quality water. Their role should be cherished and stimulated and at the same time also regulated	Whereas introducing the private sector can mitigate budgetary constraints for public water utilities, but a water corporation usually extends services to high-value customers and avoids serving low-income communities because of their low water needs and capacity to pay their high charges. This can create stark economic and social disparity in water consumption in urban areas if checks slacken. This could also distort supply as urban businesses with water needs might be willing to pay more price. It might get difficult to keep tabs on "Meeting water as a human right need vs business need" as the private sector might not share their client data Secondly, the private sector operates and is perceived as mafia, especially in Karachi. Regulating them can lead to conflict between authorities, communities and private operators
WASH	For outside canal areas, public investment shall be made for rainwater harvesting to augment the range of services	Rainwater harvesting on a medium to large scale requires the selection of appropriate geographical sites. If such sites are far away from community settlements, women/girls are likely to be impacted as water collection is seen as their primary responsibility.

5.3 Screening of Potential Impacts of Physical Interventions

The typical environmental and social impacts and risks likely to be caused by the proposed construction activities are given in **Table 5.4**. A detailed and project-specific impact assessment will be carried out while conducting ESIAs or preparing ESMPs of the individual projects under the proposed Program.

Table 5.4: Potential E&S Impacts and Risks During Construction

Subproject Activity	Screening of E&S Impacts and Risks	Potential Mitigation Measures
Component 2.2 Main Canals Infrastructure	Canal rehabilitation works, particularly embankment works, require a huge amount of	The borrow areas are to be developed in the barren lands that are preferably owned by the governments.

Subproject Activity	Screening of E&S Impacts and Risks	Potential Mitigation Measures
- Rehabilitation of left bank canals (Akram Wah, Lower Nara Canal) and emergent works on right bank canals	borrow material. Development of borrow areas will affect the natural landscape, environment and local land use	The site-specific ESIA/ESMP studies identify potential sites for the development of borrow areas. The contractors, as part of their C-ESMPs, should give the locations of the borrow sites. These sites will be inspected and cleared by the E&S staff of the SIDA and PMU. After completion of the borrow sites, the contractors should restore the borrow sites and other sites disturbed by the contractors. The SIDA and PMU will ensure adequate budgetary provisions are made in the contract documents for the restoration of the borrow areas and other disturbed sites.
	Canal rehabilitation works also generate a huge amount of spoils (excess earth) that need to be properly disposed of.	Similar to above, the spoil disposal sites should be identified in the site-specific ESIAs/ESMPs. The C-ESMP of the contractor should include locations of the spoil disposal sites. The E&S staff of SIDA/PMU will inspect and approve the sites. Proper dumping and adequate compaction to avoid dust and release back to the river. Landscaping of the disposal areas after completion of works The unit rate for the canal excavations should include disposal of the spoils in the approved locations.
	Inadequate facilities at the construction camps, such as lack of proper accommodation, safe drinking water, sanitation facilities, cleanliness, emergency health care, will impact the workers' health.	A construction camp will be built with all adequate facilities (safe drinking water and sanitation, kitchen, rest areas, recreation). The LPG/gas should be used for cooking purposes, and hygienic food should be served to the workers. The Contractor will establish a mechanism to collect the complaints from the workers and address those complaints by the approved GRM plan First aid and fire-fighting facilities should be provided at all camps sites
	Solid waste (organic, paper and plastic, and garbage) will be generated every day at the construction camp. Most of the waste generated will be organic waste and improper disposal of the organic waste will have significant health impacts on the local communities and workers. Contractors will use a wide variety of hazardous materials such as fuels, chemicals, paints, batteries, etc. The storage and	Segregation of solid waste into kitchen waste (organics), paper and plastic (recyclable) and garbage (non-recyclable) Placement of containers of adequate size and numbers Organic waste will be treated, buried on-site or composted Use of services of waste management contractors for the management of recyclable and hazardous waste. Disposal of the garbage at the existing municipal land disposal sites.

Subproject Activity	Screening of E&S Impacts and Risks	Potential Mitigation Measures
	handling of hazardous material will have a potential risk on the air, soil and water resources. Improper disposal of hazardous waste will also have a significant impact on the local communities.	
	Wastewater discharges from construction sites are high in silt content and if they are directly discharged to the river without any prior treatment will impact the aquatic ecology. The batching plant discharges also contain a high sediment load.	Wastewater treatment facilities at the campsite (e.g., septic tank and soak pit) and at the worksites (sedimentation tanks for batching plants; and site drainage) should be established.
	Workers Health and Safety due to hazards associated with the construction activities	Contractors will develop an Occupational Health and Safety Plan prior to mobilization, which will be reviewed and approved by SIDA and PMU. Implementation of the plan by the OHS staff of the contractor. Use of relevant personal protection equipment at all times Regular training program for workers on occupational health safety (monthly training and daily toolbox talks) Incident investigation and reporting Availability of firefighting, ambulance, medical and rescue facilities at the site for implementation of an emergency response plan All workers should be insured and compensated immediately for incase of any accidents.
	Gender and Labor Related Impacts: Possible cultural conflicts between communities and workers and health impacts, including women's privacy and access, and gender-based violence Impacts from the influx of labor from the outside areas Risk of exploitation of local workers and child labor	Measures to protect the privacy of women and girls by the contractor, sub-contractors and service providers

Subproject Activity	Screening of E&S Impacts and Risks	Potential Mitigation Measures
	Impacts on the mobility of women	
	Other Social Impacts: Temporary disruption in water supply during repair and rehabilitation Friction between/amongst XEN, AWB, and FOs over the management of modernized branch canals/distributaries Tail enders being apprehensive of hydraulic structures that can allow upstream to control flows in the distributaries Grievances over the allocation of water, the release of water, O&M	The works should be designed carried out to avoid any disturbance to the irrigation flows and tail-end farmers are not adversely affected by the upstream improvement works.
Component 2.3: Rehabilitation of Selected distributaries Component 3.2: Rehabilitation of Agriculture Extension Offices Component 3.4 Improve last-mile water service delivery	General construction-related impacts such as soil erosion and sedimentation, dust and noise pollution, generation of waste and waste water discharges, surface and groundwater pollution, traffic and road safety, and occupational health and safety risks.	SIDA/PMU will develop site-specific ESMPs, for the subprojects that are expected to have moderate to substantial risks (which will be identified using a screening checklist), with adequate mitigation measures. These measures will be integrated into the contract documents and will be subsequently implemented during the construction. For the subprojects with small-scale civil works and limited E&S impacts and risks, a generic/standard ESMP and ECPs developed by PCMU will be used.
3.3 Developing Agriculture Value Chain	The facilities to be established under the value chain subprojects may potentially generate a wide range of solid wastes, including sludge produced by washing and cleaning operations, waste/rotten agriculture produce, wastage from packing operations, workshop wastes, and others. Inappropriate disposal of these wastes can potentially aggravate the solid waste management problems in the area while also contaminating soil and water.	The subprojects will be designed employing technologies that minimize the generation of solid wastes. Composting of biodegradable waste will be considered and adopted if practicable. Disposal of solid waste will be carried out in a manner that does not negatively affect the drinking water sources, cultivation fields, irrigation channels, natural drainage.

5.4 Environmental Challenges Associated with Water Sector in Sindh

An overview of environmental challenges associated with the Water Sector in Sindh is summarized below. The SWAT will develop a broad Strategic Water Plan to address these challenges. A draft ToR of the study is given in Annex 11.

1. Canal and drainage system

Waterlogging in Sindh remains endemic and covers, depending on the season, 50 to 70% of the canal commands. This stifles agricultural production, brings salinity to the surface and creates an unhealthy rural environment with a higher incidence of water-borne diseases and limited options for rural sanitation.

Closely related to the widespread waterlogging and salinity, water productivity in Sind is very low:. Part of the explanation is the climate in Sindh and the crop varieties in use. But also part of the explanation is in the poor way water is being managed with little attention in many areas to proper field water management. The huge inequities in the systems cause some areas to be oversupplied and others deprived of water. For the canal system as a whole 65% of the water is lost through non-beneficial evaporation.

Formal water allocations have never been updated, in spite of many changes that took place in the last fifty years, in particular, the commissioning of the Mangla and Tarbela dam drastically change the flow regime.

In the canal command areas, groundwater use, after a slow start, increased after the 2002 droughts but is entirely unmanaged.

Overuses are being fueled by the presence of many high water-consuming crops with sugar and rice topping the bill. The cropping pattern for many canal commands and sub-commands is not appropriate and not in line with official water availability, agro-ecological zoning, soils, local aquifer characteristics and drainage coefficients. New dry crops have been introduced in areas, yet these high water-consuming crops are at the same time promoted through several public incentives. There is a need to reconsider the cropping patterns in Sindh and give more space for low delta crops and for salt-tolerant crops and varieties.

Also, in spite of it de facto serving so many essential functions in Sindh, the canal systems are not managed in an integrated multi-functional manner.

Water scarcity is increasing in the canal system due to reduced storage capacity in the main reservoirs, the increased (unauthorized) water use in the riverine tracts and the more rigid cropping patterns in the tail areas.

The poor performance both as an agricultural water utility and as a multi-functional system has its pendant in the institutional performance, with the canal system primarily managed as an irrigation asset with little room for water resources management. In the last two decades moreover, a dichotomy has developed with the canal system, now managed under two different regimes, the direct control under the Irrigation and Power Department and the more autonomous management of other canal systems under the Sindh Irrigation and Drainage Authority. There is a need to unify the systems and come to a consolidated, integrated institutional system where the integrated management of water resources has the central place it deserves besides the adequate multi-functional management of the canal infrastructures.

Equally, financial performance is worrying. There is no secure base for the financing of the canal system. As a result, important tasks do not get done, such as the desilting of canals or the upkeep of

drainage facilities. The collection of the abiana water charges has been a source of concern for many years and, rather than improving, now stands at less than 6% of the target. The fees as such are very low, and the method of assessment and collection is overly complicated. There are other options to generate income from the irrigation systems that are not utilized.

2. Drylands

An emerging trend in these dryland areas of the province is the rapidly increasing use of groundwater. This is driven by the emergence of solar pumping – which no longer is putting a price on water abstraction. Because the aquifer systems are fragile and sometimes underlain with saline water, utmost care is required, as this very scarce resource for vital drinking water and high-value uses is rapidly lost.

There has been little attention for the improvement of the rangelands in these dry areas, even though they sustain a considerable population and make a significant contribution to the food security of the Province. The rangelands also make up the watersheds: they can contribute to the availability of water resources and the prevention of catastrophic mountain floods. Unlike other parts of the world, there has been no effort to improve the quality of these areas by retaining their water resources, improving grazing practice or add to the quality of the rangelands.

3. Wetlands

Lakes and wetlands in Sindh are under inordinate pressure and risk. The threats to the wetlands of Sindh are largely anthropogenic. They are unavailability of fresh water, uncontrolled abstraction, disposal of untreated industrial and agricultural effluent, encroachment, siltation and shrinkage, a threat to native flora and fauna species by invasive exotic species, illegal hunting, overgrazing and uncontrolled logging. In addition to low rainfall, high evaporation rate, coastal erosion, drought and the incessant impact of a burgeoning population (Sial 2020).

Manchhar Lake, Asia's largest fresh water lake in surface area, is exemplary of all the wetland predicaments: severely degraded by the inflow of contaminated drainage water from the MNVD, its food system has collapsed, and more than 50% of its people are suffering from malnutrition, whereas diseases are rampant. Several other wetland areas – as the Dhhora's – have disappeared and their land has been converted for agricultural use, for instance.

In general, there is no management of wetlands, and a large number of organizations are involved without coordination or consolidated investment planning.

4. Urban water supply

Keeping in view rapidly growing population in urban areas, there are serious concerns on the long-term access to reliable water resources for the major cities in Sindh. Domestic water use in urban areas is expected to double between 2017 and 2050. This is a major concern in particular for Karachi and Hyderabad that depend on surface water. Especially Karachi needs to secure its long-term supplies.

A second challenge is waste water disposal, which has a large bearing on the quality of water intake for urban areas and others. It is common practice to discharge untreated effluents into public water bodies, including the canal system and the river Indus. Inevitably this ends up in the water intake of downstream users.

Urban infrastructure is not equipped to deal with special weather events: the widespread floods in Sindh cities of 2020 have its roots not only in unusual rainfall but also very much of urban build-up areas (including the drainage system) not being able to accommodate above-average quantities of

water. In most urban areas, there is a combined system for the disposal of sewerage and storm water. Moreover, the natural drainage system is not functioning due to urban development and excessive occupation at their banks.

5. Rural water supply

The rural water supply in Sindh is challenged by the difficulty of finding good quality drinking water resources. With 80 percent of the Province underlain by saline to highly saline groundwater (PCRWR 2020), small fresh groundwater lenses, created by seepage from canals floating on the saline water, are the major sources for rural water supply. These small fresh water lenses are precarious and dependent on how the water in the canals is managed. They are vulnerable to overuse (Jensen, Van Der Hoek et al. 1998; Ensink, Aslam et al. 2002). This requires care in encouraging seepage (no lining in many areas), extraction (choice of pumping systems) and recharge (avoid long canal closure periods, for instance), among others.

The management of canal and drainage systems is essential for rural water supply for the fresh water pockets but also for those who take water from the canals directly. That being said, there is no system in place for this. The quality of surface water in the canal areas is often problematic because untreated sewerage, industrial effluents and sugar mill wastes are directly discharged in irrigation canals.

6. Indus Delta

The Indus Delta covers 600,000 ha along the coast of Pakistan. The Indus Delta is the fifth largest delta in the world and a designated Ramsar wetland site world and a designated Ramsar wetland site. It contains many different ecosystems: riverine forests, freshwater lakes, irrigated areas, and brackish wetlands. Prior to the development of the mega-irrigation infrastructure on the Indus and its tributaries, it was a highly productive area with rice cultivation on the higher lands and rich grazing on the dried-up inundated areas. At present, it is, however, an area of ecological deterioration, endemic poverty and poor access to basic services such as clean drinking water.

A number of man-made interventions caused a huge environmental transformation:

Severe reduction of water deliveries with the expansion of the irrigation networks. Flows into Sindh at Guddu averaged 65.19 MAF between 2004 and 2019, with flows concentrated during June and September, however, only a small proportion of the flow is available downstream. These average flows are subject to significant interannual variability. For 2018-2019 the inflows were, for instance, 49.80 MAF. The releases after the Kotri barrage were 1.76 MAF, less than what is recommended to sustain the Indus Delta. In the Indus River Accord, annual flows of 10 MAF per annum are recommended to meet environmental flow requirements, but this figure is almost never reached unless it is in the shape of flood pulses. Due to the reduced river flows, the saline barrier has moved upstream of the Indus, affecting the river ecology and fresh water availability in areas in large areas of land in Thatta, Sijawal, Badin Districts, causing the abandoning of a large number of villages.

Severe reduction of the sediment inflow. A conservative estimate is that 250 million tons of sediment were deposited in the Indus Delta in natural conditions. This maintained the Delta on the high-energy coast of the Arabian Sea. With the commissioning of the Mangla Dam (1965) and the Tarbell Dam (1972), sediment inflow into the delta was severely reduced. The Tarbela dam reservoir, for instance, is gradually silting up, losing 41% of its capacity already, from 14.3 BCM to 8.4 BCM. . Following the estimated 80% reduction in sediment discharge after the late 1950s, the deltaic shoreline along the central delta coast started to recede at average rates of 50 m/year (Giosan et al, 2019).

Change of flooding pattern. Due to the construction of embankments, the River Indus was confined. The flooding area was reduced, further affected by the changes in the river releases. This has had

several effects, an important one being the reduced recharge of groundwater along the Indus. This also translated to higher exposure to saline water ingression.

Fall out of the failed Tidal Link. As part of the massive Left Bank Outfall Drain (LBOD), the Tidal Link Canal was constructed to carry the saline drainage effluent from the spinal drain 42 km across the mudflats of the coastal zone to the Arabian Sea. Soon after completion, some of the banks and weir structures in the Tidal Link failed in the highly sensitive silty loam flats, exacerbated by the prevailing typhoon and high tide storm direction and the water coming from the irrigation canals. Originally sea water was not expected to penetrate more than 19 km from the outlet of the Tidal Link. The scouring of the tidal link – creating basically a new river – moved the tidal effect much further upstream (70 km). The result is that there is now an open connection between the *dhands* and the Tidal Link, exposing the coastal lakes (dhands) to tidal fluctuations, sea water intrusion, sedimentation, and excessive drainage during low tide. At the same time, during high tide, drainage is impeded in the area, and there is a constant threat of sea water entering into the tail of the command areas. During rainfall events, the combination of excessive rainfall run-off and the impeded drainage during high tide is a major cause of flooding in the area. During the southwest monsoon, the neighbouring sea in the south inundates vast areas with salt water.

Change of mangrove forest cover. One-third of the Indus Delta was originally covered by mangrove forests, in particular Avicennia Marina (Young et al., 2019). Over the years, this vegetation changed too: mangrove cover dropped from 16% in 1990 to 10% in 2010 due to the changed hydrology and encroachment. In recent years with concerted efforts though mangrove cover increased to 13% with success achieved, especially on the Right Bank of the Indus. The mangroves have many economic and ecological benefits: sources of firewood, timber and bee forage, grazing areas for livestock and fish spawning ground. Mangroves have an important function in protecting the coastal areas against storms. Due to their dense growth and strong rooting system, mangroves protect the coast against floods and high waves. (Kathiresan, 2012) Mangroves are able to store high amounts of CO2 and are one of the most carbon-rich forests. The downside of this is that when these forests are destructed, a lot of carbon will be released, possibly intensifying global warming and other climate change trends. (Abbas et al., 2018).

6 Environmental and Social Assessment Framework

This chapter describes the step-by-step methodology to be followed for carrying out the environmental and social assessment studies for proposed subprojects, from the screening stage to the completion stage. Procedures for the preparation of A/RAP are detailed in RPF.

6.1 The sequence of Proposed Activities

The sequence of various activities to be followed during the environmental and social assessment of the proposed subprojects, from screening to the preparation of ESIAs/ESMPS and their implementation, are given in **Table 6.1**. Detailed guidelines for carrying out these activities are described in the subsequent sections.

Table 6.1: Sequence of Proposed Activities for E&S Framework

Step	Activity	Description of the Activity	Timing/Status	Responsibility
1	Screening (Annex 2)	Screening of the proposed subprojects to assess the requirement of safeguard instruments (site-specific ESIAs/ESMPS or generic ESMPs) to be prepared	After identification of the proposed subproject	Environmental Management Unit (EMU) of SIDA of PMU of Agriculture Department/Delivery Unit (ADU) will carry out a screening exercise (**Annex 2**) whenever the new projects are identified. PCMU will review and approve the screening forms.
2	E&S Considerations in Project Design & Analysis of Alternatives	Environmental and social aspects (e.g., site selection, spoil management, land acquisition) shall be considered during the analysis of various project alternatives and designs	During Feasibility and E&S assessment studies	EMU/SIDA and PMU/AED (with the support of Engineering Design consultants)
3	E&S Studies – Baseline Data Collection, Impact Assessment, preparation of ESIA/ESMP and RAP/ARAP	Primary baseline environmental data of the project influence area (covering physical, chemical, biological and socioeconomic environment) will be collected Assessment of impacts and their significance Preparation of site-specific ESIAs/ESMPs and RAPs	During E&S assessment studies	EMU/SIDA and PMU/AED with the support of Engineering Design Consultants or ESIA Consultants
4	Consultations and Disclosure	Consultations with the stakeholders (including affected communities) prior to E&S studies and after	During E&S studies	EMU/SIDA and PMU/ADU with the support of PCMU

Step	Activity	Description of the Activity	Timing/Status	Responsibility
		completion of draft ESIA/ESMP and RAP/ARAP. Disclosure of the ESIA and RAP (including translated summaries) on PCMU's website	After completion of ESIA/ESMP and RAP/ARAP	
5	Submission of ESIA/ESMP and RAP for Sindh EPA and WB clearance	Submission of ESIA/ESMP documents along with necessary fees to Sindh EPA, and arranging a public hearing for Sindh EPA	After Completion of ESIA/ESMP – Prior to construction	EMU/SIDA and PMU/ADU. PCMU will coordinate the approval process.
6	Environmental and social specifications for Bidding Documents	Preparation of environmental and social specifications for bidding documents, including preparation of BOQs and inclusion of ESMP in the bidding documents.	Prior to bidding	E&S Staff of EMU/SIDA and PMU/ADU will review and approve the bidding documents.
7	Implementation of ESMP	Contractors will develop site-specific construction-ESMPs and OHS Plans and will implement them Regular monitoring of compliance by the Construction supervision consultants and EMU of SIDA and PMU of ASPD.	During Construction	E&S staff of EMU/SIDA and PMU/ADU will review and approve the C-ESMPs and OHS Plans. ESHS Staff of Contractor will implement the plans. E&S staff of Construction Supervision Consultant, EMU and PMU will supervise the implementation of these plans

6.2 Step 1: Screening

For subprojects that are yet to be identified, a screening exercise will be carried out once they are identified through a reconnaissance site visit. The purpose of this visit will be to initiate the environmental and social assessment of the project, to assess the baseline conditions of the area, to identify the key environmental resources and social features of the area, to identify any environmental and or social sensitivity of the area, and to determine the presence of any environmental and or social hotspots in the area. A checklist (**Annex 2**) will be filled for subprojects based upon the findings and observations of the reconnaissance visit.

The outcome of the screening exercise is whether the proposed subprojects would need detailed ESIAs or ESMPs. The screening report will be shared with the World Bank. If the screening concludes, the proposed subprojects are of high-risk category, a detailed ESIA will need to be developed. For the substantial risk projects, a site-specific ESMP will be developed. For the low to moderate risk projects, the generic ESMPs in **Annex 3** and ECPs in **Annex 1** will be used. Tentative categorization of the subprojects and required E&S documentation are given in Table 6.2. However, it will be confirmed after the completion of the screening exercise.

The canal rehabilitation and modernization works that include large-scale civil works are expected to require site-specific ESIAs and ESMPs, while works related to the improvement of last-mile connectivity of distributaries and other small-scale rehabilitation works are expected to require generic-ESMPs.

Table 6.2: Potential Categories of Subprojects and E&S Requirements

Component	Project Activity	Potential E&S Category	Required E&S Documentation
2.2. Left Bank Canal Infrastructure	Rehabilitation of Akram Wah Canal and Lower Nara Cana with Chotiari Reservoir Improvements	Substantial to High	Subproject-specific ESIA/ESMP and RAP
2.3 integrated FO area Agriculture Development	Rehabilitation of Selected distributaries in three AWBs	Moderate to substantial	Site-specific ESMP and RAP
	Construction of Social infrastructure (canal crossings, water collection points, etc.). Construction of FO Offices	Low to Moderate	Generic ESMP-and ECPs
3.2. Solidifying IT Base	Rehabilitation of IT Offices	Low to Moderate	Generic ESMP-and ECPs
3.3 Developing Agriculture Value Chain	Providing support to improved market access to farmers	Moderate	Site-specific ESMP for large scale facility and Generic-ESMP for small-scale facility
3.4 Integrated FO Development	Rehabilitation of 300 water courses for improved last mile delivery	Low to Moderate	Generic ESMP-and ECPs
	Construction of Water Storage Tanks and promote high-efficiency irrigation in 1000 acres	Moderate to substantial	Site-specific ESMP and RAP
	Rehabilitation and de-silting of 50 farm drains	Moderate	Generic ESMP-and ECPs

Terms of reference (ToR) for the proposed ESIA/ESMP studies have been prepared and presented in **Annex 4**. An outline (table of contents) of the ESIA/ESMP reports is also given in **Annex 4**.

6.3 Step 2: E&S Considerations in Subproject Design and Analysis of Alternatives

Environmental and social issues will be mainstreamed into the Project design through a detailed analysis of alternatives of the subproject location, alignment, design, technology, and construction approach. The primary objective of the 'analysis of alternatives' is to identify the location/design/technology for a particular subproject that would generate the least adverse impact and maximize the positive impacts.

The criteria to be considered in evaluating various alternatives will be based on the following sub-criteria:

- Technical Aspects: Robustness, constructability, geology, and maintenance requirements.
- Financial Aspects: Construction cost and maintenance cost
- Environmental Aspects: project footprints, impacts on terrestrial and aquatic ecology, and
- Social Aspects: Land acquisition, Resettlement, nuisance, and socioeconomic impacts.

6.4 Step 3: E&S Studies

6.4.1 Baseline Data Collection

Project influence area for each subproject will be identified, covering areas likely to be directly or indirectly affected by the subproject construction and operation and their associated facilities; areas that will be subjected to impacts from unplanned but predictable developments caused by the subproject, and areas that will be subjected to cumulative impacts that result from the subproject in conjunction with the other activities in its area of influence.

Baseline environmental data of the project influence area (covering physical, chemical, biological, and socioeconomic environment) will be collected through a review of secondary literature and primary data collection/survey. Primary data collection will be carried out for assessment of fish migration, riparian habitats, wildlife habitats, forests and other ecological conditions in the project influence, ambient air and noise quality, and surface water and groundwater quality. Primary surveys will also be carried out to establish the baseline socioeconomic conditions of the communities in the Project area. Details of surveys to be carried out are given in the ToRs (**Annex 4**).

6.4.2 Impact Assessment

Based on the initial assessment, potential impacts and risks of the proposed projects have been identified and presented in previous **Chapter 5**.

Detailed characterization and assessment of these impacts will be carried out in the respective subproject-specific ESIA/ESMP. In addition, the impacts of the proposed subprojects on the environmental and social components will be identified through consultation with experts and the local community. The impacts will be analyzed and graded qualitatively (e.g. high, medium, low) in order to identify the major impacts. Potential impacts will be predicted using the professional judgment of the multi-disciplinary team members based on baseline information collected and any modelling studies if required. The impact assessment will also consider both cumulative and induced impacts of the subprojects.

6.4.3 Environmental and Social Management Plan

ESMPs will be prepared in order to address all the identified potential environmental and social impacts and risks following the principles of the mitigation hierarchy. To the extent feasible, all potential impacts and risks will be avoided through design changes, and if avoidance is not possible – measures will be taken to minimize the magnitude of the impact. Mitigation measures will be proposed for all the significant impacts. If the residual impacts are still significant even after applying the mitigation measures, compensation measures will be proposed. Further, enhancement measures will be proposed for increasing the benefits of positive impacts. A sample mitigation plan, as a guideline, is prepared and presented in **Table 6.3** to address the impacts during construction and

operation stages. Based on these guidelines, a detailed ESMP will be prepared as part of the subproject ESIA/ESMP.

Generic ESMPs are prepared for small-scale and low to moderate risk projects and presented in **Annex 3**. Environmental Code of Practices (ECPs) has been prepared under this ESMF to provide guidance to be followed to address general environmental risks due to various activities during planning, design, construction, operation and maintenance phases associated with each subproject. The ECPs will also include mitigation measures to address general environmental and social risks associated with the general construction activities. These ECPs have been prepared in conformity with the World Bank Group General EHS Guidelines and Good International Industry Practice. The ECPs are presented in **Annex 1**. The list of ECPs is given below.

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

An environmental monitoring plan will also be prepared in the ESMP to monitor the effectiveness of the mitigation measures and compliance with the environmental standards. A template for this plan is provided in **Annex 5**.

Detailed guidelines for the preparation of A/RAPs are given in RPF.

Physical and cultural resources management framework including chance-Find procedures to be implemented in case any chance finds are made during earthworks have been prepared and are presented in **Annex 6**.

The Gender Action Plan is provided in **Annex 7**, whereas the labour-management framework is presented in **Annex 8**.

Table 6.3: Sample Mitigation Plan

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
E&S impacts due to Project siting				
1. Loss of vegetation and habitats due to land	Obtain clearance from tree cutting from relevant authorities if they are located in the government property (for example,		EMU of SIDA and PMU of ASPD	PCMU

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
clearing under project footprints	trees located with ROW belongs to the Irrigation Department) Compensatory tree plantation at the rate of 5 new trees per tree cut.			
2. Acquisition of private land for the construction of project facilities	Adequate compensation and resettlement assistance for affected households as per the entitlement matrix		EMU of SIDA and PMU of ASPD	PCMU
3. Loss of livelihood due to the permanent acquisition of agricultural lands	Adequate compensation and implementation of income and livelihood restoration plan		EMU of SIDA and PMU of ASPD	PCMU
4. Impact on residential structures and wood and fruit trees	Adequate compensation and resettlement assistance for affected households as per the entitlement matrix		EMU of SIDA and PMU of ASPD	PCMU
5. Employment generation for the local community	The hiring of local people during construction works	Annex 8	Contractor, EMU of SIDA and PMU of ASPD	PCMU
Environmental impacts during construction				
6. Tree cutting from construction sites	Handing over the fallen tree to the owner Compensatory tree plantation at the rate of 5 new trees per tree cut.		Contractor	EMU/PMU CSC
7. Generation of spoils (excess excavation) and their disposal	Transport and disposal of spoils and designated spoil disposal sites Proper dumping and adequate compaction to avoid dust and release back to the river Landscaping of the disposal areas after completion of works	ECP 1 ECP 5 ECP 6	Contractor	EMU/PMU CSC
8. Generation of construction, including hazardous waste	Containers of adequate size and numbers in place for collection of various types of wastes (metal, rubbers, used fuels, batteries, etc.) Procurement of services of a waste management contractor for transport and treatment of recyclable and hazardous waste	ECP 2	Contractor	EMU/PMU CSC
9. Generation of solid waste from worker's campsites and offices	Segregation of solid waste into kitchen waste (organics), paper and plastic (recyclable) and garbage (non-recyclable) Placement of containers of adequate size and numbers Organic waste will be treated through composting or buried on site. s Recyclable waste will be managed by using the services of the waste management contractor Disposal of the garbage at the nearest municipal waste disposal site.	ECP 1 ECP 16	Contractor	EMU/PMU CSC
10. Wastewater discharges from the construction	Construction of wastewater treatment facilities at the campsite (e.g., septic	ECP 3 ECP 4	Contractor	EMU/PMU CSC

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
camps, sites, and batching plants	tank and soak pit) and at the worksites (sedimentation tanks for batching plants and site drainage)	ECP 16		
11. The potential risk of soil pollution by construction works	Storage of fuels and chemicals in contained facilities Availability of spill kits for immediate clean-up of any oil spills	ECP 5 ECP 6 ECP 7	Contractor	EMU/PMU CSC
12. Increased traffic on the local roads	Traffic Management Plan (e.g. avoiding school hours, following sped limits, hiring licensed drivers, etc.) including awareness-raising and safety measures. EMU/PMU will coordinate with other relevant government departments like traffic police, district commissioner office, etc.	ECP 15	Contractor PMO	EMU/PMU CSC
13. Air and noise pollution from construction and traffic	Compliance with NEQS on vehicle and machinery emissions and ambient noise	ECP 10 ECP 11	Contractor	EMU/PMU CSC
14. Sourcing of aggregates for concrete works	Reuse of excavated material from the weir site to the extent feasible Source the material from the licensed quarry and borrow sites. Crushing of the boulders to the aggregates and sand with adequate dust control measures in place.	ECP 9	Contractor	EMU/PMU CSC
15. Impact on aquatic habitat due to construction activities	Control of wastewater and sediment releases to the river/canal	ECP 3 ECP 14	Contractor	EMU/PMU CSC
16. Impacts from increased human activities on flora and fauna	Use of non-wood fuel for cooking and heating; Code of conduct for workers and employees' protection of flora and fauna Awareness-raising to workers on the protection of flora and fauna.	ECP 12 ECP 13	Contractor	EMU/PMU CSC
Community and Occupational Health and Safety Impacts during Construction				
17. Safety hazards due to increased traffic, especially for children and elderly people	Traffic Management Plan (e.g. avoiding school hours, following sped limits, hiring licensed drivers, etc.) including awareness-raising and safety measures. EMU/PMU will coordinate with other relevant government departments like traffic police, district commissioner office, etc.	ECP 15	Contractor PMO	EMU/PMU CSC
18. Community exposure to work hazards	Barricade the work areas with hard fencing to prevent the entry of community in the construction areas. Placing of adequate signboards and flagmen to divert the community away from the construction works.	ECP 16 ECP 17	Contractor	EMU/PMU CSC
19. Dust from vehicular movement on local roads and construction activities	Frequent sprinkling of water on the local roads and worksites to control dust emissions	ECP 10	Contractor	EMU/PMU CSC

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
20. Impacts from the influx of labor from the outside areas	A construction camp will be built with all adequate facilities (safe drinking water and sanitation, kitchen, rest areas, recreation) The Contractor will establish a mechanism to collect the complaints from the workers and address those complaints by the approved GRM plan	ECP 16 ECP 17 Annex 8	Contractor	EMU/PMU CSC
21. Possible cultural conflicts between communities and workers and health impacts, including women's privacy and access and gender-based violence	The contractor's code of conduct shall cover the program to promote awareness to the construction workers on respecting the local community, avoiding gender-based violence, and the risk of spreading sexually transmitted diseases. The Contractor's monthly training program will cover topics related to Code of Conduct such as sexual harassment, particularly towards women and children, violence, including sexual and/or gender-based violence and respectful attitude while interacting with the local community	ECP 17	Contractor	EMU/PMU CSC
22. Workers Health and Safety due to hazards associated with the construction activities	Conduct a 'job hazard analysis' at the new construction site to identify potential hazards that may arise from the proposed works or working conditions to the project workers and implement necessary control measures. Use of relevant personal protection equipment at all times Regular training program for workers on occupational health safety (monthly training and daily toolbox talks) Incident investigation and reporting Availability of firefighting, medical and rescue facilities at the site for implementation of an emergency response plan	ECP 18 ECP 19	Contractor	EMU/PMU CSC
24. Risk of child labor	No hiring of workers less than 18 years of age	ECP 15 Annex 8	Contractor	EMU/PMU CSC
25. Impact on women and girls' privacy due to the presence of construction labor	Measures to protect the privacy of women and girls by the contractor, sub-contractors and service providers	ECP 16 ECP 17 Annex 8	Contractor	EMU/PMU CSC
E&S Impacts during O&M				
1. Management of water, sanitation and waste from the offices established in the project	Maintenance of office facilities with adequate water and sanitation facilities. Regular collection and disposal of waste		EMU/PMU	PCMU
2. Illegal off takes and abstractions above sanctioned discharge from the irrigation systems	Design of stilling basins suitable for flow measurement on main canal head regulators and fall structures. Replacement of direct outlets with APM		SIDA	AWB

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
	modules designed for sanctioned discharge			
3. Mosquito breeding at the water storage areas	Taking appropriate steps against mosquito breeding and educating the communities in preventive & curative measures against malaria/dengue. Educating the community regarding the importance and methods of cleaning subproject the ponds and tanks		FO	AWB
4. Agri-logistic facilities operations – waste generation and OHS risks	Educating the farmer/owner about safe waste management and disposal. EFPs During O&M Educating the owners about the safe and efficient operation of the phase facility Educating the owners about standard HSE procedures and precautions.		Farmer/Owner	PM
5. The project interventions can potentially increase the usage of pesticides and fertilizers.	Implementation of the integrated pest management plan prepared under WB funded SAGP Project		PMU	PCMU
6. Environmental Degradation from Intensification of Agricultural Land Use	Judicious use of the irrigation water, chemical inputs and use of alternate techniques (such as integrated pest management, using disease-resistant seeds, and mulching) will be promoted through awareness-raising and capacity building initiatives which are included in Component A of the proposed project. Adoption of IPM techniques will be promoted through capacity building programs. Crop rotation practices will be promoted to avoid soil fertility degradation.			

6.5 Step 4: Stakeholder Consultations and Disclosure

Stakeholder consultation will be used to help identify opportunities and risks, improve subproject design and implementation, and increase subproject ownership and sustainability. Stakeholder consultations will be carried during all phases of the project.

The stakeholders of the Project have been classified into the following two categories.:

- Primary Stakeholders: include people, groups, institutions that either has a direct influence on the project or are directly impacted (positively or adversely) by the project and its activities. These stakeholders include district governments that are involved in project implementation,

local communities, civil society organizations, private landowners, and poor non-titled persons/households.

- Secondary stakeholders: are those that have a bearing on the project and its activities by virtue of their being closely linked or associated with the primary stakeholders and, due to the influence they have on the primary stakeholder groups. These stakeholders include all relevant government institutions such as Sindh EPA, Local Governments, and non-government organizations.

Stakeholder consultations will be carried out at two stages. The first-stage stakeholder consultations will be carried out during the preparation of the safeguard instruments to obtain their feedback and address their concerns. The second stage consultations will be carried out after the preparation of the draft ESIA/ESMP to share the outcome of the ESIA study and to obtain their feedback.

The ESIA/ESMP and RAP of each subproject will be disclosed on the PCMU website and on the World Bank website. The Executive summary of the ESIAs and RAPs will be translated into Sindhi and will be disclosed on the PCMU website. Hardcopies of the Executive Summary reports of Sindhi will also be made available in the local offices of the implementing agencies.

6.6 Step 5: Submission of ESIA/ESMP for Sindh EPA and World Bank Clearance

ESIA /ESMP and RAP/ARAP for each subproject will be submitted to World Bank and Sindh EPA for clearance and approval before initiating any construction works. In addition, the proposed subprojects require various approvals from the relevant government departments during implementation. These requirements are summarized in **Table 6.4**.

Table 6.4: Environmental Approvals and Permits Required during Implementation of the Project

	Details of Approval and Permits	Issuing Authority	Requirements	Responsible Agency	Timing
1	**Clearance of ESIA/ESMP and A/RAP**	World Bank	Submission of ESIA/ESMP and A/RAP	EMU/PMU with the support of PCMU	Prior to the Construction of the project
2	**Environmental Approval** for the overall construction of the Project	Sindhi EPA	Submission of ESIA/ESMP	EMU/PMU with the support of PCMU	Prior to Construction of the Project
7	**Permit** for the use of quarry and excavated material	Mines and Mineral Department	Submission of a request with the location map of the quarry area	EMU/PMU with the support of PCMU	During the construction phase

6.7 Step 6: Environmental and Social Requirements in Bidding Documents

EMU of SIDA and PMU of ASPD (and their Engineering Consultants) will include the following Environmental, Social, Health and Safety (ESHS) Conditions in the bidding documents to ensure all the mitigation measures proposed in the ESMPs are effectively implemented:

- Past performance of the Contractor on ESHS aspects including sexual exploitation and abuse and gender-based violence;
- ESHS Staff with the Contractor;
- Performance Security;

- Mitigation measures to address construction impacts (which will be prepared based on Table 6.1);
- Payments for implementation of ESHS measures;
- Code of conduct of Contractor's Personnel;
- Management Strategies and Implementation Plans (MSIP) to manage the ESHS Risks.

Each of the above conditions is elaborated in **Table 6.5**.

Table 6.5: ESHS Conditions in the Bidding Documents

Condition	The rationale for the inclusion of this Condition in the Contract	Specifications to be included in the Bidding Documents	Responsibility	
			Bidders	SIDA/PMU
1. Past performance of the Contractor on ESHS is one of the eligibility criteria for the shortlisting process	The contractor's past performance on compliance with ESHS is an indicator of the contractor's commitment and capability for implementation of the ESMP	The Bidder shall "declare any civil work contracts that have been suspended or terminated and/or performance security called by an employer for reasons related to the non-compliance of any environmental, or social (including sexual exploitation and abuse (SEA) and gender-based violence (GBV) or health or safety requirements or safeguard in the past five years".	Bidder to make the Declaration	SIDA/PMU use this information to seek further information or clarifications in carrying out its due diligence
2. Contractor shall propose adequate ESHS Specialists in his team (Environmental Specialist, OHS specialist, Social specialist, site supervisors)	The Contractor's staff should include adequate ESHS specialists who are responsible for the implementation of all mitigation measures on ESHS risks and compliance with ESMP	The Bidder shall propose an Environmental, Social, Health and Safety (ESHS) Specialist as the Contractor's Key Personnel at the Site. The Bidder shall provide details of the proposed ESHS specialist including academic qualifications and work experience. The ESHS Specialist should have a minimum bachelor's degree in engineering or a master's degree in sciences related to environmental management. The Specialist should have 5 years of experience working on monitoring and managing ESHS risks related in infrastructure projects.	The bidder to submit the CV of proposed ESHS Specialist	SIDA/PMU will review and approve
3. Contractor shall submit ESHS Performance Security for compliance with ESHS obligations	The Contractor should have a financial implication if he could not comply with ESHS requirements. Hence performance security will be collected from the contractor	The Bidder shall submit the ESHS Performance Security in the form of a "demand guarantee" in the amount of three percent (3%) of the Contract Amount.	The bidder will submit a Performance Security	

Condition	The rationale for the inclusion of this Condition in the Contract	Specifications to be included in the Bidding Documents	Responsibility	
			Bidders	SIDA/PMU
4. Implement Mitigation Measures to Address Construction-Related Impacts given in ESMP	The mitigation measures to address potential ESHS risks and impacts should be included in the bidding documents. The contractor shall be made responsible for the implementation of the mitigation measures through the necessary conditions in the contract.	SIDA/PMU will ensure the ESMP in the General Specifications of the Bidding Document, and the reference to this document will be provided in the Conditions of the Contract as follows: • The Contractor shall implement the mitigation and monitoring measures given in the ESMP to address ESHS risks associated with the construction works. The Consultant shall refer to the ESIA of the Project, which is available on the PCMU website for further guidance. • The Contractor shall comply with the World Bank Group's General Environmental Health and Safety Guidelines and Environmental Code of Practices (**Annex 1**)		SIDA/PMU will include this condition in the bidding document
5. Payments for implementation of ESHS Mitigation and Monitoring Measures	BOQs on ESHS implementation are included in the Bidding Documents	The budget will be allotted for the preparation and implementation of C-ESMP (including OHS plans), which include waste management, spoil site development, environmental monitoring, etc.	Bidder will quote for the ESHS Management	
6. Code of Conduct for Contractor's Personnel	All workers hired by the Contractor should sign a code of conduct to ensure compliance with ESHS obligations of the Contract	The Bidder shall submit the Code of Conduct that will apply to the Contractor's employees and subcontractors. The Code of Conduct will state that the workers will comply with the following ESHS requirements: • Wearing of Personal Protective Equipment (PPE's) in the workplace at all times • Non-discrimination in dealing with the local community by race, ethnicity, gender, religion, disability, sexual orientation, gender identity, social, or health status	Bidder shall submit code of Conduct with the bid documents	

Condition	The rationale for the inclusion of this Condition in the Contract	Specifications to be included in the Bidding Documents	Responsibility	
			Bidders	SIDA/PMU
		• Respectful attitude while interacting with the local community • Prohibit sexual harassment particularly towards women and children • Prohibit violence, including sexual and/ or gender-based violence • Respecting the reasonable work instructions • Protection and Proposer use of the property		
7. Contractor's Management Strategies and Implementation Plans (MSIP) to manage the ESHS Risk	The Contractor proposal should include his understanding of the ESHS requirements of the project and the proposed strategies to manage the ESHS risks	The Bidder shall submit Management Strategies and Implementation Plans (MSIP) to manage the following key ESHS risks: • Strategy for the protection of workers and community from the construction-related hazards inside the terminal • Pollution prevention (wastewater, air and noise emissions) and management • A waste management plan for proper collection and disposal of waste • Traffic management plan to ensure the safety of local communities from construction traffic • Hazardous material management plan safe storage and handling • Strategy to address labor influx impacts on the local communities • Gender-based violence and sexual exploitation and abuse prevention and response action plan • Emergency response plan and early warning system The Contractor shall be subsequently required to submit (before mobilization) Contractor's Environment and Social Management Plan (C-ESMP) by the above strategies and Condition 4 of this Table.	The bidder will submit MSIP along with the Bid Documents	

6.8 Step 7: Implementation of ESMPs of Subprojects

The steps to be followed during the construction stage of subprojects for effective implementation of ESMP are described in this section.

6.8.1 Contractor's Construction Environmental Action Plan and Occupational Health and Safety Paln

As a requirement under the bidding documents, the Contractors will need to submit a Construction Environmental Action Plan (C-ESMP) and Occupational Health and Safety Plan (OHS Plan) prior to their mobilization for PMU approval. The C-ESMP will consist of the following site-specific management plans that will be prepared in compliance with the requirements of the bidding documents, ESMP and World Bank EHS guidelines:

- Waste management plan
- Wastewater discharges management plan
- Air and noise emissions management plan
- Hazardous material management and spill control plan
- Water supply and sanitation management at the worksites and workers' accommodations
- Management of labor influx and facilities for the foreign workers
- Labor recruitment procedures and labor management
- Traffic management plan
- Training plan for ESHS risks including HIV/AIDS, sexual exploitation and abuse, and gender-based violence
- Emergency Response Plan for the project
- Grievance Redress Mechanism
- Demobilization plan after completion of works

In addition, the Contractor will need to submit a Job Safety/Hazard Analysis at the beginning of construction works at each new site addressing the measures associated with various hazards at the work sites. These reports will be reviewed and approved by the Construction Supervision Consultants of SIDA/PMU after ensuring the mitigation measures proposed in the analysis are in place at the work sites.

6.8.2 Step 8: Compliance Monitoring and Reporting

The overall responsibility for ESMP implementation will rest with the EMU of SIDA and PMU of ASPD oversighted by PCMU. However, at the construction areas, environmental and social staff of the Contractor are responsible for implementing the ESMP, while the environmental and social specialists of the Construction Supervision Consultant and SIDA/PMU will be responsible for the monitoring of the EMSPs throughout the Project implementation.

Compliance monitoring comprises of on-site inspection of the construction activities to verify that measures identified in the ESMP and that are included in the clauses for contractors are being implemented. This type of monitoring is similar to the normal technical supervision tasks ensuring that the Contractor is achieving the required standards and quality of work.

The following reports will be prepared on the implementation of ESMP:

- Monthly environmental monitoring reports by the Contractor on the status of implementation of environmental, social, health and safety aspects, and
- Quarterly environmental monitoring reports by the PCMU on the status of implementation of environmental, social, health and safety aspects

The topics to be covered in these reports are summarized below:

- Environmental incidents or non-compliance with contract requirements
- Health and safety incidents, accidents, injuries and all fealties that require treatments
- Inspection of Workers accommodation; Workers and community grievances
- Training conducted and their content;
- Environmental issues encountered and how they were mitigated and
- Compliance status on ESMP requirements

Regular training programs will be conducted throughout the project implementation on the EHS issues associated with the construction activities (further discussed in **Section 7.2**).

7 Project Institutional Framework

This Chapter describes the institutional framework for the management of the overall Program and also its environmental and social aspects.

7.1 Institutional Arrangements for ESIA Preparation and Implementation

SWAT is an integrated project. The transformation under the project requires multiple departments of the Government of Sindh to work in close coordination. Overall project coordination and monitoring will be undertaken by PCMU along with Component 1, Water Resources Management. Water Service Delivery will be implemented by SIDA, and Agricultural Investments are to be carried out by the Agriculture Supply and Prices Department of the Government of Sindh. Institutional arrangements are in the stage of finalization but below is a brief description of each institution to be engaged in SWAT implementation

i) PCMU

The Project Coordination and Management Unit (PCMU) will be under the Planning and Development Department (PDD) of the Government of Sindh. PCMU will support project coordination and M&E, including monitoring environment and social safeguard compliances, and facilitate citizen engagement through grievance redress mechanism

ii) SIDA

SIDA is overall responsible for the implementation of the RAP/EMP through the Environmental Management Unit. This includes disbursement of funds for compensation and permanent acquisition of land identified in the RAP/EMP. The AWB will assist SIDA for implementation of the RAP. Note that SIDA shall maintain overall responsible for any RAP implementation activities which may be delegated to other parties.

iii) Agriculture Delivery Unit

Project Management Unit (PMU), already established under SAGP, Department of Agriculture, Supply & Prices and Department headed by Project Director who is appointed by the Government will continue to implement and carryout the project implementation. The PMU of SAGP with its existing setup would be responsible and continue the overall project management, monitoring and supervision, as well as fiduciary and environmental and social safeguards implementation and compliance. Further, A total of four (4) PIUs will be established; for Agriculture Hyderabad, Mirpurkhas, Sukkur & Larkana districts. .

The overall responsibility of environmental performance, including ESMP implementation, will rest with the PMUs of SIDA and ASPD. Existing environmental and social staff of the PCMU, SIDA and PMU of Agricultural Department are shown in **Table 7.1**. All these staff are experienced in implementation of World Bank funded projects. Additional specialists to be hired under these units are also given in Table 7.1.

Table 7.1: E&S Staffing of Implementing Agencies

Component	Implementing Agency	Existing Staff		Additional Staff to be hired under the SWAT	
		Environment	Social	Environment	Social

1. Water Resources Management, and 4. Project Coordination and Monitoring	PCMU	Deputy Director, Environmental	Deputy Director, Social	OHS Specialist	
2. Water Service Delivery	SIDA/EMU	1. Deputy Director 2. Environmental Specialist 3. Ecologist (Amin Khushk) 4. Environmental Inspectors (2 positions)	Sociologist	OHS Specialist	Social Specialist
3. Agricultural Subsidies and Investments	PMU/ADU	Environmental and Social Safeguard Specialist		Environmental Specialist	Social Specialist

The roles and responsibilities of the environmental and social staff of implementing agencies and consultants for environmental and social management of the Project are given in **Table 7.2**.

Table 7.2: Roles and Responsibilities in Environmental and Social Management of the Project

Organizations	Responsibilities
PCMU	• The PCMU will provide overall coordination of project activities to ensure synergy between components.
SIDA/PMU	• Ensure that all project activities are well-managed and coordinated. • Recruitment of consultants for carrying out engineering designs and E&S studies • Procurement of works and goods. • Payment of compensation to the project affected households
E&S Staff within SIDA and PMU	• Screening of proposed subprojects to identify their risk category and requirement of safeguard instruments to be prepared (ESIA or ESMP or generic-ESMP, etc.) • Prepare terms of reference for the E&S studies of subprojects • Reviewing consultant deliverables related to environmental assessment, reviewing bid documents for inclusion of ESMP measures, supervising construction activities, producing periodic monitoring reports, • Supervising CSC for the implementation of ESMP • Closely coordinate with other concerned agencies, local governments, and communities to support the implementation of ESMP
E&S Consultants	• Carrying out E&S assessment studies in compliance with the Sindh EPA and World Bank safeguard policies and following the procedures described in the Program's ESMF • Prepare ESIA/ESMP and A/RAP
Construction, Supervision Consultants, CSC	• Prepare feasibility studies and detailed engineering designs for projects • Prepare bidding documents

Organizations	Responsibilities
	• Supervise civil works, ensuring compliance with all design parameters, including quality requirements and ESMP implementation • Prepare monthly reports and submit to PMU • CSC will have dedicated environmental, OHS and social staff
Contractor	• Prepare construction ESMP and OHS Plan. • implementation of mitigation and monitoring measures proposed in the ESMP • Each contractor will recruit an Environmental, Health, and Safety Manager, who will be responsible for implementing the contractors' environmental, health and safety responsibilities, and liaising with government agencies. S/he will have adequate environmental, social, health, and safety staff.

7.2 Capacity Building and Training

Capacity building programs will be conducted to all the Program staff, including engineers and relevant stakeholders, during the initial stages of the Program to sensitize them on the management of environmental and social issues and to build the requisite capacities.

The proposed training plan is given in **Table 7.3**. PCMU will deliver the training programs through its E&S staff and hiring a training consultant. At the construction site, CSC will take the lead in implementing the capacity building plan, though the contractors will also be responsible for conducting training for their own staff and workers. The various aspects that are covered under the capacity building will include general environmental and social awareness, key environmental and social sensitivities of the area, key environmental and social impacts of the project, ESMP requirements, OHS aspects, and waste disposal. **Table 7.3** provides a summary of various aspects of environmental and social training to be conducted at the construction site. PCMU may revise the plan during the project implementation as required.

Table 7.3: Environmental and Social Training Programs

Contents	**Participants**	**Trainer**	**Schedule**
ESMF of SWAT Project and its implementation World Bank Safeguard Requirements Screening of subprojects and preparation of ESIAs/ESMPs and A/RAPS General environmental and socio-economic awareness; Environmental and social sensitivity of the subproject influence areas; Key findings of the subproject ESIAs/ESMPs; Mitigation measures; EMP; Social and cultural values of the area.	The selected staff of SIDA, PMU of ASPD and PCMU, including their consultants	E&S specialists of PCMU, EMU, PMU and CSC	Before the start of the project activities. (To be repeated as needed.)

Contents	Participants	Trainer	Schedule
General environmental and socio-economic awareness; Environmental and social sensitivity of the project influence area; Mitigation measures; Community issues;	SIDA/PMU/PCMU personnel who will be in charge of Operation & Maintenance and the Engineers from the local contractor	CSC E&S Staff	During project implementation (To be repeated as needed.)
E&S issues associated with the construction works ESMP requirements of the contractors. Workers Health and Safety Grievance Redress Mechanism	Construction crew	Contractors EHS Staff	Prior to the start of the construction activities and during the construction activities (To be repeated as needed.)

7.3 Grievance Redress Mechanism

The main objective of the Grievance Redress Mechanism (GRM) is to establish a systematic and transparent set of arrangements to enable local communities, Project Affected Persons (PAPs), contractors, employees, and other stakeholders to raise grievances and suggestions. As SWAT is an integrated project, both SIDA and Agriculture Department will institute a GRM process and mobilize resources for its associated component and respective interventions. PCMU will facilitate both implementing agencies in GRM by establishing a Steering Committee to address major grievances. It will be a comprehensive system to redress all types of grievances, including technical, social, environmental, procurement and financial management aspects of the PMU Agriculture component and of SIDA. GRM of SIDA and Agriculture Department will be based on the following steps:

i) Acceptance of Grievance: The aggrieved person/party can register a complaint to the relevant department using any or multiple channels that include in-person meetings, designated GRM online channels, phone and WhatsApp numbers, and complaint boxes
ii) Acknowledgement, Assessment, and Record: Each department will ensure that the plaintiff receives confirmation within 3 working days that his/her grievance has been received. The grievance will be entered by the relevant department in the database using a grievance registry form, and relevant management within the department is notified.
iii) Investigation and Resolution: Appropriate investigation will be decided at the assessment stage. Minor complaints can be managed at the district level by contractors or deputy directors of the project. The investigation may include follow-up meetings between plaintiffs/stakeholders and the department. For major complaints, Grievance Redress Committee (GRC) will be established at the PMU level. Minutes will be recorded and added to the grievance database. Efforts will be made to manage grievances within 30 days of receipt of the complaint and at the lowest level to avoid escalation. In case of high-risk grievance, PCMU/Steering Committee might be engaged directly.
iv) Complaint Satisfaction: In case of satisfactory resolution, the process is to be concluded with a written agreement signed by the plaintiff(s) and contractors/deputy directors. If not, the issue will be shared with GRC at the PMU level. If it continues to be unresolved, it will be

taken up to PCMU or the Steering Committee. If it still remains unresolved, legal action may be taken by the plaintiff(s)/stakeholders

v) Documentation management: Throughout the process, documentation of complaints, grievances, and actions against them are maintained by each relevant department

i) GRM of PCMU

The PCMU will handle all project-related complaints related to Water Resources Management. It will also resolve complaints, including implementation of environmental and social safeguards, mainly from communities identified in the project and command areas that are escalated to them by SIDA and PMU of the Agriculture Department under Water Service Delivery and Agriculture Investments components, respectively. A Steering Committee on grievance redress will be nominated to resolve complaints that cannot be managed by SIDA/PMU or PCMU. The Steering Committee will include members from SIDA, Agriculture Department, and PCMU.

ii) GRM of SIDA

SIDA is responsible for Component Two: Water Service Delivery of the project. The Contractor hired under this component will employ a community mobilization officer. The community mobilization officer will be responsible for receiving and recording day-to-day grievances of communities through various means (including complaint boxes). The camp management officer of the contractor will keep and maintain a complaint register. Complaints of minor nature will be handled by the contractor independently. In case of nonresolution, the complaint will be forwarded to AWB/SIDA. If AWB/SIDA is also unable to resolve a complaint, then it will be referred to the GRC under SIDA. The GRC will establish community complaints register at sub-project sites. GRC will register and file all grievance redress cases and would bring these to the notice of the Project Director. The revenue department will be involved in land acquisition and crop compensation. In case the PAP remains dissatisfied, the matter will be forwarded to PCMU or its Steering Committee.

Project Director	Chairman
Director AWB	Member
Chairman AWB	Member
Sociologist/Participation Specialist, SIDA	Member (Secretary)
Local Dignitary	Member
2 PAPs	Members
Major Omar Farooque	Member
Canal Assistant Akram Wah	Member

iii) GRM of Agriculture Department

Component three: Agriculture Investments will be implemented by the PMU, Agriculture. To manage grievances, a three-tier system will be in place. GRCs will be formed at the PIU, PMU and PCMU levels to address complaints.

GRM Committee-I will be set at the local level under the chairmanship of the director PIU to resolve the minor level of grievances. The GRM Committee –II will be formed at the PMU level under the Chairmanship of the Project director of Agriculture component to resolve moderate to major level of complaints and those grievances which are not resolved by Committee-I.

While the third committee will be at the PCMU level under the chairmanship of Project Coordinator to resolve those complaints which are not or cannot be resolved at committee of level II. The constitutions of the committees will be as under:

Committee Level-I:
1. Director Agriculture Extension (PIU) concerned (Chairman)
2. Environmental and Social Safeguard Specialist (PMU Agriculture)
3. Deputy Director of the Concerned District

Committee Level-II:
1. Project Director Agriculture Component (Chairman)
2. DG Agriculture Extension

2. Environmental and Social Safeguard Specialist (PMU Agriculture)
3. Chief Monitoring & Evaluation Specialist of PMU Agriculture
4. Director/PIU concerned district

Committee Level-III:
1. Project Coordinator (PCMU)
2. Project Director (Agriculture Component)
3. DG Agriculture Extension
4. Chief Monitoring & Evaluation Specialist of PMU Agriculture
5. Environmental and Social Safeguard Specialists (Agriculture Component)

In addition to these GRM committees, Agriculture component will establish one separate committee through construction supervision consultants during the implementation of civil works to resolve community or labor related complaints arisen due to the implementation of civil works. The constitution of the committee is as under and will be active during the implementation of the civil works.

GRC for Civil Works under Agriculture Investments

Project Director of the Agriculture Component (Chairman)
Environmental and Social Safeguard Specialists of PMU (Agriculture Component)
Chief Resident Engineer or Resident Engineer of Construction Supervision Consultants
Environmental & Social Officer/Manager of Construction Supervision Consultants
Project Manager and Community Liaison Officer of the Contractor

If the complaints have arisen are not resolved by this committee, the grievance will be transferred to PCMU.

7.3.1 Proposed GRM for Construction Workers

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

accommodations; lack of clean drinking water and sanitation facilities; lack of medical care in emergencies; lack of protection against gender-based violence (GBV) by labor suppliers, supervisors, and others who also deal with workers.

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

To ensure impartiality and transparency, hearings on complaints will be held in a non-threatening environment and will remain open to all other workers on the site. The GRCs will record the (i) details of the complaints, (ii) reasons that led to acceptance or rejection of the individual cases, as well as the number of accepted and rejected cases, and (iii) decisions agreed with the complainants. SIDA/PMU will keep records of all resolved and unresolved complaints and grievances and make them available for review as and when asked for by the World Bank and other interested entities/persons.

7.3.2 Proposed GRM for Construction Workers

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

To ensure impartiality and transparency, hearings on complaints will be held in a non-threatening environment and will remain open to all other workers on the site. The GRCs will record the (i) details of the complaints; (ii) reasons that led to acceptance or rejection of the individual cases, as well as the number of accepted and rejected cases; and (iii) decisions agreed with the complainants. PMO will keep records of all resolved and unresolved complaints and grievances and make them available for review as and when asked for by the World Bank and other interested entities/persons.

8 Stakeholder Consultations and Disclosure

This Chapter provides a brief description of the consultations carried out with the key stakeholders while preparing the present ESMF and also a framework for the future consultations to be carried out during the project-specific ESIAs and A/RAPs.

8.1 Consultations Summary

8.1.1 Component One: Water Resources Management

Overall, stakeholders agreed that the impact of climate change requires a shift in attitudes and practices in the irrigation and agriculture sectors as well as integrated management. Everybody recognizes that Irrigation water has multiple uses, and it is imperative that surface and ground water consumptions are accounted for to ensure its judicious use and prevent its further degradation. They agreed that technology-driven data should be used in making informed policy decisions on water allocations and consumptions, but keeping in mind the interests of the vulnerable segments.

The issue of tail-enders suffering the most was raised and some believe that increasing *abiana* would compel farmers in upper and middle riparian districts to give up wasteful practices, allowing the availability of water for lower riparian. However, it was also recognized that since water has always been treated as a free commodity, water pricing reforms are likely to meet resistance from various sectors. In the past, an increase in water charges was challenged in courts. If water pricing reforms do not have legal coverage, it would be difficult to implement them. Some suggested that rates for commercial users should be increased more. At the farm level, it was observed that water is allocated on land size, but *abiana* is charged over crop yield. It was recommended that water reforms could start by introducing flat rates first per acreage as opposed to crop allocation and then move on to volumetric rates so that users find the changes acceptable.

Institutional reforms were considered important, but some highlighted that in the past they were not too successful. SIDA's role in implementing large-scale irrigation projects was lauded, but at the same time, it was recognized that it could not evolve to its expected role. The employees of SIDA remained unsure of their future in the organization and hoped that this project would settle the position of SIDA vis a vis SID

8.1.2 Component Two: Water Service Delivery

The projected interventions under this component were welcomed by and large. The rehabilitation of Akram Wah is expected to improve water delivery and is going to be celebrated by farmers, as evidenced in the previous project in which Ghotki Feeder Canal was rehabilitated. However, reservations on the modernization of distributaries/minors were expressed. Any design that involves holding back water is looked upon with suspicion by farmers. Such intervention requires excessive consultation and clear communication with farmers. It was suggested to engage area engineers to mobilize the community for this intervention as farmers trust engineers more in technical matters as opposed to social mobilizers. But it was also mentioned that some engineers thought that the design model was too technical for FOs to manage and maintain. There is also a possibility that engineers might feel that by giving more control to FOs their authority is likely to be undermined which might strain relations between engineers and FOs

Stakeholders believed that capacity development of SIDA and AWBs is required. At present, 4 canals are managed by 3 AWBs out of which Nara AWB has been most effective. It was reported that in other AWBs FOs were mostly dormant and not playing their due role. AWBs and FOs have a crucial part in

abiana collection for which they need to be revitalized. At present, SIDA provides training to FOs, which might not always be relevant to their needs. It has been suggested that training of FOs should be done by AWBs as they are more aware of farmers' capacity development needs.

8.1.3 Component Three: Agriculture Investments

Overall the proposed interventions were well received by stakeholders. Value chain development, use of saline land for agriculture, research and improving extension services were considered important steps in improving agriculture productivity and increasing rural livelihood opportunities. Whereas stakeholders recognized the importance of promoting water-thrifty crops like oilseeds, but were unsure of the economic gains from them. Currently, farmers that are encouraged to grow water-thrifty crops are unable to get the market advantage as imports flood the market, lowering the cost of their produce. It was recommended that production and market policy need to tie up to benefit local producers. Secondly, water-intensive crops like rice and sugar cane cannot be completely eliminated as they are part of our food security. However, efficient use of water, cross cropping, and fish farming were advised to maximize the use of each drop.

Incentives in the form of e-vouchers were received with mixed feelings. Whereas, some thought that they would benefit farmers, others felt that the scheme does not address farmers needs timely and adequately. The success of e-vouchers was reported to be based on a very well-established and aligned and timely distribution system amongst agro-dealers, suppliers and farmers. In the past, GoS had refrained from giving smart subsidies as they could be perceived as bipartisan, favoring a particular group. GoS is more in favour of across the board subsidies for farm input supplies like fertilizers.

The SAGP project showed farmers are eager to improve their productivity and reported an increase in their yield by using modern techniques to cultivate, dry, and process their produce. Proper and modern means of extension services and training are demanded by farmers.

8.2 Consultation Meetings

Public consultations were carried out during the preparation of the present ESMF and ESMP of Akram Wah. Details of the consultation meetings are given in **Table 8.1,** and photographs of these meetings are given in **Annex 10**.

The purpose of the consultation meetings was to present the overall Program interventions to the stakeholders and know their concerns and expectations regarding the project. During consultations, a Pashtu leaflet was disbursed among the participants to disseminate the message of the project and make them aware of the project as well. A presentation was made on the proposed Project interventions, potential environmental impacts and risks, and the planned mitigation measures.

Table 8.1: Details of Stakeholder Consultation Meetings

	Organization	Name	Designation
1	Ghotki Feeder Canal Area Water Board (GFCAWB)	Muhammad Ali Zardari	Director
2	Nara Canal Area Water Board (NCAWB)	Ghulam Mujtaba	Director
3	Left Bank Canal Area Water Board (LBCAWB)	Mir Ghulam Ali Talpur	Director
4	Progressive Farmers Organization (FO) GFCAWB	Shah Nawaz Junejo	Chairman, Kunri Minor

	Organization	Name	Designation
5	Progressive Farmers Organization (FO) NCAWB	Sher Ali Mahar	Chairman, Bakro Minor
6	Progressive Farmers Organization (FO) LBCAWB	Kamal khan Noonari	FO Chairman Pandhi Minor
7	Sindh Irrigation & Drainage Authority (SIDA)	Masroor Shahwani	Institutional Specialist, SIDA
8	Sindh Irrigation & Drainage Authority (SIDA)	Jai Ram	GM Operations
9	Sindh Irrigation Department, GoSindh	Anwar Ali Sial	Executive Engineer Sindh Irrigation department
10	Sindh Agriculture, Supply & Prices Department, GoSindh	Aftab Solangi	Deputy Director, SAGP
11	Sindh Agriculture, Supply & Prices Department, GoSindh	Dr. Mansoor	
12	Forest & Wildlife department, GoSindh	Riaz Wagan	Chief Conservator Forest and Rangelands
13	Livestock & **fisheries department**, GoSindh	Aslam Jawar	Director Fisheries
14	Project Coordination and Monitoring Unit	Abdul Basit	Deputy Director, M&E Environment
15	Project Coordination and Monitoring Unit	Habib Ahmedani	Agriculture Economist
16	Project Coordination and Monitoring Unit	G.H Qureshi	Deputy Director, Social
17	Food & Agriculture Organization (FAO)	Ashfaq Ahmed	Provincial Coordinator
18	SIAPEP	Mustafa Ujjan	E&S Specialist
19	Public Health & Engineering Department, GoSindh	Bashir Ahmed Sheikh	XEN
20	Sindh Environmental Protection Agency (SEPA)	Waqar Hassan Phulpotto	
	Gender Consultations		
1	UNWomen	Fareeha Umar	
2	ILO	Faisal Iqbal	
3	SPO	Barkat Ali	
4	FOs, SIDA	Mansoor Khanzada	Assistant Engineer
5	SIDA	Bilawal Soho	
6	SIDA	Masroor Shahwani,	Institutional Specialist,
7	SIDA	Shakila Laghari	
8	DCWD	Sajid Soomro	Deputy Director
9	AWB Nara Canal	Hidayat Narejo	Assistant Manager Social Mobilization,
10	AWB Nara Canal	Sikandar Mangrio	Assistant Manager Social Mobilization,
11	AWB, Ghotki Feeder Canal	Sajjan Khan	Assistant Manager Social Mobilization,

	Organization	Name	Designation
12	LBCAWB	Zaib Jatoi	Assistant Manager Social Mobilization
13	Mirpurkhas, Agriculture	Chetan Mal	Director Division
14	Deputy Director Larkana Division	Asad Solangi	
15	PCMU	Abdul Basit	

8.3 Feedback from the Stakeholder

All the participants of the meetings have largely welcomed the Project interventions. However, they have raised some concerns, which are summarized in **Table 8.2**.

Table 8.2: Feedback on Consultation Meetings

1	Mustafa Ujjan, E&S Specialist, SIAPEP	- Withdrawal of subsidy might put small farmers at the mercy of market. It needs to be kept in mind that market does not always offer a level playing field and is not always fair. Wheat prices can go up or might even be reduced. It's important to have a very strong regulatory framework - WHR requires easy procedures and a great deal of awareness campaign needs to be launched, otherwise it will fall flat - Water reforms can start by introducing flat rates first per acreage as opposed to crop allocation and then move on to Volumatic rates so that users find the changes acceptable - In the past institutional reforms were half-hearted. AWBs and FOs were formed to reduce the bottlenecks caused by the Irrigation Department, but then those who were to be reformed became the regulatory body - FOs in few areas are very active, but mostly they are dormant - Women farmer representation has been made mandatory by SIDA at all levels: FOs and Water Course Associations - Other than main infrastructure rehabilitation, women-specific issues related to water use need to be addressed too. These include financing fetching points and washing areas
2	Masroor Shahwani, Institutional Specialist, SIDA	- In a recent meeting of AWB, farmers asked for an increase in subsidy. Withdrawal might lead to an outcry - The majority of FOs' chairmen are now tail-enders. They want agriculture training. As for subsidies, they want farm equipment and modern tools which they can use and share as FO clusters since they are expensive - As for institutional reforms are concerned there are apprehensions regarding job security
3	Aslam Jarwar, Director Fisheries	- Inland fisheries are very limited in Sindh - It is estimated fisheries is spread over 300,000 to 500,000 acres of land in which projected 200,000 farmers might be engaged - Fisheries for many is a secondary source of income - Most of the objections might arise over water charges
4	Jai Ram, GM SIDA	- Canal Command Areas cropping patterns have changed. Progressive farmers are realizing this and are open to adopting new practices. However, areas with tribal practices and socio features will resist change and not easily adopt new practices based on agro-ecological zoning - Coordination exists between AWBs and FOs. Conflicts between the two usually arise in water distribution, especially during scarcity

		- In a recent AWB, Agriculture Department and SIDA, two key priority areas were highlighted by the AWBs and FOs: Land levelling and 100% lining of select water courses - As for water policy, the decision on rates has to be universal. If there is a disparity in abiana rates between different AWBs, users will not comply. In the past, when the water rate for the industry in the AWBs was raised from PKR 1 for 1000 gallons to PKR 10 a court case was filed, and the court then revised the rate to PKR 3 - Small farmers, in general, will accept the reforms. Large farmers with political clout might disrupt - Major social impacts will be related to the rehabilitation of main canals - Involving FOs in the modernization of distributary may result in minor conflicts with engineers - AWBs feel that FOs might not be able to carry out the technical aspects of modernization of distributary systems effectively. There is always a chance of middle reach taking more water and tailenders receiving less water - The grievance mechanism exists in SIDA. More than 90% of grievances are related to water shortages which are forwarded to respective AWBs and FOs.
5	Aftab Solangi SAGP	- Alteration in current agro-ecological zones and subsequent changes will only be well received if there is an extensive awareness campaign accompanied with demonstrations - Seed suppliers need to be strengthened and they need to ensure timely delivery. The agriculture department does not supply seeds as one cannot be sure how new variety of seeds germinates and their impact. In the past, Agriculture Department has stayed away from this - GoS has reservations over smart subsidies as they can be seen as bipartisan, favouring a particular group. GoS is more in favor of across the board subsidies for farm input supplies like fertilizers. Also E-vouchers need a very well established and aligned and timely distribution system amongst agro dealers, suppliers and farmers - WHR is a good system and has potential to be aligned with PMEX. It was done for red chillies - FEGs have not been very innovative in their services or outreach - FOs can be supported through subsidies to purchase expensive machines and tools which they can sublet to other farmers/growers by charging some fee - For water reforms to be successful it is important to ensure a very strong abiana collection mechanism - Progressive farmers are ready to make a shift to new crops. It is happening as we speak. In the past, orchards were never grown in Badin, but recently Badin is growing citrus and banana orchards and also tomatoes - Women farmers are also interested in modernizing agri-practices and want to develop as entrepreneurs but are in general disadvantaged. They are unable to participate in many schemes as they cannot produce “form 7” which is the land ownership document.
6	Dr. Mansoor Bugio, Agriculture Department,	- The current agro-ecological zoning is based on water availability. Some areas are prohibited for rice growing, but one also needs to look into practical applications. Rice can be grown in water logged area. Any decision on cropping patterns need to be discussed with farmers and not

	Planning and Progressive Officer and Deputy Director Admin	forced upon them. There is a talk about growing oilseeds as it will reduce our import bill. In Badin oilseeds were grown but they were not very profitable. Focus should be on high value produce like papaya, coconut etc. so farmers can benefit - 80 percent land is held by 5 percent whereas 95 percent growers are landless. Benefits need to reach landless too - Farmers in SAGP projects expressed interest in farm inputs like battery powered spray machines, tarpal (geotex) sheets for drying etc. It would be nice if through institutional arrangements between SIDA, AWBs, FOs and Agriculture department they are facilitated in acquiring farm inputs that they need. In this way SWAT is unique as it is bringing together agriculture and irrigation departments to meet common goals - Extension is difficult. It is not only reliant on inputs and services but also behavioral changes in farmers. It is not necessary that extension services are always health or environment friendly. Extension also requires investments for field coverage which are high - Currently, Agriculture Department is undertaking a Transformation of Indus Basin with Climate Resilience Agri and Climate Smart Water Management Project. In this project there is a component on open business schools in which we are going to enlist women farmers. Lessons from this project will feed into SWAT and help us develop better strategies for women inclusion
8	Kamal khan Noonari, FO Chairman Pandhi Minor	- He expressed concerns over revision of agro-ecological zone and said that in Badin rice is grown from May, June, Jul as excess water is released. He also said that since nothing else can grow here because of soil quality how can farmers be expected to change cropping patterns - As for water rates, he was of the view that as long as it comes timely and there is a small increase in it farmers will be willing to pay, but any big jump will not be accepted - He reported that farmers in Badin do not get subsidies on seeds or anything else (Interviewer's observation: this needs to be crossed checked) - Institutional reforms might drastically impact collection of abiana and works at the minor canals. Currently, SIDA has been very instrumental in maintaining and managing water distribution and management of minors timely. If SIDA's role is diminished it might undo the gains. He lamented that in the past the irrigation department was not proactive in resolving issues and in fact created many problems - Women representation in FOs is 1% but in Badin women do not own land
9	Anwar Sial, Executive Engineer Sindh Irrigation Dept	- Overall the project impact is going to be positive - Implementation on the Right Bank can be challenging as changing mindsets, behaviors and attitudes of farmers is going to be tough. It would require a well thought out communication and awareness strategy. Mobilization strategies need to be different - Institutional reforms will be successful if proper ownership is given. People would need to be motivated about their new roles - FOs in NARA have been very instrumental in managing their channels, abiana collection, and managing distributaries. In other areas, FOs feel that it is the responsibility of the irrigation department to manage water courses so they are not that motivated to take on additional work
10	Riaz Wagon, Chief	- The suggested reforms and proposed projects are all going to have good social impact, especially for lower riparian. As people will be charged for

	Conservator Forest and Rangelands	water, they are likely to use it judiciously. This will allow lower riparian to receive water - At present, abiana collection is cumbersome and is not undertaken effectively. - GIS mapping will allow a more efficient monitoring of water allocation and agriculture activities - As long as reforms are backed by regulation and proper subsidies, people will oblige by new price
11	Bashir Ahmed Sheikh, Public Health & Engineering Department, GoSindh	- At present PHED is responsible for providing clean and safe drinking water to Sindh, other than Hyderabad and Karachi along with sanitation services - At first our focus was providing access to water and now it is to provide clean drinking water. Irrigation usage does not come under PHED - At domestic level ground water is used and tube wells have been installed all over to provide access to drinking water. Water for drinking and domestic usage is not charged - Farmers, especially poor farmers don't have the capacity to pay for water consumption for domestic use
12	Ashfaq Ahmed, Provincial Coordinator FAO	- Success of reforms depends on strong policies. Climate change has impacted cropping patterns. FAO has done a study on agro-ecological zones. - Farmers are responding to climate change by sowing earlier. Sometimes government directives come late, but farmers already take a head start - Water intensive crops like rice and sugar cane cannot be completely eliminated as they are part of our food security, however, efficient use of water, cross cropping, and fish farming can be encouraged to maximize the use of each drop - Water pricing needs to be matched with subsidies and returns on investments - Currently farmers that are encouraged to grow water thrifty crops are unable to get market advantage as imports flood the market, lowering the cost of their produce. Production and market policy needs to tie up to benefit local producers - Subsidies need to be given on inputs rather than yields. Enabling environment need to be created to encourage use of bio-fertilizers - Institutional reforms are very important. Departments need to be established that can undertake water accounting, monitor demand and supply etc. - Developing value chains take time, but they will be effective in medium to long term, given market opportunities exists and are monitored - FAO is undertaking Transforming Indus Basin with Climate Resilient Agriculture and Water Management, SAGP (Agriculture Extension). SIAPEP (On farm water management), Better Cotton Initiative (CABI), and GRASP projects
13	Waqar Hassan Phulpoto, SEPA	- In the past SEPA's recommendations were not included in the meeting minutes nor paid heed to for other projects - Introduction of new crops or seeds need approval from proper authorities and boards. This needs to be ensured by implementing institutions - In the past economical needs overrode environmental concerns. For example, Ghotki has ideal conditions for cotton, but sugarcane is grown there and there are 5 mills. This has impacted land use and water use.

		- Wherever structural works are conducted or cropping initiatives taken its EIA is a must
14	Sher Ali Mahar , Chairman FO Bakro Minor.	- The agro-ecological zoning system may or may not alter existing practices. It may encourage more corruption and water theft. Actual issue is water shortage. IRSA does not give due share of water to Sindh. So rather than changing traditional agricultural practices government should provide the due water share. Whatever crops you grow they need water. If there is no water in the system then agro ecological zoning will be useless. People are habitual of current water delivery practices since years. I don't wish for any alteration in the system. These concepts look good on paper, but policies are not implemented properly. There is no reward or punishment system, no monitoring of policies. Projects do not change agricultural practices. - It may result some serious social and environmental issues. There would be need for land planning. If sufficient land is not available or the community is divided along tribal lines they will not agree on joint zoning if their lands fall nearby. Everyone will approach influential people and demand to declare their land according to their own favorite crop zones. Currently they buy water with money than they will buy crop zones. Poor and small farmers will suffer. Government makes policies in offices they do not consult farmers. Policy makers are not farmers they do not know farmers issues and cultivation practices. So they will make agro ecological zones without consultations of farmers. In the long run it may damage productive lands. Environmentally also this may have negative results. High water demand zones will have water logging and salinity in the future. It may have negative impacts on ecology of the province. Sindh province has heavy rains during monsoon and everywhere rain water stands. So what will be the status of low water zones? How will excess water be managed in high water zones? If government is planning to introduce agro ecological zoning then they must plan drainage canals accordingly. They must plan land reforms and land use management. - The overall Coordination between SIDA and FOs is good. AWB don't care about farmers. They are irrigation people they do not encourage FOs. - There are no schemes for FOs. Trainings are implemented by SIDA. SIDA does not involve AWB. - We do not have the WHR system but it sounds good. Post-harvest crop care is very difficult. Farmers do not have big and safe spaces to store their crops. Regarding challenges it might be expensive. Government will charge rent to store crops. We need to know will warehouses be equipped with modern technology so that crops do not rot or spoiled , crops should not be stolen or crops should not be damaged by any worms / insects etc. - Subsidies should be direct. It should be given directly to farmers. There should be no agent or receipt or scratch card system. There should be no money system. Subsidy should be in shape of discount. Government should give all agricultural and extension products / services at discounted rates - The abiana rates should be revised and notified by the government. Water should be pre-paid . We use mobile phones and purchase pre-paid cards. Same system should be introduced for water. There is no need for Abiana. Just give water through pre-paid system on volumetric basis

		- Water pricing reforms will impact tail-enders and small farmers. - Recently, Ghotki feeder canal has been rehabilitated. There is reason to believe that Akram Wah will have good impacts. Water will reach the tail end of the canal. If canal is not encroached again water flow will be regular. As per design Akram Wah will take water according its capacity. Biodiversity will increase. SIDA environmental team planted lots of trees at Ghotki canal after rehabilitation so I hope Akram Wah will also be full of trees after rehabilitation. - Currently canals are running against their sanctioned design discharge, Farmers have broken the modules and tempered canal. They have the habit of taking unlimited water. In modernization of distributaries conflict might arise on design discharge of distributary. SIDA constructs actual design distributary so water availability reduces. The community gets angry that they do not allow to re construct it again as per sanctioned design. Secondly, the contractual documents are in English. They tell farmers to sign the contracts which farmers do not understand. Thirdly contractors' financial receipts and claims are in English which farmers are supposed to verify. They are usually forced to sign them. - Grievances are handled with money and reference mostly - Brackish water increasing day by day. There are no research institutes. Government has no plans to stop water from turning brackish. No laws on ground water consumption. People install tube wells and then pump water day and night which causes water table to go down. There is a dire need to work on ground water regulations and consumptions - Women have no role in irrigation or FOs - Shift to new crops is difficult. We cultivate cash crops. We do not cultivate for food. So whatever the water consumption is farmers would only prefer cash crops. Crops are not an issue. Water is the issue. Water management is an issue. We need equitable management of water. There should be no politics in water management. Other provinces should not be allowed steal our water. Good governance in water management is the only solution.
15	Shah Nawaz Junejo, Chairman FO Kunri Minor	- Agro ecological zoning system involves land use planning. Here we have no concept of land use planning and future of land. We are just traditional cultivators and grow cash crops. I do not think agro ecological zoning system will be successful in our country. I do not think it will alter current agriculture and water delivery practices. People would like to continue their traditional cropping system and water delivery practices - Challenges in changing agro-ecological zones are that people will not easily accept it. If they plan a big area for a specific crop zone and it falls in 2 or more than 2 territories, it is possible that people may not agree. Secondly, if they designate my area as sunflower growing zone but then I have never grown sunflower in my life, I would be putting my interests at risk as I am not unaware of sunflower water requirements, disease, harvesting etc. So how will I manage my crop? Thirdly, climate. Each area has its own climate so there may be big zones or smaller zones. The areas where there are small zones policy makers are likely to ignore them. Currently, Pakistan is facing the issue of locust. So if locust attacks a zone then that crop will totally vanished from the province. - There is poor coordination between AWB and FOs. If we have any issue we directly call concerned SDO, AEXN or officer. Even after IDMT agreement

		FO do not get channel record. We have to pay unlimited visits to AWB offices to get channel records. In case of any tree cutting, water theft, water course tempering AWB does not help FOs. After IDMT agreement AWB is bound to hand over whole record voluntarily. FO should have powers to file FIR against persons who cut trees, tempers water courses. AWB should make water rotation plan in consultation with FOs. Director AWB should have monthly meetings with FOs or open discussions with FOs in order to listen to their issues and find out solution - Trainings are done by SIDA. SIDA never coordinates with AWB. They design and implement trainings without knowing the technical needs of FOs. I suggest trainings should be transferred to AWBs - Post-harvest crop losses are the biggest issue of our farmers. WHR system has provided an opportunity to the farmers to eradicate their post-harvest losses. WHR system could bring a revolution in the rural finance. Due to WHR system all rural producers would have access to bank loans. However, this system is likely to benefit only big farmers/big land owners as farmers has to provide collateral verification to the bank for production. For small farmers providing collateral verification of their production is difficult. Therefore small farmers may not benefit. There should be some easy procedures for small farmers and peasants, tenants etc. - Subsidies should be given directly to farmers like other products. Large amount of money is wasted in the name of subsidy in Pakistan. Rather than distributing large amount of money in subsidies farmers should be given agriculture products at discounted rates and financial assistance should be given to fertilizer dealers and companies. I do not support the idea of smart subsidies (e-vouchers). In the name of subsidy, the farmers get tokens or scratch cards in bags and get cashback or so-called subsidy in three months, which is a very long period of time for small growers. Direct subsidy system as the only best solution for farmer. The problem with the current system is that instead of receiving instant financial support, farmers get a token, which is processed and payment is made in three to four months. The farmer then rarely employs this amount for farm activities and it goes for other personal expenses. Farmers infrequently track payments against the token (usually worth Rs100 each), and thus in most cases that subsidy payment vanishes into the air - FEGs also benefit big farmers as you have to provide 50 percent private support against extension services. Small farmers lack technical capacities, they have poor financial status too. Also they have their own issues like cast, culture, creed, race, religious conflicts so they do not unite to form FEGs. - Extension services are provided through the agent of service provider. Farmers have to run after the agents to get service or visit their offices. Poor and small farmers are already suffering. It is difficult to chase agents - Current abiana rates were fixed by the Britis. After their departure no increase in abiana rates. Abiana needs to be increased and government should notify increased rates. Rates should be on volumetric basis. AWB should be responsible to do consultations with farmers to calculate Abiana rates and have public opinion on it. Definitely public response is unlikely to be popular. So must be increased for commercial users not for farmers - Water pricing reforms will impact tail enders - Soft skills of SIDA and AWBs need to improve. They need to work in collaboration with FOs. FOs have not supported maintenance of irrigation system

		- As for grievance, there exists at the project activity level but not overall - Shift to new crops might not be easy as **majority are small** farmers. They already facing water scarcity, high cost of fertilizers, counterfeit seeds, pest attacks so they might not accept shift. They are likely to continue their current practices. The fear of failure and loosing whatever they have would discourage theme to make a shift.
16	Muhammad Ali Zardari, Director AWB, Ghotki Feeder Canal	- The agro-ecological zoning system will greatly enhance, the agriculture production significantly, in a way that irrigation system will be divided into different zones and each zone will be allowed certain type of crop, keeping in view the ecological condition of that particular zone - The change in the zones will not be easily accepted. Ours is an agrarian society with low literacy rate. One has to implement the change with force and continued follow-up seminars. - The overall Co-ordination between AWB and FOs is good. This coordination has given fruitful results, no need to improve it, as it is already working fine - In the past AWB played a significant role in the training of FOs. Now the FOs are capable of handling any problem in their respective jurisdiction without taking advice from any quarter. No bottlenecks are witnessed - The abiana rates are the same as 1999. No change since then. The rates should be revised annually in consultation with FOs and AWB, it is hoped the public response would be positive and not adverse reaction would be witnessed - I was XEN at Akram Wah for three years. I know that rehabilitation of Akram Wah will greatly enhance the socio economic conditions, especially of those who are not getting enough water for their crops to mature - In the past, FOs played a pivotal role in supporting improvement and maintenance of irrigation system. Now the FOs feel ownership of channel, the trend has enhanced the moral of officers/officials and farmers community as a whole - Modernization of distributaries can be impacted by the “biradari system” as tribes have old scores to settle. Support from law enforcement agencies can curb conflicts - There is no proper mechanism to redress the grievances in the water delivery system. This can be modernized in stages such as if someone has a complaint he should register that at the lowest level and it should be resolved at that level. For bigger issues matters can be raised to senior levels - Market plays a vital role in the decision of the farmers to choose a particular crop. If farmers are getting good returns on their crop they will not shift to any other crop. They will shift only if returns are higher
17	Ghulam Mujtaba, Director Nara Canal	- Agro-ecological zoning system would be more useful and can easily be altered and water delivery practice would be more efficient. Most of the developed world has already adopted agro-ecological zoning system. We have Canal network in the command of Nara Canal and there will be no issue in adopting zoning system. The zoning will improve the water delivery efficiency - No serious environmental issues are expected with the implementation of agro-ecological zoning system. But definitely there will be social issues as it might require changing of cropping pattern and practice. The farming community will require close coordination, help and technical guidance from Agricultural Extension department on day-to-day basis. But ultimately it will have positive impacts for the farming community

		- The Nara Canal AWB is the pioneer and most senior AWB in the province of Sindh so AWB and FOs are more mature than any other AWB. There is a good coordination mechanism is available between AWB and FOs right from Sub-Division to Directorate level. AWB has specialized Social Mobilization Team, which is the key for coordination between AWB and FOs. At present, the Social Mobilization Team is comprised of few professional staff. The coordination can be improved by induction of more Social Mobilization staff and conduct of regular coordination meeting between the AWB staff and FOs at the sub-division level on monthly basis. Also effective complaint handling mechanism can improve the system, which is already available at Nara Canal AWB - All the training components under different projects i.e. NDP Reprograming Scheme, SOFWMP, WSIP, etc. were directly executed by the SIDA. In my opinion, these training components may be directly allocated to AWB to execute. The AWB is directly dealing with FOs on day to day basis so these trainings executed by the AWB will be more beneficial and fruitful. There shall be a full time independent Training Center at each AWB for training of AWB staff and FOs round the year - The WHR system would be very beneficial as the farmers usually don't get appropriate prices when produce is harvested in general. They get very low prices for their produce at the time of harvest. It has been observed that prices usually increase after 2-3 months. So it would be good system if adopted and farmers will get good prices for their produces. It will also reduce the role of middle-man who is earning more than farmer. - Currently, the farmers don't get subsidies directly rather through the Revenue and Agriculture Department. It has been observed that the small farmers lacks the knowledge about the procedures and subsidies. Usually, the small farmers are unable to get benefit of government subsidies due to lack of knowledge, access, corruption, etc. Therefore, the e-voucher concept would be appropriate and suitable for farmers specially the small ones. - Small farmers do not have proper knowledge about markets for their produce and inputs so they usually get inputs at higher rates but low returns for their produces. The concept of FEGs will be more beneficial for the small farmers and they net benefit will be more. - Current Abiana rates are the lowest in whole Asia. They need to be increased through the AWB. Specially the rates for commercial users must be increased many times because water is used for commercial purpose. I believe that initially there will be resistance from the stakeholders but they can be mobilized to pay increased rates due to scarcity and importance of water resources - impact of institutional reforms will be good in relation with AWB and FOs. Farmers will have sense of ownership at each level right from identification of issues to implementation. FOs will show responsible behavior and overall efficiency of AWB in terms of revenue collection, channel operation; maintenance and water distribution will be improved. The Nara Canal is the oldest and pioneering AWB in Sindh province and we have crossed the transitional period. The AWB management and FOs are very mature. Most of the FOs of the Nara Canal AWB are going through their 4th and 5th legal tenure. The maximum members of Model FOs in Sindh are located in Nara Canal

		- To some extent the FOs have been very supportive in improvement of irrigation system but they lack technical skills. So they need continuous technical guidance and support - There may be conflicts among the farmers of head, middle and tail on modernization of distributary, but they can be resolved by dissemination of information, briefing about the scheme and joint FO meetings - Nara Canal AWB has a well established "Complaint Cell" at the Directorate level, the Director Nara Canal and General Manager – FACR regularly meet the farmers at the Directorate and also receive written, telephonic and WhatsApp complaints from the farmers and FOs. These complaints are referred to the concerned Executive Engineer and Assistant Executive Engineer for redressal and report at earliest. Also Director Nara Canal and all Executive Engineers hold "Khuli Katchehries" regularly with the farmers in the field to listen to their grievances and resolution. Each Executive Engineer holds open meeting every Wednesday at Sub-Divisional Headquarter with all the staff and listens to the complaints of FOs and farmers. - 95% of the ground water in the command of Nara Canal is saline/brackish and not usable for agriculture and drinking purpose. This increases our role and responsibility for equitable water distribution from head to tail for agriculture and drinking purpose - Factors that can discourage farmers from shifting to new crops are Lack of skills and knowledge about the process of cultivation of these low water consumption crops, the transition process, marketing, non-availability of proper technical support for transition by Agriculture Department, Lack of capacity

8.3.1 Consultation on Gender Action Plan

A separate online consultation on Gender Action Plan was conducted on 30th June, 2021. The session was attended by 18 participants from SWAT implementing agencies, AWBs, ILO, UNWomen, and NGOs working in Sindh. The list of participants is given in Table 8.1. The participants were presented with the gender issues highlighted in the gender analysis phase. Their feedback is summarized in Table 8.2.

Table 8.2: Feedback on Gender Action Plan

Issues	Action Points	Comments/Observations/Suggestions
Women specific issues are not addressed in policies related to water use and agriculture	- Consultation sessions with multiple women users of water - Schemes for women farmers to access farm inputs and subsidies	- It is important to properly analyze women's contribution in agriculture and water use. - Women farmers need to be directly consulted to understand their demands and requirements
Data collection and tabulation is not always gender representative	- Gender representative sampling in data collection	- ILO uses gender representative sampling. Lessons can be learnt from their projects and data collection methodology
Women are not sufficiently represented in official/professional water institutions (Irrigation departments/Area Water Boards/Farmers Organizations/Water Utilities)	- Women in Water User Associations can be trained to be part of FOs - Women in FOs can be engaged in abiana collection	- The participation of women in FOs is not effective because they do not manage water for irrigation - As women do not have land titles, they are unable to participate in FOS - Water is released usually in late or in early hours. It is not safe for women to be out on their own at such hours
Women are engaged in agriculture, but their role and contribution is understated or even unrecognized	- Detailed studies on women farmers contribution to agriculture	- There is little data to quantify women's contribution to the agriculture sector
Most rural women are engaged in livestock rearing, however, this is seen as a domestic activity and not a productive one	- Dairy women farmers should be provided with business support services - Water infrastructure for livestock sector development needs to be explored	- SPO undertook a project in which women were provided with water access for their livestock for free. This substantially increased the milk yield and their incomes - Women look after animals, but selling and buying is done by male relatives
Are women engaged at any level in decision making regarding crop selection, agro-processing facilities, FO sub projects?	- Promote women-led agro businesses - Engage women in packaging and agro-processing activities	- Women have set up rice nurseries and are engaged in fruit and vegetable packaging. Their roles can be further formalized and supported
Women continue to be engaged in low paid activities	- On-farm capacity development of women	- Women in rural areas are interested in agro-businesses
Women's access to agriculture input and output markets are non-existent or limited	- Engage women in service providing sectors	- Women usually cannot benefit from subsidies as majority do not have "form 7" (land title)

8.4 Access to Information

This ESMF will be disclosed on both PCMU and World Bank websites. Executive summary of the ESMF and the RPF will be translated into Sindhi and will be published on the PCMU website, and hard copies of these documents will be made available at local union council offices for public access. The ESIA and A/RAP documents to be prepared for proposed projects will also be disclosed on the PCMU and

World Bank websites and also will be made available to the local communities by placing them at the local union council offices.

Annex 1: Environmental Code of Practices

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

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

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

ECP 1: Waste Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
General Waste	Soil and water pollution from the improper management of wastes and excess materials from the construction sites.	The Contractor shall • Develop a waste management plan for various specific waste streams (e.g., reusable waste, flammable waste, construction debris, food waste etc.) prior to commencing of construction and submit to CSC for approval. • Organize disposal of all wastes generated during construction in an environmentally acceptable manner. This will include consideration of the nature and location of the disposal site, so as to cause less environmental impact. • Minimize the production of waste materials by 3R (Reduce, Recycle and Reuse) approach. • Segregate and reuse or recycle all the wastes, wherever practical. • Prohibit burning of solid waste • Collect and transport non-hazardous wastes to all the approved disposal sites. Vehicles transporting solid

		waste shall be covered with tarps or nets to prevent spilling waste along the route • Train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process. • Provide refuse containers at each worksite. • Request suppliers to minimize packaging where practicable. • Place a high emphasis on good housekeeping practices. • Maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal.
Hazardous Waste	Health hazards and environmental impacts due to improper waste management practices	The Contractor shall • Collect chemical wastes in 200-liter drums (or similar sealed containers), appropriately labeled for safe transport to an approved chemical waste depot. • Store, transport and handle all chemicals avoiding potential environmental pollution. • Store all hazardous wastes appropriately in bunded areas away from watercourses. • Make available Material Safety Data Sheets (MSDS) for hazardous materials on-site during construction. • Collect hydrocarbon wastes, including lube oils, for safe transport off-site for reuse, recycling, treatment or disposal at approved locations. • Construct concrete or impermeable flooring to prevent seepage in case of spills

ECP 2: Fuels and Hazardous Goods Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Fuels and hazardous goods.	Materials used in construction have the potential to be a source of contamination. Improper storage and handling of fuels, lubricants, chemicals and hazardous goods/materials on-site, and potential spills from these goods may harm the environment or health of construction workers.	The Contractor shall • Prepare spill control procedures and submit the plan for CSC approval. • Train the relevant construction personnel in the handling of fuels and spill control procedures. • Store dangerous goods in bunded areas on a top of a sealed plastic sheet away from watercourses; and also, under rainwater shed (to prevent contact with rainwater). • Refueling shall occur only within bunded areas. • Make available MSDS for chemicals and dangerous goods on-site. • Transport waste of dangerous goods, which cannot be recycled, to a designated disposal site approved by EPA or sold to EPA registered vendors.

		• Provide absorbent and containment material (e.g., absorbent matting) where hazardous material is used and stored, and personnel trained in the correct use. • Provide protective clothing, safety boots, helmets, masks, gloves, goggles, to the construction personnel, appropriate to materials in use. • Make sure all containers, drums, and tanks that are used for storage are in good condition and are labeled with the expiry date. Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur. • Put containers and drums in temporary storage in clearly marked areas, where they will not be run over by vehicles or heavy machinery. The area shall preferably slope or drain to a safe collection area in the event of a spill. • Put containers and drums in permanent storage areas on an impermeable floor that slopes to a safe collection area in the event of a spill or leak. • Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution. • Avoid the use of material with greater potential for contamination by substituting them with more environmentally friendly materials. • Return the gas cylinders to the supplier. However, if they are not empty prior to their return, they must be labeled with the name of the material they contained or contain, information on the supplier, cylinder serial number, pressure, their last hydrostatic test date, and any additional identification marking that may be considered necessary.

ECP 3: Water Resources Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Hazardous Material and Waste	Water pollution from the storage, handling and disposal of hazardous materials and general construction waste, and accidental spillage	The Contractor shall • Follow the management guidelines proposed in ECPs 1 and 2. • Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways, stormwater systems or underground water tables
Discharge from construction sites	Wastewaters from construction sites and work camps. The construction works will	The Contractor shall • Minimize the amount of exposed soil at any one time (only clear vegetation immediately before construction is about to begin)

	modify groundcover and topography changing the surface water drainage patterns of the area including infiltration and storage of stormwater.	• Install temporary drainage works (channels and bunds) in areas required for sediment and erosion control and around storage areas for construction materials • Install temporary sediment basins, where appropriate, to capture sediment-laden run-off from the site • Divert runoff from undisturbed areas around the construction site • Stockpile materials away from drainage lines • Prevent all solid entering waterways by collecting solid waste, oils, chemicals, bitumen spray waste and wastewaters from brick, concrete and asphalt cutting and transport to an approved waste disposal site or recycling depot • Collect, transport and discharge the septic tank waste from the construction camps in the nearby municipal wastewater treatment plants • Ensure that tires of construction vehicles are cleaned in the washing bay (constructed at the entrance of the construction site) to remove the mud from the wheels. This shall be done in every exit of each construction vehicle to ensure the local roads are kept clean.
Soil Erosion and siltation	Soil erosion and dust from the material stockpiles will increase the sediment and contaminant loading of surface water bodies.	The Contractor shall • Ensure that sealed roads used by construction vehicles are swept regularly to remove sediment. • Water the material stockpiles, access roads and bare soils on an as-required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds)

ECP 4: Drainage Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Excavation and earthworks, and construction yards	Lack of proper drainage for rainwater/liquid waste or wastewater owing to the construction activities harms the environment in terms of water and soil contamination, and mosquito growth.	The Contractor shall • Prepare a program for preventing/avoid standing waters, which CSC will verify in advance and confirm during implementation • Provide alternative drainage for rainwater if the construction works/earth-fillings cut the established drainage line • Establish local drainage line with appropriate silt collector and silt screen for rainwater or wastewater connecting to the existing established drainage lines already there • Rehabilitate road drainage structures immediately if damaged by contractors' road transports. • Build new drainage lines as appropriate and required for wastewater from construction yards connecting to

		the available nearby recipient water bodies. Ensure wastewater quality conforms to the relevant standards provided by NEQS, before it being discharged into the recipient water bodies. • Ensure the internal roads/hard surfaces in the construction yards/construction camps that generate has stormwater drainage to accommodate high runoff during a downpour and that there is no stagnant water in the area at the end of the downpour. • Construct wide drains instead of deep drains to avoid sand deposition in the drains that require frequent cleaning. • Provide appropriate silt collector and silt screen at the inlet and manholes and periodically clean the drainage system to avoid drainage congestion • Protect natural slopes of drainage channels to ensure adequate stormwater drains. • Regularly inspect and maintain all drainage channels to assess and alleviate any drainage congestion problem. • Reduce infiltration of contaminated drainage through stormwater management design
Ponding of water	Health hazards due to mosquito breeding	• Do not allow ponding of water especially near the waste storage areas and construction camps • Discard all the storage containers that are capable of storing water, after use or store them in inverted position

ECP 5: Soil Quality Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Storage of hazardous and toxic chemicals	Spillage of hazardous and toxic chemicals will contaminate the soils	The Contractor shall • Strictly manage the wastes management plans proposed in ECP1 and storage of materials in ECP2 • Construct appropriate spill contaminant facilities for all fuel storage areas • Establish and maintain a hazardous materials register detailing the location and quantities of hazardous substances including the storage, use of disposals • Train personnel and implement safe work practices for minimizing the risk of spillage • Identify the cause of contamination, if it is reported, and contain the area of contamination. The impact may be contained by isolating the source or implementing controls around the affected site • Remediate the contaminated land using the most appropriate available method to achieve required commercial/industrial guideline validation results

Construction material stockpiles	Erosion from construction material stockpiles may contaminate the soils	The Contractor shall • Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds

ECP 6: Erosion and Sediment Control

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities and material stockpiles	The impact of soil erosion are (i) Increased runoff and sedimentation causing a greater flood hazard to the downstream, (ii) destruction of aquatic environment in nearby lakes, streams, and reservoirs caused by erosion and/or deposition of sediment damaging the spawning grounds of fish, and (iii) destruction of vegetation by burying or gullying.	The Contractor shall • Locate stockpiles away from drainage lines • Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds • Remove debris from drainage paths and sediment control structures • Cover the loose sediments and water them if required • Divert natural runoff around construction areas prior to any site disturbance • Install protective measures on-site prior to construction, for example, sediment traps • Observe the performance of drainage structures and erosion controls during rain and modify them as required.

ECP 7: Topsoil Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earthworks	Earthworks will impact the fertile topsoil that is enriched with nutrients required for plant growth or agricultural development.	The Contractor shall • Strip the topsoil to a depth of 15 cm and store in stockpiles of height not exceeding 2m. • Remove unwanted materials from topsoil like grass, roots of trees and similar others. • The stockpiles will be done in slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil. • Locate topsoil stockpiles in areas outside drainage lines and protect from erosion. • Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil. • Spread the topsoil to maintain the physico-chemical and biological activity of the soil. The stored topsoil will be utilized for covering all disturbed area and along with the proposed plantation sites

		• Prior to the re-spreading of topsoil, the ground surface will be ripped to assist the bunding of the soil layers, water penetration and revegetation
Transport	Vehicular movement outside right of way of existing roads or temporary access roads will affect the soil fertility of the agricultural lands	• Limit equipment and vehicular movements within the approved construction zone • Construct temporary access tracks to cross concentrated water flow lines at right angles • Plan construction access to make use, if possible, of the final road alignment • Use vehicle-cleaning devices, for example, ramps or wash down areas

ECP 8: Topography and Landscaping

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Land clearing and earthworks	Construction activities especially earthworks will change topography and disturb the natural rainwater/floodwater drainage as well as will change the local landscape.	The Contractor shall • Ensure the topography of the final surface of all raised lands (construction yards, approach roads, access roads, etc.) are conducive to enhance natural draining of rainwater/flood water; • Keep the final or finished surface of all the raised lands free from any kind of depression that insists waterlogging • Undertake mitigation measures for erosion control/prevention by grass-turfing and tree plantation, where there is a possibility of rain-cut that will change the shape of topography. • Cover immediately the uncovered open surface that has no use of construction activities with grass-cover and tree plantation to prevent soil erosion and bring improved landscaping

ECP 9: Quarry and Borrow Areas Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Development and operation of Quarry and borrow areas. The project will use approved quarry sites available near the project site. This ECP will be	Quarry areas will have impacts on local topography, landscaping and natural drainage.	The Contractor shall • Use only quarry and borrow sites that are licensed by the provincial government and approved by the project management Organization/Implementation Consultants. • Identify new borrow and quarry areas in consultation with Project Director, if required. • Reuse excavated or disposed of material available in the project to the maximum extent possible. • Store topsoil for reinstatement and landscaping.

used only when a new quarry or borrow area to be developed.		• Develop surface water collection and drainage systems, anti-erosion measures (berms, revegetation etc.) and retaining walls and gabions where required. Implement mitigation measures in ECP 3: Water Resources Management, ECP 6: Erosion and Sediment Control • The use of explosives should be used in as much minimum quantity as possible to reduce noise, vibration and dust. • Control dust and air quality deterioration by application of watering and implementing mitigation measures proposed in ECP 10: Air Quality Management • Noise and vibration control by ECP 11: Noise and Vibration Management.

ECP 10: Air Quality Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Air quality can be adversely affected by vehicle exhaust emissions and combustion of fuels.	The Contractor shall • Fit vehicles with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition. • Operate the vehicles in a fuel-efficient manner • Cover haul vehicles carrying dusty materials moving outside the construction site • Impose speed limits on all vehicle movement at the worksite to reduce dust emissions • Control the movement of construction traffic • Water construction materials prior to loading and transport • Service all vehicles regularly to minimize emissions • Limit the idling time of vehicles not more than 2 minutes
Construction machinery	Air quality can be adversely affected by emissions from machinery and the combustion of fuels.	The Contractor shall • Fit machinery with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition in accordance with the specifications defined by their manufacturers to maximize combustion efficiency and minimize the contaminant emissions. Proof of maintenance register shall be required by the equipment suppliers and contractors/subcontractors • Focus special attention on containing the emissions from generators • Machinery causing excess pollution (e.g. visible smoke) will be banned from construction sites • Service all equipment regularly to minimize emissions

		• Provide filtering systems, duct collectors or humidification or other techniques (as applicable) to the concrete batching and mixing plant to control the particle emissions in all its stages, including unloading, collection, aggregate handling, cement dumping, circulation of trucks and machinery inside the installations
Construction activities	Dust generation from construction sites, material stockpiles and access roads are a nuisance in the environment and can be a health hazard.	• Water the material stockpiles, access roads and bare soils on an as-required basis to minimize the potential for environmental nuisance due to dust. Increase the watering frequency during periods of high risk (e.g. high winds). Stored materials such as gravel and sand shall be covered and confined to avoid their being wind-drifted • Minimize the extent and period of exposure of the bare surfaces • Reschedule earthwork activities or vegetation clearing activities, where practical, if necessary, to avoid during periods of high wind and if visible dust is blowing off-site • Store the cement in silos and minimize the emissions from silos by equipping them with filters. • Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust dispersion is prevented because of such operations • Crushing of rocky and aggregate materials shall be wet-crushed, or performed with particle emission control systems

ECP 11: Noise and Vibration Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Noise quality will be deteriorated due to vehicular traffic	The Contractor shall • Maintain all vehicles in order to keep it in good working order in accordance with manufactures maintenance procedures • Make sure all drivers will comply with the traffic codes concerning the maximum speed limit, driving hours, etc. • Organize the loading and unloading of trucks, and handling operations for the purpose of minimizing construction noise on the worksite
Construction machinery	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	The Contractor shall • Appropriately site all noise-generating activities to avoid noise pollution to local residents • Use the quietest available plant and equipment

		• Modify equipment to reduce noise (for example, noise control kits, the lining of truck trays or pipelines) • Maintain all equipment in order to keep it in good working order in accordance with manufactures maintenance procedures. Equipment suppliers and contractors shall present proof of the maintenance register of their equipment. • Install acoustic enclosures around generators to reduce noise levels. • Fit high-efficiency mufflers to appropriate construction equipment • Avoid the unnecessary use of alarms, horns and sirens
Construction activity	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	The Contractor shall • Notify adjacent landholders prior to any typical noise events outside of daylight hours (6 pm to 7 am) if the construction works are being carried out near residential areas • Educate the operators of construction equipment on potential noise problems and the techniques to minimize noise emissions • Employ the best available work practices on-site to minimize occupational noise levels • Install temporary noise control barriers where appropriate • Notify affected people if major noisy activities are undertaken, e.g. pile driving • Plan activities on-site and deliveries to and from site to minimize impact • Monitor and analyze noise and vibration results and adjust construction practices as required. • Avoid undertaking the noisiest activities, where possible, when working at night (6pm to 7 am) near the residential areas

ECP 12: Protection of Flora

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Vegetation clearance	Local flora is important to provide shelters for the birds, offer fruits and/or timber/firewood, protect soil erosion and overall keep the environment very friendly to human-living. As such damage to flora has a wide range of	The Contractor shall • Reduce disturbance to surrounding vegetation • Use appropriate type and minimum size of machine to avoid disturbance to adjacent vegetation. • Get approval from the supervision consultant for the clearance of vegetation. • Make selective and careful pruning of trees where possible to reduce the need for tree removal.

	adverse environmental impacts.	• 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 plans. These measures are applicable to both the construction areas as well as to any associated activities such as sites for stockpiles, disposal of fill and construction of diversion roads, etc. • Before excavation, mark the trees that must remain on the site and cannot be removed. • Do not burn off cleared vegetation – where feasible, chip or mulch and reuse it for the rehabilitation of affected areas, temporary access tracks or landscaping. Mulch provides a seed source, can limit embankment erosion, retains soil moisture and nutrients, and encourages re-growth and protection from weeds. • Return topsoil and mulched vegetation (in areas of native vegetation) to approximately the same area of the roadside it came from. • Avoid work within the dripline of trees to prevent damage to the tree roots and compacting the soil. • Minimize the length of time the ground is exposed, or excavation left open by clearing and re-vegetate the area at the earliest practically possible. • Ensure excavation works occur progressively and re-vegetation done at the earliest • Provide adequate knowledge to the workers regarding nature protection and the need to avoid felling trees during construction • Supply appropriate fuel in the work caps to prevent fuelwood collection

ECP 13: Protection of Fauna

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Vegetation clearance	Clearance of vegetation may impact shelter, feeding and/or breeding of animals	The Contractor shall • Restrict the tree removal to the minimum required. • Retain tree hollows on-site, or relocate hollows, where appropriate • Leave dead trees where possible as habitat for fauna • Identify the trees that require specific attention (e.g. the hollow-bearing trees) and fell them in a manner that reduces the potential for fauna mortality. Felled trees will be inspected after felling for fauna and if identified and readily accessible will be removed and relocated or rendered assistance if injured. After felling, hollow-bearing trees will

		remain unmoved overnight to allow animals to move of their own volition.
Construction camps	Illegal poaching	• Provide adequate knowledge to the workers regarding the protection of flora and fauna, and relevant government regulations and punishments for illegal poaching. • The contractor's code of conduct shall include on the protection of flora and fauna, and ban on tree cutting and hunting of animals. Employees found violating would be subject to strict actions including fines and termination of employment.

ECP 14: Protection of Fish

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities in River	The main potential impacts to fisheries are hydrocarbon spills and leaks from riverine transport and disposal of wastes into the river	The Contractor shall • Prepare procedures for the protection of fish and submit them for supervision consultant approval. • Ensure the construction equipment used in the river are well maintained and does not have oil leakage to contaminate river water. • Contain oil immediately on the river in case of accidental spillage from equipment; make an emergency oil spill containment plan (under the Fuels and Hazardous Substances Management Plan) to be supported with enough equipments, materials and human resources. • Do not dump wastes, be it hazardous or non-hazardous into the nearby water bodies or in the river.
Construction activities on the land	The main potential impacts to aquatic flora and fauna River are increased suspended solids from earthworks erosion, sanitary discharge from work camps, and hydrocarbon spills	The Contractor shall • follow mitigation measures proposed in ECP 3: Water Resources Management and EC4: Drainage Management.

ECP 15: Road Transport and Road Traffic Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Increased traffic use of the road by construction vehicles	The Contractor shall

	will affect the movement of normal road traffics and the safety of the road-users.	• Prepare and submit a traffic management plan to the CSC for their approval before the commencement of construction. • Include in the traffic management plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges temporary diversions, necessary barricades, warning signs / lights, and road signs. • Provide signs at strategic locations of the roads complying with the schedules of signs contained in the Pakistan Traffic Regulations. • Install and maintain a display board at each important road intersection on the roads to be used during construction, which shall clearly show the following information in local language: o Location: chainage and village name o Duration of the construction period o Period of proposed detour / alternative route o Suggested detour route map o Name and contact address/telephone number of the concerned personnel o Name and contact address / telephone number of the Contractor o Inconvenience is sincerely regretted.
	Accidents and spillage of fuels and chemicals	• Restrict truck deliveries, where practicable, to daytime working hours (7 am to 6 pm). • Restrict the transport of oversize loads. • Operate road traffics/transport vehicles, if possible, to non-peak periods to minimize traffic disruptions. • Enforce on-site speed limit

ECP 16: Labor Influx Management and Construction Camp Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Siting and Location of construction camps	Campsites for construction workers are the important locations that have significant impacts such as health and safety hazards on local resources and infrastructure of nearby communities.	The Contractor shall • Prepare a management plan for construction of workers camp in accordance with IFC Guidance on Workers Accommodation and submit the plan for supervision consultant's approval. • Locate the construction camps within the designed sites or at areas that are acceptable from environmental, cultural or social point of view; and approved by the supervision consultant. • Consider the location of construction camps away from communities in order to avoid social conflict in using natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities.

		• Submit to the supervision consultant for approval a detailed layout plan for the development of the construction camp showing the relative locations of all temporary buildings and facilities that are to be constructed together with the location of site roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, prior to the development of the construction camps. • Local authorities responsible for health, religious and security shall be duly informed on the set up of camp facilities so as to maintain effective surveillance over public health, social and security matters.
Construction Camp Facilities	Lack of proper infrastructure facilities , such as housing, water supply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	Contractor shall provide the following facilities in the campsites • Adequate accommodation, transportation, and basic services including water, sanitation, and medical care for the workers working on that project Safe and reliable water supply, which should meet NEQS. Drinking water to be chlorinated at source and ensure presence of residual chlorine 0.1 ~ 0.25 ppm as a minimum after 30 minutes of chlorine contact time (WHO guideline). • Hygienic sanitary facilities and sewerage systems. The toilets and domestic wastewater will be collected through common sewerage. Provide separate latrines and bathing places for males and females with total isolation by location. The minimum number of toilet facilities required is one toilet for every ten persons. • Treatment facilities for sewerage of toilet and domestic wastes. • Stormwater drainage facilities. • Paved internal roads. • Provide child crèches for women working construction sites. The crèche should have facilities for dormitory, kitchen, indoor and outdoor play area. Schools should be attached to these crèches so that children are not deprived of education whose mothers are construction workers. • Provide in-house community/common entertainment facilities. Dependence of local entertainment outlets by the construction camps to be discouraged/prohibited to the extent possible.
Workers Accommodation	All workers in the camp should have adequate accommodation facilities	The Contractor shall provide the following: • The labor will be provided with accommodation on twin sharing basis made of insulating material and locally available building material, etc.;

		• The migrant workers with families shall be provided with individual accommodation comprising a bedroom, sanitary and cooking facilities; • The units will be supported by common latrines and bathing facilities duly segregated for male and female labor; • An adequate number of toilets shall be provided in the accommodation facilities. A minimum of 1 unit to 15 males and 1 unit for 10 females shall be provided; • The contractor shall provide a kitchen facility for the construction workers and the food will be of appropriate nutritional value and will consider religious/cultural backgrounds; • All doors and windows shall be lockable and mobile partitions/curtains shall be provided for privacy; • Facilities for the storage of personal belongings for workers shall be provided within the campsite only; • Dustbins shall be provided for collection of garbage and will be removed on a daily basis; • It is also required to provide first aid box in adequate numbers; and • Ventilation should be appropriate for the climatic conditions and provide workers with a comfortable and healthy environment to rest and spend their spare time.
Disposal of waste	Management of wastes is crucial to minimize impacts on the environment	The Contractor shall • Ensure proper collection and disposal of solid wastes within the construction camps • Insist waste separation by source; organic wastes in one pot and inorganic wastes in another pot at the household level. • Store inorganic wastes in a safe place within the household and clear organic wastes on a daily basis to waste collectors. Establish waste collection, transportation and disposal systems with the manpower and equipment/vehicles needed. • Dispose of organic wastes in a designated safe place on daily basis. At the end of the day cover the organic wastes with a thin layer of sand so that flies, mosquitoes, dogs, cats, rats, are not attracted. One may dig a large hole to put organic wastes in it; take care to protect groundwater from contamination by leachate formed due to decomposition of wastes. Cover the bed of the pit with impervious layer of materials (clayey or thin concrete) to protect groundwater from contamination. • Locate the garbage pit/waste disposal site min 500 m away from the residence so that peoples are not disturbed with the odor likely to be produced from anaerobic decomposition of wastes at the waste

		dumping places. Encompass the waste dumping place by fencing and tree plantation to prevent children from entering and playing with. • Do not establish site-specific landfill sites. All solid waste will be collected and removed from the work camps and disposed in approval waste disposal sites.
Fuel supplies for cooking purposes	Illegal sourcing of fuelwood by construction workers will impact the natural flora and fauna	The Contractor shall • Provide fuel to the construction camps for their domestic purpose, in order to discourage them from using fuelwood or another biomass. • Made available alternative fuels like natural gas or kerosene on ration to the workforce to prevent them from using biomass for cooking. • Conduct awareness campaigns to educate workers on preserving the protecting the biodiversity and wildlife of the project area, and relevant government regulations and punishments on wildlife protection.
Health and Hygiene	There will be a potential for diseases to be transmitted including malaria, exacerbated by inadequate health and safety practices. There will be an increased risk of work crews spreading 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 full-time designated first aider or nurse. • Provide ambulance facility for the laborers during an emergency to be transported to nearest hospitals. • Initial health screening of the laborers coming from outside areas • Inspect all camp facilities regularly to ensure o Daily sweeping of rooms and houses shall be undertaken; o Regular cleaning of sanitary facilities shall be undertaken; o The kitchen and canteen premises shall be established under good hygiene conditions; o Daily mealtimes shall be fixed for the labor; o Smoking and alcohol consumption shall be prohibited in the workplace; o Waterlogging shall be prevented at areas near the accommodation facilities and adequate drainage is to be provided; and o Checklists pertaining to the daily housekeeping schedule shall be maintained and displayed at houses, toilets and kitchen.

		• Train all construction workers in basic sanitation and health care issues and safety matters, and on the specific hazards of their work • Provide HIV awareness programming, including STI (sexually transmitted infections) and HIV information, education and communication for all workers on a regular basis • Complement educational interventions with easy access to condoms at campsites as well as voluntary counseling and testing • Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellant sprays during monsoon. • Carryout short training sessions on best hygiene practices to be mandatorily participated by all workers. Place display boards at strategic locations within the camps containing messages on best hygienic practices
Safety	Inadequate safety facilities to the construction camps may create security problems and fire hazards	The Contractor shall • Provide appropriate security personnel (police / home guard or private security guards) and enclosures to prevent unauthorized entry into the camp area. • Maintain register to keep a track on a headcount of persons present in the camp at any given time. • Encourage the use of flameproof material for the construction of labor housing / site office. Also, ensure that these houses/rooms are of sound construction and capable of withstanding windstorms/cyclones. • Provide the appropriate type of firefighting equipment suitable for the construction camps • Display emergency contact numbers clearly and prominently at strategic places in camps. • Communicate the roles and responsibilities of laborers in case of an emergency in the monthly meetings with contractors.
Site Restoration	Restoration of the construction camps to the original condition requires demolition of construction camps.	The Contractor shall • Dismantle and remove from the site all facilities established within the construction camp including the perimeter fence and lockable gates at the completion of the construction work. • Dismantle camps in phases and as the work gets decreased and not wait for the entire work to be completed • Give prior notice to the laborers before demolishing their camps/units

		• Reuse the demolition debris to a maximum extent. Dispose of remaining debris at the designated waste disposal site. • Handover the construction camps with all built facilities as it is if agreement between both parties (contractor and landowner) has been made so. • Restore the site to its condition prior to commencement of the works or to an agreed condition with the landowner. • Not make false promises to the laborers for future employment in O&M of the project.

ECP 17: Socio-cultural and Religious Issues

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities near residential areas	Disturbance from construction activities (dust, noise, traffic, conflicts with contractor's workforce etc.)	The Contractor shall • Establish a system for receiving complaints from the community and address them (the community can also make complaints to the GRM established under the project) • Shall ensure all the construction workers follows the following code of conduct: • All workers are strictly forbidden to establish any kind of relationship with local women brings any un-related women to the project site. • All workers should avoid sexual harassment and child abuse. • All workers must not leave the camps or work sites unless written authorization is issued by the respective supervisor • The contractors will advise and prohibit the local population and its authorities or representatives not to enter the project operation areas (campsites, colonies, etc.) in order to minimize the potential risk of incidents related to the operations.
Construction 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 and newspaper announcements regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restriction. • Do not block access to cultural and religious sites, wherever possible • Restrict all construction activities within the footprints of the construction sites. • Stop construction works that produce noise (particularly during prayer time) shall there be any mosque/religious/educational institutions close to the construction sites and users make objections.

		• Take special care and use appropriate equipment when working next to a cultural/religious institution. • Stop work immediately and notify the site manager if, during construction, an archaeological or burial site is discovered. It is an offence to recommence work in the vicinity of the site until approval to continue is given by the CSC/PMU. • Provide separate prayer facilities to the construction workers. • Show appropriate behavior with all construction workers especially women and elderly people • Allow the workers to participate in praying during construction time • Resolve cultural issues in consultation with local leaders and supervision consultants • Establish a mechanism that allows local people to raise grievances arising from the construction process. • Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works so as to maintain effective surveillance over public health, social and security matters

ECP 18: Worker Health and Safety

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Best practices	Construction works may pose health and safety risks to the construction workers and site visitors leading to severe injuries and deaths. The population in the proximity of the construction site and the construction workers will be exposed to a number of (i) biophysical health risk factors, (e.g. noise, dust, chemicals, construction material, solid waste, wastewater, vector transmitted diseases etc.), (ii) risk factors resulting from human behavior (e.g. STD, HIV etc.) and (iii) road accidents from construction traffic.	The Contractor shall • Implement suitable safety standards for all workers and site visitors which shall not be less than those laid down on the international standards (e.g. International Labor Office guideline on 'Safety and Health in Construction; World Bank Group's 'Environmental Health and Safety Guidelines') and standards applicable in US/UK/Australia/or any other developed country can also be used. • Provide the workers with a safe and healthy work environment, taking into account inherent risks in its particular construction activity and specific classes of hazards in the work areas, • Provide personal protection equipment (PPE) for workers, such as safety boots, helmets, masks, gloves, protective clothing, goggles, full-face eye shields, and ear protection. Maintain the PPE properly by cleaning dirty ones and replacing them with the damaged ones. • Safety procedures include the provision of information, training and protective clothing to workers involved in hazardous operations and proper performance of their job

		• Appoint an environment, health and safety manager to look after the health and safety of the workers • Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works and establishment of construction camps so as to maintain effective surveillance over public health, social and security matters
	Child and pregnant labor	The Contractor shall • not hire children of less than 18 years of age and pregnant women or women who delivered a child within 8 preceding weeks, in accordance with the National Labor Laws
Accidents	Lack of first aid facilities and health care facilities in the immediate vicinity will aggravate the health conditions of the victims	• Provide health care facilities and first aid facilities are readily available. Appropriately equipped first-aid stations shall be easily accessible throughout the place of work • Document and report occupational accidents, diseases, and incidents. • Prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards. In a manner consistent with good international industry practice. • Identify potential hazards to workers, particularly those that may be life-threatening and provide necessary preventive and protective measures. • Provide awareness to the construction drivers to strictly follow the driving rules • Provide adequate lighting in the construction area and along the roads
Construction Camps	Lack of proper infrastructure facilities, such as housing, water supply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	The Contractor shall provide the following facilities in the campsites to improve health and hygienic conditions as mentioned in ECP 15 • Adequate ventilation facilities • Safe and reliable water supply. • Hygienic sanitary facilities and sewerage systems. The toilets and domestic wastewater will be collected through common sewerage. • Treatment facilities for sewerage of toilet and domestic wastes • Stormwater drainage facilities. • Recreational and social facilities • Safe storage facilities for petroleum and other chemicals in accordance with ECP 2 • Solid waste collection and disposal system in accordance with ECP1. • Arrangement for trainings • Paved internal roads. • Security fence at least 2 m height.

		• Sickbay and first aid facilities
Water and sanitation facilities at the construction sites	Lack of Water sanitation facilities at construction sites cause inconvenience to the construction workers and affect their personal hygiene.	The contractor shall provide portable toilets at the construction sites, if about 25 people are working the whole day for a month. The location of portable facilities shall be at least 6 m away from the storm drain system and surface waters. These portable toilets shall be cleaned once a day and all the sewerage shall be pumped from the collection tank once a day and shall be brought to the common septic tank for further treatment. The contractor shall provide bottled drinking water facilities to the construction workers at all the construction sites.
Other ECPs	Potential risks on health and hygiene of construction workers and general public	The Contractor shall follow the following ECPs to reduce health risks to the construction workers and nearby community ECP 2: Fuels and Hazardous Goods Management ECP 4: Drainage Management ECP 10: Air Quality Management ECP 11: Noise and Vibration Management ECP 14: Road Transport and Road Traffic Management
Trainings	Lack of awareness and basic knowledge in health care among the construction workforce, make them susceptible to potential diseases.	The Contractor shall • Train all construction workers in basic sanitation and health care issues (e.g., how to avoid malaria and transmission of sexually transmitted infections (STI) HIV/AIDS. • Train all construction workers in general health and safety matters, and on the specific hazards of their work . Training shall consist of basic hazard awareness, site-specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. • Commence malaria, HIV/AIDS and STI education campaign before the start of the construction phase and complement it with a strong condom marketing, increased access to condoms in the area as well as to voluntary counseling and testing. • Implement malaria, HIV/AIDS and STI education campaign targeting all workers hired, international and national, female and male, skilled, semi- and unskilled occupations, at the time of recruitment and thereafter pursued throughout the construction phase on ongoing and regular basis. This shall be complemented by easy access to condoms at the workplace as well as to voluntary counseling and testing.

ECP 20: Instream Construction Works (Diversion, and Hydraulic structures)

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
General Construction Works	River/Canal water quality and aquatic habitat due to risk of release of deleterious substances into the river	The Contractor shall • Prevent the release of silt, sediment, sediment-laden water, raw concrete, concrete leachate, or any other deleterious substances into the River. • Ensure equipment and machinery are in good operating condition (power washed), free of leaks, excess oil and lubricants, and grease. • Machinery leaking fuel, lubricants, hydraulic fluids or solvents shall not work within the river. • Keep a spill containment kit readily accessible onsite in the event of a release of a deleterious substance to the environment. Train onsite staff in its use.
	Stranding of fish in the dewatered area	The Contractor shall • Complete fish salvage before the start of works from the dewatered portion of the river using appropriate techniques.
	Risk of safety relative to river work	The Contractor shall • Devise an evacuation plan, including installation of warning signals and emergency exits, to safely evacuate employees and equipment from the work area. • Ensure risk management procedures are in place on all work sites to minimise the potential for damage arising from inclement weather and/or/elevated river levels during the course of work.
Excavation Works	.	The Contractor shall • Remove excavated material and dispose of it into the designated disposal areas, not dumping these materials into the river. Use mitigating measures to protect excavated material from being eroded and reintroduced into the river
Concrete Works	Concrete leachate is alkaline and highly toxic to fish and other aquatic life.	The Contractor shall • Provide appropriate devices and measures against the discharge of toxic materials and fluids originated from concreting work into the rivers, • Ensure that any materials or liquids produced by works involving the use of concrete, cement and cementitious materials shall not be deposited at non-designated places, and not be discharged into or about any watercourse without treatment. • Provide containment facilities for the wash-down water from concrete delivery trucks, concrete pumping equipment, and other tools and equipment.

Annex 2: Environmental Screening Checklist[41]

INSTRUCTIONS

This checklist is designed to help users decide whether EIA is required based on the characteristics of a project and its environment.

Start by providing a brief description of the project.

Then using available information about the project answer each question in Column 2:

- Yes - if the answer is yes
- No - if the answer is no
- ? - if the answer is don't know

Briefly describe the relevant characteristic of the project or its environment and then consider whether any effect that is likely to result is likely to be significant and enter the response in Column 3 with a note of the reasons why. Use the next Checklist on Criteria for Evaluating Significance to help answer the question "Is this likely to result in a significant effect?".

Some examples illustrating how to use the checklist are given below.

Questions to be Considered	Yes / No / ? . Briefly describe	Is this likely to result in a significant effect? Yes/No/? - Why?
Brief Project Description: Development of 500 houses adjacent to an existing rural settlement at ABCville.		
1. Will construction, operation or decommissioning of the Project involve actions which will cause physical changes in the locality (topography, land use, changes in waterbodies, etc)?	Yes. The project will involve development of a large site currently in agricultural use and crossed by a small river.	Yes. Loss of agricultural land and diversion of river
3. Will the Project involve use, storage, transport, handling or production of substances or materials which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health?	No except in the small amounts typically used by householders	No
4. Will the Project produce solid wastes during construction or operation or decommissioning?	Yes. Construction will require excavation of a small hill and transport and disposal or re-use of a large quantity of spoil.	Yes. Transport could have significant impact on neighbouring village
9. Will the Project result in social changes, for example, in demography, traditional lifestyles, employment?	No. The existing village was mainly built in the 1950s.	No
10. Are there any other factors which should be considered such as consequential development which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality?	Yes. The project will require extension of the village sewage works which is already overloaded.	Yes. There is not much space to extend the works and it already causes odour problems in the village

[41] The screening checklist is developed based on the document prepared by the European Commission and is available at http://ec.europa.eu/environment/archives/eia/eia-guidelines/g-screening-full-text.pdf

19. Are there any areas or features of historic or cultural importance on or around the location which could be affected by the project?	? No information available about the area	? requires further investigation

THE SCREENING CHECKLIST

Section A: Project Details

Project Details	
1. Name of the subproject	
2. Location of the subproject (village, district and AWB/FO)	
3. Detailed description of the proposed activities in the subproject	
4. Estimated Project Cost	
5. Additional details of the site that can help to support the screening questions	

Section B; Baseline Conditions

Current Land use in the subproject area	
Land use around the subproject site	
Description of sensitive receptors in and around the subproject sites	
Description of protected areas around the subproject sties	
Any other details (attach photographs and location maps)	

Section C: Screening Questions

Screening Questions	**Yes / No /?. Briefly describe**	**Is this likely to result in a significant effect? Yes/No/? – Why?**
1. Will construction, operation or decommissioning of the Project involve actions which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.)?		
2. Will construction or operation of the Project use natural resources such as land, water, materials or energy, especially any resources which are non-renewable or in short supply?		
3. Will the Project involve use, storage, transport, handling or production of substances or materials which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health?		
4. Will the Project produce solid wastes during construction or operation or decommissioning?		

Screening Questions	Yes / No /?. Briefly describe	Is this likely to result in a significant effect? Yes/No/? – Why?
5. Will the Project release pollutants or any hazardous, toxic or noxious substances to air?		
6. Will the Project cause noise and vibration or release of light, heat energy or electromagnetic radiation?		
7. Will the Project lead to risks of contamination of land or water from releases of pollutants onto the ground or into surface waters, groundwater, coastal wasters or the sea?		
8. Will there be any risk of accidents during construction or operation of the Project which could affect human health or the environment?		
9. Will the Project result in social changes, for example, in demography, traditional lifestyles, employment?		
10. Are there any other factors which should be considered such as consequential development which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality?		
11. Are there any areas on or around the location which are protected under international or national or local legislation for their ecological, landscape, cultural or other value, which could be affected by the project?		
12. Are there any other areas on or around the location which are important or sensitive for reasons of their ecology e.g. wetlands, watercourses or other waterbodies, the coastal zone, mountains, forests or woodlands, which could be affected by the project?		
13. Are there any areas on or around the location which are used by protected, important or sensitive species of fauna or flora e.g. for breeding, nesting, foraging, resting, overwintering, migration, which could be affected by the project?		
14. Are there any inland, coastal, marine or underground waters on or around the location which could be affected by the project?		
15. Are there any areas or features of high landscape or scenic value on or around the location which could be affected by the project?		
16. Are there any routes or facilities on or around the location which are used by the public for access to recreation or other facilities, which could be affected by the project?		
17. Are there any transport routes on or around the location which are susceptible to congestion or which cause environmental problems, which could be affected by the project?		
18. Is the project in a location where it is likely to be highly visible to many people?		
19. Are there any areas or features of historic or cultural importance on or around the location which could be affected by the project?		
20. Is the project located in a previously undeveloped area where there will be loss of greenfield land?		
21. Are there existing land uses on or around the location e.g. homes, gardens, other private property, industry, commerce,		

Screening Questions	Yes / No /?. Briefly describe	Is this likely to result in a significant effect? Yes/No/? – Why?
recreation, public open space, community facilities, agriculture, forestry, tourism, mining or quarrying which could be affected by the project?		
22. Are there any plans for future land uses on or around the location which could be affected by the project?		
23. Are there any areas on or around the location which are densely populated or built-up, which could be affected by the project?		
24. Are there any areas on or around the location which are occupied by sensitive land uses e.g. hospitals, schools, places of worship, community facilities, which could be affected by the project?		
25. Are there any areas on or around the location which contain important, high quality or scarce resources e.g. groundwater, surface waters, forestry, agriculture, fisheries, tourism, minerals, which could be affected by the project?		
26. Are there any areas on or around the location which are already subject to pollution or environmental damage e.g. where existing legal environmental standards are exceeded, which could be affected by the project?		
27. Is the project location susceptible to earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions e.g. temperature inversions, fogs, severe winds, which could cause the project to present environmental problems?		
28.Will pesticides, rodenticides or any other vector control products will be used during any stage of project implementation and operation?		

Section C: Conclusion

E&S Risk Category of the Subproject (High, Substantial, Moderate, Low):	
E&S Documentation to be prepared for the Subproject (ESIA, ESMP, use of Generic/Standard ESMP in Annex 3, or use of Environmental Code of Practices in Annex 1)	
Recommendations to the Design Engineer	

Name and Designation of the Person who completed the Screening Form:

Date of completion:

Annex 3: Generic ESMPs for Low to Moderate Risk Projects

Annex 4: Terms of Reference for the ESIA/ESMP

Scope of the Work

Project Coordination and Monitoring Unit (PCMU) to engage a team of consultants to conduct the Environmental and Social Impact Assessment (ESIA) for high-risk subprojects and an Environmental Management Plan (ESMP) for the substantial risk subprojects, in order to ensure that the activities carried out under the proposed project are (i) environmentally sound and sustainable in the long run and (ii) consistent with the environmental safeguard guidelines, rules and regulations of the Government of Sindh, as well as those of the World Bank Safeguard Polices.

The Consultants will carry out the tasks including, but not limited to the following:

(i) Review available / secondary environmental data, baseline studies, and results of screening checklists.
(ii) Carry out detailed survey and investigations for collection of adequate primary baseline data
(iii) Collect primary data on the biophysical environment of the project area
(iv) Collect primary data on the socioeconomic conditions of the local communities
(v) Work with the PCMU and its engineering consultants in carrying out an alternative analysis of the proposed subproject locations and designs.
(vi) Assess all potential environmental direct and indirect impacts of the subprojects during pre-construction, construction and operation phases in the project area of influence.
(vii) Provide an independent opinion on approach and adequacy to integrate appropriate environmental management measures with related costs into the detailed design, specifications and project contract documents.
(viii) Undertake public consultation and disclose the outcome of the E&S assessment
(ix) Provide support and advice to PCMU in all matters relating to the environmental aspects of the project.
(x) Any additional work required to achieve the objective of the assignment.

Scope of Work is divided into the following main deliverables.

1. Environment and Social Impact Assessment for high-risk subprojects
2. Environmental and Social Management Plan for substantial-risk subprojects.

All of the above reports will be subject to the Bank's review and approval

Outline (Table of Contents) of ESIA and ESMP Reports

The Consultants will prepare ESIA or ESMP in accordance with the table of contents provided in Annexes 4.1 and 4.2, respectively.

Duration of Assignment

The duration of the assignment for carrying out the ESIA study is 2 months and ESMP study is 1 month. The overall duration of the consultancy services depends on the number of subprojects for which E&S studies to be carried out.

Staff and Qualifications

A team of consultants will be hired to carry out the studies. The key staff and their qualification requirements are given in the following table.

S.No.	Key Staff	Man-months	Qualifications
1	Environmental Specialist	6 (to be revised based on the actual number of subprojects)	The consultant should have a master's degree in environmental sciences, Environmental Management or similar fields. He/she shall have at least ten years of relevant work experience in environmental and social impact assessment. Experience in similar assignments, especially category A projects in the region would be highly preferred. The candidate should have experience working for the WB financed projects.
2	Social Specialist	6 (to be revised based on actual number of subprojects)	The Consultant should have a master's degree in social sciences, social development or similar fields. He/she shall have at least fifteen years of relevant work experience in social impact assessment and mitigation as well as in resettlement planning. Experience in similar assignments, especially category A projects are highly preferred. The candidate should have experience working for the WB financed projects.

Annex 4.1 Proposed Outline of the ESIA

(a) Executive Summary

- Concisely discusses significant findings and recommended actions.

(b) Legal and Institutional Framework

- Analyzes the legal and institutional framework for the project, within which the environmental and social assessment is carried out
- Identifies and assesses the environmental and social requirements of the World Bank.

(c) Project Description

- Concisely describes the proposed project and its geographic, environmental, social, and temporal context, including any offsite investments that may be required (e.g., dedicated pipelines, access roads, power supply, water supply, housing, and raw material and product storage facilities), as well as the project's primary suppliers.
- Includes a map of sufficient detail, showing the project site and the area that may be affected by the project's direct, indirect, and cumulative impacts.

(d) Baseline Data

- Sets out in detail the baseline data that is relevant to decisions about project location, design, operation, or mitigation measures. This should include a discussion of the accuracy, reliability, and sources of the data as well as information about dates surrounding project identification, planning and implementation.
- Identifies and estimates the extent and quality of available data, key data gaps, and uncertainties associated with predictions.
- Based on current information, assesses the scope of the area to be studied and describes relevant physical, biological, and socioeconomic conditions, including any changes anticipated before the project commences.
- Takes into account current and proposed development activities within the project area but not directly connected to the project.

(e) Environmental and Social Risks and Impacts

- Takes into account all relevant environmental and social risks and impacts of the project. This will follow the procedures given in the ESMF of the Project
- Identifies mitigation measures and significant residual negative impacts that cannot be mitigated and, to the extent possible, assesses the acceptability of those residual negative impacts. Identifies differentiated measures so that adverse impacts do not fall disproportionately on the disadvantaged or vulnerable.
- Assesses the feasibility of mitigating the environmental and social impacts; the capital and recurrent costs of proposed mitigation measures, and their suitability under local conditions; and the institutional, training, and monitoring requirements for the proposed mitigation measures.
- Specifies issues that do not require further attention, providing the basis for this determination.

(g) Analysis of Alternatives

- Systematically compares feasible alternatives to the proposed project site, technology, design, and operation—including the "without project" situation—in terms of their potential environmental and social impacts.
- Assesses the alternatives' feasibility of mitigating the environmental and social impacts; the capital and recurrent costs of alternative mitigation measures, and their suitability under local conditions; and the institutional, training, and monitoring requirements for the alternative mitigation measures.
- For each of the alternatives, quantifies the environmental and social impacts to the extent possible, and attaches economic values where feasible.

(h) Environmental and Social Management Plan

- Develop an environmental and social management plan
- Describe the institutional arrangements for implementation of ESMP and reporting.

(i) Consultations and Disclosure

- Summarize the consultations carried out and feedback received on the draft ESIA.

(j) Appendices

- List of the individuals or organizations that prepared or contributed to the environmental and social assessment.
- References—setting out the written materials both published and unpublished, that have been used.
- Record of meetings, consultations and surveys with stakeholders, including those with affected people and other interested parties. The record specifies the means of such stakeholder engagement that were used to obtain the views of affected people and other interested parties.
- Tables presenting the relevant data referred to or summarized in the main text.
- List of associated reports or plans.

Annex 4.2. Indicative outline of ESMP

An ESMP consists of the set of mitigation, monitoring, and institutional measures to be taken during implementation and operation of a project to eliminate adverse environmental and social risks and impacts, offset them, or reduce them to acceptable levels. The ESMP also includes the measures and actions needed to implement these measures. The Borrower will (a) identify the set of responses to potentially adverse impacts; (b) determine requirements for ensuring that those responses are made effectively and in a timely manner; and (c) describe the means for meeting those requirements.

The content of the ESMP will include the following:

(a) Mitigation

- The ESMP identifies measures and actions in accordance with the mitigation hierarchy that reduce potentially adverse environmental and social impacts to acceptable levels. The plan will include compensatory measures, if applicable. Specifically, the ESMP:
  (i) identifies and summarizes all anticipated adverse environmental and social impacts (including those involving indigenous people or involuntary resettlement);

(ii) describes—with technical details—each mitigation measure, including the type of impact to which it relates and the conditions under which it is required (e.g., continuously or in the event of contingencies), together with designs, equipment descriptions, and operating procedures, as appropriate;
(iii) estimates any potential environmental and social impacts of these measures; and
(iv) takes into account, and is consistent with, other mitigation plans required for the project (e.g., for involuntary resettlement, indigenous peoples, or cultural heritage).

(b) Monitoring

- The ESMP identifies monitoring objectives and specifies the type of monitoring, with linkages to the impacts assessed in the environmental and social assessment and the mitigation measures described in the ESMP. Specifically, the monitoring section of the ESMP provides (a) a specific description, and technical details, of monitoring measures, including the parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits (where appropriate), and definition of thresholds that will signal the need for corrective actions; and (b) monitoring and reporting procedures to (i) ensure early detection of conditions that necessitate particular mitigation measures, and (ii) furnish information on the progress and results of mitigation.

(c) Capacity Development and Training

- To support timely and effective implementation of environmental and social project components and mitigation measures, the ESMP draws on the environmental and social assessment of the existence, role, and capability of responsible parties on site or at the agency and ministry level.
- Specifically, the ESMP provides a specific description of institutional arrangements, identifying which party is responsible for carrying out the mitigation and monitoring measures (e.g., for operation, supervision, enforcement, monitoring of implementation, remedial action, financing, reporting, and staff training).
- To strengthen environmental and social management capability in the agencies responsible for implementation, the ESMP recommends the establishment or expansion of the parties responsible, the training of staff and any additional measures that may be necessary to support implementation of mitigation measures and any other recommendations of the environmental and social assessment.

(d) Implementation Schedule and Cost Estimates

- For all three aspects (mitigation, monitoring, and capacity development), the ESMP provides (a) an implementation schedule for measures that must be carried out as part of the project, showing phasing and coordination with overall project implementation plans; and (b) the capital and recurrent cost estimates and sources of funds for implementing the ESMP. These figures are also integrated into the total project cost tables.

(e) Integration of ESMP with Project

- The Borrower's decision to proceed with a project, and the Bank's decision to support it, are predicated in part on the expectation that the ESMP (either stand alone or as incorporated

into the ESCP) will be executed effectively. Consequently, each of the measures and actions to be implemented will be clearly specified, including

- the individual mitigation and monitoring measures and actions and the institutional responsibilities relating to each, and the costs of so doing will be integrated into the project's overall planning, design, budget,and implementation.

Annex 5: Sample Environmental Monitoring Plan

Parameter	Means of Monitoring	Frequency	Responsible for Implementation	Responsible for Supervision
During Construction				
Topsoil	Visual inspection on stripping, storage and reuse of topsoil	Monthly	Contractor	CSC, PMU/SIDA
Erosion	Visual inspection of erosion prevention measures and the occurrence of erosion	Monthly	Contractor	CSC, PMU/SIDA
Operation of quarry sites	Visual inspection of quarry sites	Monthly	Contractor	CSC, PMU/SIDA
Surface water quality	Sampling and analysis of river water quality and wastewater discharges for the parameters given in NEQS	Quarterly	Contractor	CSC, PMU/SIDA
Surface water quality	Spot measurements of pH, conductivity, turbidity. Visual inspection of the presence of petroleum products.	Monthly	Contractor	CSC, PMU/SIDA
Air Quality (dust, smoke)	Visual inspection to ensure good standard equipment is in use and dust suppression measures (spraying of waters) are in place.	Weekly	Contractor	CSC, PMU/SIDA
Air Quality	Visual inspection to ensure dust suppression work plan is being implemented	Weekly	Contractor	CSC, PMU/SIDA
Air Quality in tunnels	Spot measurements for CO and O2 (and other gases	Monthly	EU-CSC	PMU/SIDA

Parameter	Means of Monitoring	Frequency	Responsible for Implementation	Responsible for Supervision
	as defined in the WBG EHS Guidelines) levels in the tunnels			

Annex 6: Physical and Cultural Resource Management Framework and Chance Find Procedures

A. The PCR Management Framework

The PCR Management Plan can constitute a section of the ESIA/ESMP, if one is required. The Management Plan should clearly:

- Schedule the implementation of the proposed PCR mitigating measures and PCR monitoring, if any, taking into account the weather pattern, and identify roles and responsibilities for such implementation;
- Identify procedures for handling chance finds, including the role and responsibilities of the cultural authorities and the contractor; and
- Identify procedures for addressing PCR impacts that may occur during implementation but were not predicted in the impact assessment.

The following are the main considerations guiding the preparation of the PCR Management Plan.

1. Policy, Legal and Regulatory Framework

This section should contain a reference to the following, including identification of any implications for the PCR component of the SIA/SMP, such as special standards or requirements:

- The World Bank's EA policy OP/BP 4.01 and the PCR policy OP/BP 4.11;
- Sections of national EIA laws, regulations and guidelines relating to PCR;
- Sections of the national environmental conservation strategy, if any, relating to PCR;
- Legislation and regulations relating to:
    - Antiquities, including sale and export;
    - Procedures for addressing chance finds, in terms of ownership and requirements by the contractor and cultural authorities;
    - Archaeology, including the issue of permits.
- Relevant authorities charged with PCR identification, protection and management, their powers, the legal basis for their authority, and their actual capacity;
- PCR-related conventions and treaties to which the borrower country is signatory;
- Sites in the borrower country currently listed by other international agency in the field of PCR such as the World Monuments Fund, or ICOMOS, as being of national or international importance;
- Any national or provincial registers of PCR maintained by accredited authorities in the borrower country.

2. Project Description

The project description should detail construction and operation phases, including maps, diagrams and plans of planned activities. The description should take into consideration any potential impacts on PCR of planned activities, construction/rehabilitation processes, transport arrangements, etc.

3. Analysis of Alternatives

In cases where there are major PCR issues, the analysis of alternatives should consider alternative project sites or technologies that could specifically avoid or minimize those impacts on PCR.

4. Baseline Data

The baseline data should begin with an investigation and inventory of PCRs likely to be affected by the project. The data should consider all types of PCR that might be impacted, covering:

- Living-culture PCR, as well as historical, archaeological and paleontological PCR;
- Natural and human-made PCR;
- Movable and immovable PCR;
- Unknown or invisible PCR.

The data collection activity should involve consultations with concerned parties and potentially affected communities. Potential data sources might include cultural authorities, national or provincial PCR registers, universities and colleges, public and private PCR-related institutions, religious bodies and local PCR NGOs. Sources at the community level typically include, for example, community leaders and individuals, schools, religious leaders, scholars, PCR specialists, and local historians.

The baseline data section should include maps showing PCR baseline data within the potential impact areas. In addition, data should detail the cultural significance or value attributed by the concerned or affected parties to the PCR identified in the baseline. Consultation is a particularly important means of identifying PCR and documenting its presence and significance. This will normally not be expressed in monetary terms, but rather should explain the nature of the cultural significance, for example whether it is religious, ethnographic, historic, or archaeological. In the case of PCR of archaeological, architectural, paleontological or other scholarly or scientific value, the PCR Management Plan should provide an assessment of the relative importance of the PCR in this regard locally, nationally and/or internationally.

5. Impact Assessment

PCR should be included in the impact matrix and PCR impacts for each project stage – construction/rehabilitation, operation, etc. – should be detailed. The PCR Management Plan should specifically describe the nature and extent of the potential impacts and state precisely why they are considered to be significant or insignificant. The impact assessment should also consider the possibility of accidents during construction/rehabilitation and operations which might affect PCR, especially in urban settings, which might call for special precautionary measures.

6. Mitigation Measures

It is particularly important that consultations with concerned and affected parties are conducted on the proposed mitigation measures relating to PCR impacts. Agreements must be reached, and evidence of such agreements should be included in PCR Management Plan. It should be checked whether the recommended mitigation measures might themselves have environmental impacts (e.g. archaeological excavations). PCR Management Plan should detail the cost of implementing and the timing of the recommended PCR mitigation measures.

B. Chance Find Procedures

Chance find procedures which will be used during this Project are as follows:

- Stop the construction activities in the area of the chance find;

- Delineate the discovered site or area;

- Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a nightguard shall be present until the responsible local authorities and relevant Department of Archaeology take over;

- Notify the supervisory Engineer who in turn will notify the responsible local authorities and relevant Department of Archaeology immediately (within 24 hours or less);

- Responsible local authorities and relevant Department of Archaeology would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archeologists (within 72 hours). The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historical, scientific or research, social and economic values;

- Decisions on how to handle the finding shall be taken by the local authorities and the relevant Department of Archaeology. This could include changes in the layout (such as when finding an irremovable remain of cultural or archeological importance) conservation, preservation, restoration and salvage;

- Implementation for the authority decision concerning the management of the finding shall be communicated in writing by the relevant Department of Archaeology; and

- Construction work could resume only after permission is given from the local authorities and relevant Department of Archaeology concerning safeguard of the heritage.

These procedures must be referred to as standard provisions in construction contracts, when applicable. During project supervision, the Site Engineer shall monitor the above regulations relating to the treatment of any chance find encountered are observed.

The contact details of the relevant institutions should be mentioned in the chance-find procedures of sub-project instruments.

Annex 7: Gender Action Plan

Project Activities	Gender Action Outputs	Indicators and Targets
Component 1: Water Resources Management		
Component 1.1: Water Resources and Irrigation Policy and Institutional Reforms		
Formulate new Water Management Legal Framework	- Principles of social and gender equity used in developing the legal framework	- Water rights of landless women/farmers explicitly safeguarded in the Legal Framework - Participation of women users/representatives in water resources projects made mandatory at all stages
Transform the Irrigation Department into an Irrigation and Water Resource Management Department	- Institutional policy of equal opportunity and pay developed and followed - On-job training for women employees - Sexual harassment policy, reporting, and grievance redress systems in place - Women friendly facilities at work, like separate toilets, communal space, childcare made available	- # of women employed in managerial, operational and technical roles across different water bodies - # number of women promoted vertically - High level of job satisfaction reported by female employees
Comprehensive Water Pricing Reform	- Water security ensured in water pricing for the poor and domestic consumption based on rightful needs	- # of water insecure/secure households
Component 1.2: Sindh Strategic Water Plan and Specialized Studies		

Project Activities	Gender Action Outputs	Indicators and Targets
Preparation of a "Strategic Water Plan" on a periodic basis (every 5 to 10 years)	- Women stakeholders consulted in the preparation of the Plan - Research/Studies commissioned to uncover women's contribution in water resources management - Gender data gaps in agriculture and water resource management identified and addressed	- Segregated data on women users of water in different sector available - # of new women friendly services/provisions, management principles upgraded/introduced - New and gender sensitive data standards developed
Preparation of provincial wide "Drought Risk Management Plan", as an ancillary to the Strategic Water Plan.	- Women consulted and adequately represented in preparation of the Drought Risk Management Plan	- # of women specific risks identified in the plan - # of mitigation strategies/recommendations specific to women included in the plan
Updating the Right Bank Master Plan.	- Women consulted in the proposed studies for their input and suggestions	- Gender segregated data/situational analysis available - Separate sections on women's engagement plan and impact analysis in the Master Plan
Component 1.3: Hydro-Agro Informatics Program		

Project Activities	Gender Action Outputs	Indicators and Targets
– **Development of System** (including: collection, digitization and standardization of available data sets; development of central data repository; web-based portal; knowledge-based data tools).	- Gender representative sampling in data collection	- New and gender sensitive data standards developed and used
– **Monitoring & *Data Generation*** (Remote Sensing and GIS; Canal Flow and Level Monitoring; Groundwater Monitoring; Water-Environmental Monitoring; Agrometeorological Monitoring).	- Gender representative sampling in data collection	- New and gender sensitive data standards developed and used
Component 2: Water Service Delivery		
Component 2.1: Preparatory Studies for Right Bank Main Canals Infrastructure		
- Studies on modification of the 3 main canals	- Women consulted in the proposed studies for their input and suggestions	- Gender segregated data/situational analysis available - Separate sections on impact on women of proposed projects and action plans
Component 2.2: Left Bank Main Canals Infrastructure		

Project Activities	Gender Action Outputs	Indicators and Targets
– Rehabilitation of Akram Wah Canal	- Resettlement Action Plan developed - Communication strategy for use of alternate water supply, routes, traffic plans developed - Grievance redress system, including for harassment of girls/women in place	- All affected families compensated - Area residents, including women aware of project activities and alternate schemes - All reported harassment cases fairly and timely addressed/resolved
Component 2.3: Integrated FO Area Agriculture Development		
– Modernization of Distributary	- Women consulted for the modernization program - Role of women identified in operation/maintenance of new structures (it can include training on preventing degradation by not misusing new structures) - Baseline survey of the role and level of participation of women in water resource management	- # of women trained in different aspects (including preventive) O&M requirements of new structures - # of women directly engaged in O&M of water structures
Component 2.4: SIDA and AWB Capacity Building		
SIDA and AWB Capacity Building	- Periodic gender sensitization training of SIDA and AWB (including use of participatory tools and techniques of consultation, project/program design, and reporting) - "Ladies Window/Channels" developed at SIDA, AWB, FOs for women to record suggestions/complaints	- # of suggestions/complaints made by women (record maintained) - # of suggestions/complaints made by women addressed - # of women in AWBs, FOs, WUAs

Project Activities	Gender Action Outputs	Indicators and Targets
	- Gender mobilization strategy developed	
Component 3: Agriculture Investments		
Component 3.1: Solidifying Information and Technology Base		
Strengthening Agricultural Statistical Services	- Gender data gaps identified	- New and gender sensitive data standards developed and used
Strengthening Sindh Crop Reporting System	- Gender data gaps identified	- New and gender sensitive data standards developed and used
Strengthening Marketing Pricing Monitoring System	- Gender data gaps identified	- New and gender sensitive data standards developed and used
Strengthening Research and Extension System	- Extension services made accessible to women - Women farmers/entrepreneurs trained in smart agriculture practices - Female entrepreneurs and business service providers developed	- # of women availing extension services - # of female extension agents/entrepreneurs trained/developed
Component 3.2: Developing Agriculture Value Chain		
Developing Agriculture Value Chain	- Baseline of women participation in the selected value chains - Role of women in more productive and high paying value chain activities identified and facilitated	- Participation of women in the value chain

Project Activities	Gender Action Outputs	Indicators and Targets
Component 3.3: Integrated Farmer Organization Area Development		
Improving On-Farm Water Management	- Women consulted for their views on proposed component and their potential role - Women's capacity developed in on-farm HEIS management - Improved health with increased capacity to manage water storage ponds	- # of women engaged in on-farm water management - # of women trained in O&M of on-farm water management investments - Contamination levels of storage ponds monitored
Promoting Climate Smart Agriculture	- Women trained in new climate smart and bio-saline agricultural practices	- # of women adopted new climate smart and bio-saline agriculture practices
Component 3.4: Agriculture Delivery Unit		
Agriculture Delivery Unit	- Institutional policy of equal opportunity and pay developed and followed - On-job training for women employees - Sexual harassment policy, reporting, and grievance redress systems in place - Women friendly facilities at work, like separate toilets, communal space, childcare made available	- # of women employed in managerial, operational and technical roles across different water bodies - # number of women promoted vertically - High level of on job satisfaction reported by female employees
Component 4: Project Management and M&E		
M&E	- Gender indicators incorporated in project M&E framework	- Female participation in water resources management increased by # percent - Gender sensitive reported and used in decision making

Annex 8: Labor-Management Framework

This framework describes the requirements for the projects under program with respect to labor and working conditions applicable during the implementation phase of the project. It ensures that workers in the proposed project are treated fairly and provided with safe and healthy working conditions. It aims to ensure the management of issues that may arise due to labor-related risks. The Labor-Management Framework (LMF) sets out potential impacts; and consequences and describes its appropriate mitigation measures.

Objectives and scope

The purposes of the LMF are to:

- Promote fair and equitable labor practices for the fair treatment, non-discrimination and equal opportunity of workers;
- Establish, manage and promote a healthy management-worker relationship;
- Protect workers' rights including migrant and third-party workers;
- Promote healthy, safe, secure and comfortable accommodation that does not impact negatively on the communities in the surrounding area;
- Establish standards on workers' welfare, working and living environment; and
- To support the principles of freedom of association and collective bargaining of workers.
- This framework describes the requirements and expectations in terms of compliance, reporting, roles, supervision and training with respect to labor and working conditions, including working environment, camp management, accommodation and local community interaction.

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

Labor Management Framework

Table 1 presents an LMF including summary of the potential risks and impacts related to labor employment and working conditions, together with mitigation measures to avoid, eliminate or reduce associated impacts. The monitoring requirements to assess the performance of these mitigation measures are also described in this section.

Table 1: Labor and Working Conditions Management Framework

Category	Workers Impacts/ Risks	Project Impacts/Risks	Mitigation Measures	Monitoring	Monitoring Frequency	Responsibility
I. Labor Employment and Working Conditions						
Recruitment and selection of workers	- Perception of unfair recruitment and selection practices. - Child labor and school drop-out	Unpleasant work environment, which may affect the project activities.	Recruitment and selection of workers through adopting process including: - Company policy for recruitment - Eligibility - Selection criteria - Method of recruitment - Places of recruitment - Transparency - Preference to local citizens to avoid labor influx - Ensuring the children and minors are not employed directly or indirectly on the project - Communication on hiring criteria, minimum age, and applicable laws - Enforcement of legislation on child labor	Verify	On-going activity (at the hiring stage)	SIDA/PMU and Contractor
Terms and conditions of employment (earnings/ benefits).	Perceptions that Wages/salaries and benefits are less for locals relative to outsiders/ foreigners.	Work stoppages/ protest, absenteeism, sit-ins, sabotage.	Labor procedures need to follow as below: - Contract arrangements and content - Equal pay for equal work - Process for pay increases - Pay scales and increments as well as other benefits.	Verify	Quarterly	SIDA/PMUand Contractor
Labor relations (Conflict Handling)	Workers feel aggrieved and don't know how to vent their grievances.	- Workers embark on various forms of action. - Workers take matters into their own hands, which results in violence and conflict that affects workplace harmony.	Policy needs to include the following: - Effective grievance redress process which should be gender-sensitive - Disciplinary procedure - Workplace rules and regulations - Demobilization procedure - Effective Information dissemination to workers	Assessment	Monthly	SIDA/PMUand Contractor
Labor communication mechanisms.	- Workers are not informed about activities/ or events that affect them	- Action due to rumours or incorrect perceptions - Poor morale and unproductive workforce	Effective communication mechanisms including: - Regular written communication for all workers about the project operations/activities - Worker committees/organization/unions - Use of notice boards/toolbox	Assessment	Monthly	SIDA/PMUand Contractor

Category	Workers Impacts/ Risks	Project Impacts/Risks	Mitigation Measures	Monitoring	Monitoring Frequency	Responsibility
	- Workers are unable to communicate collective issues that bother them - Rumors/ misinformation spreads					
Labor behavior	Increased risk of illicit behavior and crime (theft)	Offensive work environment, which may affect the project related activities/operations	- Paying salaries into workers' bank accounts rather than in cash - Creation of supervised leisure areas - Cooperation with local law enforcement - Introduction of sanctions (e.g., dismissal) for workers involved in criminal activities - Enforcement of laws on drug abuse - Sensitization campaigns both for workers and local communities	Monitoring to prevent drugs trafficking	On-going	SIDA/PMUand Contractor
II. Labor Camp Management						
Workers accommodation building specifications (Camps)	Accommodation is considered substandard which leads to discomfort amongst the workers; and concerns about perceived health risks.	Workers have low morale which in turn affects the project activities/operations.	A minimum standard of accommodation is proposed as well as other living standards are applied to labor camps[42].	Verify	Quarterly	SIDA/PMU
Camp management practices	Workers (residents) do not live in harmony and the potential for conflict rises; so, they do not know how to	The conflict escalates which results discomfort to the workers and ultimately affects the project activities/operations.	The camp management must have the following: - Ensure the space/accommodation to all workers with equal terms and conditions (i.e. minimum space, facilities, safety, security). - Set-up for grievances redressal - Ensure the code of conduct	Verify	Prior to appointment	SIDA/PMUand Contractor

[42] https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=9791

Category	Workers Impacts/ Risks	Project Impacts/Risks	Mitigation Measures	Monitoring	Monitoring Frequency	Responsibility
	complain or make a grievance in the camp.					
Camp location	Inappropriate campsite/or difficult access to campsite creates disturbance and un-comfort to the labor/ workers.	- Siting of camps may result in the displacement of residents, loss of productive lands and the resources upon these lands. - Camps may also restrict or impede access to areas for the local community. - Construction camps may result in a noticeable increase in traffic, noise and environmental pollution, which could negatively affect the social amenities of nearby communities and also pose a potential safety issue.	Selection of potential camp locations includes: - Selection based on the consultations with company representatives and affected communities - Approval from concerned local government organization with a requisite permit. - Environment & social management plan of the camp location which includes mitigation/avoidance measures.	Verify	Prior to establishing Camp On-going	SIDA/PMUand Contractor
Maintenance	Equipment breaks down affecting accommodation standards	Workers living conditions are affected, which in turn could affect the motivation and performance of workers	Provide the following to have proper maintenance: - Regular maintenance - Replacement/repair of damages - Periodic supervision	Verify	Monthly	SIDA/PMUand Contractor
Food and dining	- Food is not appropriate and there are long queues to get food. - Frustrating dining experience leading to some incidents in the dining hall (workers and kitchen staff).	Workers embark on the camp management regarding: - Incidents increase in the dining halls which could escalate towards violence - Morale is low which leads to poor interest and performance towards the project activities/operations.	Camp management ensures to provide: - Balanced food[43] - Potable water, accommodation, dining and recreation areas - Feedback/complaints on food and dining arrangements - Regular meetings with workers nominated representatives - Complaints must be trended and tracked for remedial action - Ensure that dining halls have adequate seating, condiments, cutlery and crockery for efficient service - Dining times need to be fixed and informed to all workers in the camp	Assessment	Monthly	Food Department and SIDA/PMU

[43] approved by a Nutritionist

Category	Workers Impacts/ Risks	Project Impacts/Risks	Mitigation Measures	Monitoring	Monitoring Frequency	Responsibility
Housekeeping	The general appearance of the camp deteriorates making camp life unpleasant.	The overall camp experience is compromised which in turn leaves workers demoralized and demotivated.	- Ensure that campgrounds and common areas are routinely cleaned and organized with appropriate signage - Ensure access to laundry service to all workers	Verify	Regularly	SIDA/PMUand Contractor
Recreation	Workers spend most of their time in the camp and become bored and disenchanted	Workers are dissatisfied which result as: - Non-initiative attitude - Lack of interest in work	Access to recreational spots for the workers especially during the weekend	Assessment	Monthly	SIDA/PMUand Contractor
Spiritual/ Religious sites	Workers require to have access to the spiritual & religious places nearby the camp.	Non-attendance of spiritual and religious events/places, may cause frustration and unhappy attitude/behavior, which will have an adverse impact on the performance in the project related activities.	Ensure access to spiritual & religious places/sites. In addition, facilitate the workers in terms of transport/travelling activities. Provide awareness to workers to take care of social norms and cultural values of the community.	Assessment	Monthly	SIDA/PMUand Contractor
Security	Inconsistent behavior of security personnel towards workers can result in tensions at workplace.	Insufficient security and control of security personnel, which may lead to inappropriate behavior.	Ensure the camp security personnel are: - Adequately trained for appropriate conduct towards workers and community members - Exercising constraint and caution and understand how force may be used.	Assessment	Quarterly	SIDA/PMUand Contractor
III. Labor and Local Community Interaction						
Workers relations/ interaction with the community	- Disturbing the nearby communities due to the workers' routine activities such as recreation, and travelling etc. - Communities are negatively impacted by	All negative actions on the community may cause hindrance in the project construction/operation as well as other project related activities, such as road blockage, community sit-ins resulting prevention of workers, contractors & suppliers from entering the Project/ worksite.	Implement the control measures to avoid/and or minimize the impacts of camp and living conditions of workers on communities. Control measures include: - Encourage to recruit local labor/staff - Limited interaction of outsiders/foreign workers with the local/nearby community of the camp - Provide cultural sensitivity awareness training to facilitate appropriate actions interaction with communities - Limited movement of workers during the peak working hours of the community.	Assessment	Quarterly	SIDA/PMUand Contractor

Category	Workers Impacts/ Risks	Project Impacts/Risks	Mitigation Measures	Monitoring	Monitoring Frequency	Responsibility
	some camp activities as well (i.e. lighting, traffic movement).					
Risk of social friction	- The difference in cultural norms & ethics disturbs the routine life of workers and community as well. - Frequent visit of workers at community places can arise friction between workers and community	Impact on the project includes: - Strikes by local workers and community which could lead to the work stoppage - Absenteeism and sit-ins	- Provision of information regarding workers code of conduct in the local language(s) - Organize cultural sensitization/awareness for workers - Consultations with and involvement of local communities in project planning and implementation - Awareness-raising among local community	Assessment	Quarterly	SIDA/PMUand Contractor
Increased traffic and rise in accidents	Use of already existing roads to project and workers' campsites may cause accidents and increased burden on community	Less organization of commute to work may increase traffic on community road and risks of accidents on roads that may affect the mobility of local community and supplies of materials for the project	- Preparation and implementation of a traffic management plan which might be covered under the ESMP - Construction of additional/separate access roads to project and workers' campsites - Organize road safety training and defensive driving training for staff	Assessment	Quarterly	SIDA/PMUand Contractor

Monitoring

The monitoring for the implementation of LMF will be carried out to (a) document the implementation and effectiveness of management and mitigation measures; (b) assess actual impacts against predicted impacts; (c) demonstrate compliance with applicable legal and other requirements. Monitoring will be carried out based on both desk work and field-based verification to confirm that specified mitigation measures are being implemented effectively and achieving the intended outcomes.

The project will undertake monitoring/assessments to determine the extent to which this framework is being implemented. The assessment will be undertaken by social development consultant deployed by Contractor, who will monitor the implementation and submit the report to PMO/ESU. There will also be a third-party validation Consultant to be engaged by the PMO , who will undertake periodic monitoring to determine the compliance of this framework.

Performance Indicators

Performance indicators are used to measure and track performance against the effectiveness of mitigation and control measures discussed in this framework. Performance indicators are measurable against a specified target. The performance indicators need to be recorded and accordingly suggest the remedial measures to reduce potential risks and to be reported in periodic reports. List of performance key indicators which will need to be derived are as below:

<u>Labor employment and working conditions</u>

- Grievances lodged by type and number
- Disciplinary action by type and number
- Induction training numbers, queries and comments
- Issues raised by workers' committees and action taken
- Workforce numbers by local and outsider/foreign workers
- Actual demobilization numbers against planned targets and the incidents around demobilization
- Project-related incidents - stoppages go-slows, threats, damage to property, violence (if any)
- Absenteeism, sick leave and late arrivals

<u>Labor camp management</u>

- Grievances lodged by type and number
- Disciplinary action by type and number
- Induction training numbers, queries and comments
- Issues raised by camp committees and action taken
- Camp numbers by local and foreign workers
- Camp incidents
- Food or lodging complaints
- Recreation activities

<u>Labor and local community interaction</u>

- No. of community roads used for project purposes
- No. of community concerns registered

- Grievances lodged by the community by type and number
- Disciplinary action against concerned employees by type and number
- Campsites accidents by type and numbers

Information Management

The information management system during project implementation stage will need to be developed to manage data including labor employment & working conditions, camp management, labor interaction with community and other. The information tracking system will be used during implementation considering the key performance indicators and tracking will be used for non-compliances identified in the monitoring reports and accordingly corrective action plan will be prepared.

Reporting

An internal monitoring periodic report will be compiled to address the labor and working conditions aspects as discussed in this framework, while an external monitoring report will be undertaken by third party consultant and quarterly monitoring report will be pared and accordingly submitted to PIU for onward submission to World Bank.

Training and Awareness

Training needs assessment will be conducted to analyze the knowledge and skills of project workers and community representatives who will be considered for the training implementation. The training and awareness program will cover but not limited to the following areas as presented in Table 2 below

Table 2: Training areas and timelines

Training areas	Participant	Timeline	Frequency
Mitigation measures including all procedures	Supervisors and senior camp management Personnel who will be involved in training, reporting or monitoring activities.	Prior to commencement of work	Once prior to commencement of work
Workplace induction including: - Payslips - Disciplinary and grievance procedures - Cultural awareness - Code of conduct	All workers	Prior to commencement of work	Refresher training annually
Camp induction including: - Rules and regulations - Code of conduct - Camp committee system - The camp food complaints system - Interaction with communities and - Security.	All camp residents	Prior to commencement of work	Refresher training annually
Monitoring	Personnel who will be conducting monitoring events	Before monitoring commences	Refresher training annually
Reporting and performance indicators	Personnel who will be	Before reporting commences	Refresher training annually

Training areas	Participant	Timeline	Frequency
	compiling reports relating to labor and working conditions		
Human rights awareness	Senior Management, Supervisors, security personnel (staff and contracted	Prior to commencement of work	As required by changes in training materials or awareness topics

Annex 9: Special Studies on Broad Strategic Water Plan

Background

The Indus Delta covers 600,000 ha along the coast of Pakistan. The Indus Delta is the fifth largest delta in the world and a designated Ramsar wetland site. It contains many different ecosystems: riverine forest, freshwater lakes, irrigated areas, and brackish wetlands (Khuhawar et al., 2018) Prior to the development of the mega-irrigation infrastructure on the Indus and its tributaries it was a highly productive area with rice cultivation on the higher lands and rich grazing on the dried up inundated areas. At present it is however an area of ecological deterioriation, endemic poverty and poor access to basic services such as clean drinking water.

A number of man-made intervention caused a huge environmental transformation:

Severe reduction of water deliveries with the expansion of the irrigation networks. Flows into Sindh at Guddu averaged 65.19 MAF between 2004 and 2019, with flows concentrated during June and September, however only a small proportion of the flow is available downstream. These average flows are subject to significant interannual variability. For 2018-2019 the inflows were for instance 49.80 MAF. The releases after the Kotri barrage were 1.76 MAF , less than what is recommended to sustain the Indus Delta. In the Indus River Accord annual flows of 10 MAF per annum are recommended to meet environmental flow requirements, but this figure is almost never reached, unless it is in the shape of flood pulses. Due to the reduced river flows, the saline barrier has moved upstream of the Indus, affecting the river ecology and fresh water availability in areas in large areas of land in Thatta, Sijawal, Badin Districts, causing the abandoning of a large number of villages.

Severe reduction of the sediment inflow. A conservative estimate is that 250 millions tons of sediment were deposited in the Indus Delta in natural conditions. This maintained the Delta on the high-energy coast of the Arabian Sea. With the commissioning of the Mangla Dam (1965) and theTarbela Dam (1972), sediment inflow into delta was severely reduced. The Tarbela dam reservoir for instance is gradually silting up, loosing 41% of its capacity already, from 14.3 BCM to 8.4 BCM. . Following the estimated 80% reduction in sediment discharge after the late 1950s, the deltaic shoreline along the central delta coast started to recede at average rates of 50 m/year (Giosan et al, 2019).

Change of flooding pattern. Due to construction of embankments the River Indus was confined. The flooding area reduced, further affected by the changes in the river releases. This has had several effects, an important one being the reduced recharge of groundwater along the Indus. This translated also a higher exposure to saline water ingression.

Fall out of the failed Tidal Link. As part of the massive LBOD the Tidal Link Canal was constructed to carry the saline drainage effluent from the spinal drain 42 km across the mudflats of the coastal zone to the Arabian Sea. Soon after completion some of the banks and weir structures in the Tidal Link failed in the highly sensitive silty loam flats. exacerbated by the prevailing typhoon and high tide storm direction and the water coming from the irrigation canals. Originally sea water was not expected to penetrate more than 19 km from the outlet of the Tidal Link. The scouring of the tidal link – creating basically a new river – moved the tidal effect much further upstream (70 km). The result is that there is now an open connection between the dhands and the Tidal Link, exposing the coastal lakes (dhands) to tidal fluctuations, sea water intrusion, sedimentation, and excessive drainage during low tide. At the same time during high tide drainage is impeded in the area and there is a constant threat of sea water entering into the tail of the command areas. During rainfall events, the combination of excessive rainfall run-off and

the impeded drainage during high tide is a major cause of flooding in the area. During the southwest monsoon, the neighboring sea in the south inundates vast area with salt water.

Change of mangrove forest cover. One-third of the Indus Delta was originally covered by mangrove forests, in particular Avicennia Marina (Young et al., 2019). Over the years this vegetation changed too: mangrove cover dropped from 16% in 1990 to 10% in 2010, due the changed hydrology and due to encroachment. In recent years with concerted efforts though mangrove cover increased to 13% with success achieved especially on the Right Bank of the Indus. The mangroves have many economic and ecological benefits: sources of firewood, timber and bee forage, grazing areas for livestock and fish spawning ground. Mangroves have an important function in protecting the coastal areas against storms. Due to their dense growth and strong rooting system mangroves protect the coast against floods and high waves. (Kathiresan, 2012) Mangroves are able to store high amounts of CO_2 and are one of the most carbon-rich forests. The downside of this is that when these forests are destructed, a lot of carbon will be released, possibly intensifying global warming and other climate change trends. (Abbas et al., 2018).

Indus Action Plan Study

There is an urgent need for a study to develop an action plan for the Indus Delta, making use of different studies and pilot activities that have been implemented over the years. The action plan should create a shared total picture of the challenges, threats and opportunities that affect the Indus Delta, on the reduced inflows, reduced sediment deposition, changed groundwater availability and changed flooding patterns, saline water intrusion, changed tidal effect and effect on hydrology and drainage and in particular the changed livelihoods of the Indus Delta. The study should involve systematic engagement of system stakeholders and local communities, so as to come to convergence on the best realistic course to be taken.

The study should consist of:

(1) Systematic stock taking of current situation, in terms of (1) socio-economics including livelihoods (2) Indus river hydrology and sedimentation (3) flooding patterns, drainage patterns, tidal effects and salt water intrusion (4) flood protection and mangrove cover (5) ecology and wetland status
(2) Develop a realistic positive vision on the course of action to be taking in the Indus Delta, accepting irreversible changes that have occurred and combining different functions, such as water availability for multiple purposes, agriculture and aquaculture prospects, drainage, flood protection, ecology and others
(3) Propose institutional arrangements for implementation and coordination of Indus Delta, aligning with the discussion on the Sindh Water Policy
(4) Work out clear solution packages within this overall vision, preferably with investors and shareholders. These solution package should

    a. Options for securing minimum flows, – looking at scope for authorized releases and water savings and make best use of flood pulses
    b. Improved sediment inflow options, among others from changed dredging methods
    c. Flood protection for multiple purposes, including mangrove restoration based on successful nature based solution programs and connection to Coastal Highway

d. Salt water intrusion options, including efficacy of the proposed Sindh Barrage as well as smaller alternatives and complementary actions
e. Management of coastal wetlands for multiple functions under changed conditions
f. Tidal effects – options to mitigate or adapt to shortcoming from current eroded Tidal Link
g. Agriculture and aquaculture options, looking at working with salt tolerant crops and biosaline farming
h. Overall improvements of livelihoods in Delta Region

Special study on Manchar Lake Rehabilitation

- Water balance study, taking into account (a) predicted inflows from Khirther range, in particular water allocation from the (to be completed) Naj Gaj Dam against the traditional spate water rights in the area (b) overflows from Indus combined with using Manchar Lake for storage (c) inflows from MNVD before and after RBOD-II completion
- Wetland/ lake restoration plan, restocking of fish population and making use of wetland vegetation and biological processes to improve water quality
- Lake management plan, creating local regulations and instititutional responsibilities to protrct and make use of the Manchar Lake