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

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Cover Photo: An aerial view of a minor irrigation canal, agricultural lands and rural landscape in Nara Canal Command Area (FO Sarki Minor, near Jhole city, Sinjhoro taluka, Sanghar district, off taking from Shahoo Wah Jamrao System Nara Canal)

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List of Acronyms

A/RAP	Abbreviated/Resettlement Action Plan
ADU	Agriculture Delivery Unit
AWB	Area Water Board
BP	Bank Practice
BOQ	Bill of Quantity
CSA	Climate Smart Agriculture
CSC	Construction Supervision Consultant
C-ESMP	Construction Environmental Social Management Plan
CDD	Communication Driven Development
ECP	Environmental Code of Practice
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMU	Environmental Management Unit of SIDA
EPA	Environmental Protection Agency
ESHGs	Environmental, health and safety guidelines
ESHS	Environmental, Social, Health & Safety
ESU	Environmental and Social Unit
FO	Farmer Organization
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
HAI	Hydro-Agro Informatics
IEE	Initial Environmental Examination
IUCN	International Union o for Conservation of Nature
IWRM	Integrated Water Resources Management
NGO	Non-Government Organization
O&M	Operation and Maintenance
OP	Operational Policy
OHS	Occupational Health and Safety
PCMU	PCMU Project Coordination and Monitoring Unit
PDD	Planning and Development Department
PIC	Project Implementation Consultants
PIU	Particulate Implementation Unit
PMO	Project Management Organization
RPF	Resettlement Policy Framework
SAGP	Sindh Agriculture Growth Project
SBIP	Sindh Barrages Improvement Project
SIDA	Sindh Irrigation and Drainage Authority
SMRP	Akram Wah Social Management and Resettlement Plan
SWAT	Sindh Water and Agriculture Transformation Project
SWP	Strategic Water Plan
WB	World Bank
WCA	Water Course Association
WSIP	Water Sector Improvement Project

EXECUTIVE SUMMARY

The Government of Sindh (GoS), through the Planning and Development Department (PDD), Irrigation Department, and Agriculture Department, is planning to implement the **Sindh Water and Agriculture Transformation Project** (hereinafter referred as **SWAT** or **the Project**), with financial assistance from the World Bank (WB). Under the SWAT, GoS aims to increase agricultural water productivity in selected Area Water Boards (AWBs) command areas and improve the institutional framework for water resources management. The present Environmental and Social Management Framework (ESMF) has been prepared to screen the potential environmental and social impacts of the SWAT and guide the screening, assessment and management of environmental and social risks and impacts of subprojects that will be identified during the project implementation. The ESMF has been prepared following the World Bank safeguard policies and the relevant government regulations. A Resettlement Policy Framework (RPF) has also been prepared for the SWAT to address the involuntary resettlement impacts of these subprojects and presented as a standalone document.

Project Overview

The project development objective is to increase agricultural productivity and improve water resources management throughout Sindh province through a series of projects. SWAT focuses on three AWBs on the Left Bank Canals of the Indus River: Ghotki (Ghotki Feeder canal with a command area of 381,000 Ha), Nara (Nara canal with a command area of 1,047,946 Ha) and Left Bank (Akram Wah and New Fuleli canals with a command area of 592,548 Ha). SWAT will also focus on completing the "last mile connections" in the canal network upgraded through the recently completed Bank-funded Water Sector Improvement Project (WSIP)[1] and ongoing Sindh Barrages Improvement Project (SBIP)[2]. In addition, SWAT will introduce modernization concepts for canal operation and irrigation service that will help Sindh make better use of these infrastructure investments. The Project consists of six components: (i) **Water Resources Management** policy and institutional reforms in Sindh, (ii) **Water Service Delivery** improvement of irrigation services, (iii) **Agricultural Incentives and Investments** to promote higher value, water-thrifty crops, (vi) **Project Coordination and Monitoring** to support the implementation of the project, (v) **Agricultural Flood Emergency Rehabilitation to help small farmers recover from the 2022 floods** and (vi) **Contingent Emergency Response** to support any support unforeseen emergency needs from natural disasters. The implementing agencies are the Project Coordination and Monitoring Unit (PCMU) of the Planning and Development Unit (for Components 1 and 4), Sindh Irrigation and Drainage Authority (SIDA) of the Irrigation Department (for Component 2) and Agriculture Department (for Component 3 and Component 5).

The activities and typical subprojects to be implemented under these six components are listed in the following table. These subprojects are divided into two categories based on the requirement of civil works (i) Soft Interventions, which don't involve any civil works (Components 1, 4, and 5) and (ii) Physical Interventions, which involve civil works (Components 2 and 3). During the preparation of SWAT, only the design and location of one subproject, the rehabilitation of the Akram Wah canal, is finalized. In addition, there are approximately 15 “Farmer Organization (FO) Subprojects” which are relatively small in scale and

[1] The Water Sector Improvement Project (WSIP), closed in 2020, financed the renovation of the main canal networks for the three AWBs under SWAT.

[2] The on-going Sindh Barrages Improvement Project (SBIP), scheduled to close in 2024, is improving the safety of the three large barrages on the Indus River which feed the Sindh irrigation system.

will be selected, defined, and approved during implementation through a community-driven development (CDD) process.

The soft interventions (such as engineering and ESIA studies) that could lead to civil works in future projects are also included under the physical interventions category (to guide the preparation of ESIA and RAP documents). A schematic view of major irrigation canals in Sindh is shown in Figure E.1 to better understand the project interventions. A detailed map showing the locations of barrages and canals in Sindh is given in Figure E.2, and the locations of three Area Water Boards where the FO subprojects will be implemented are shown in Figure E.3.

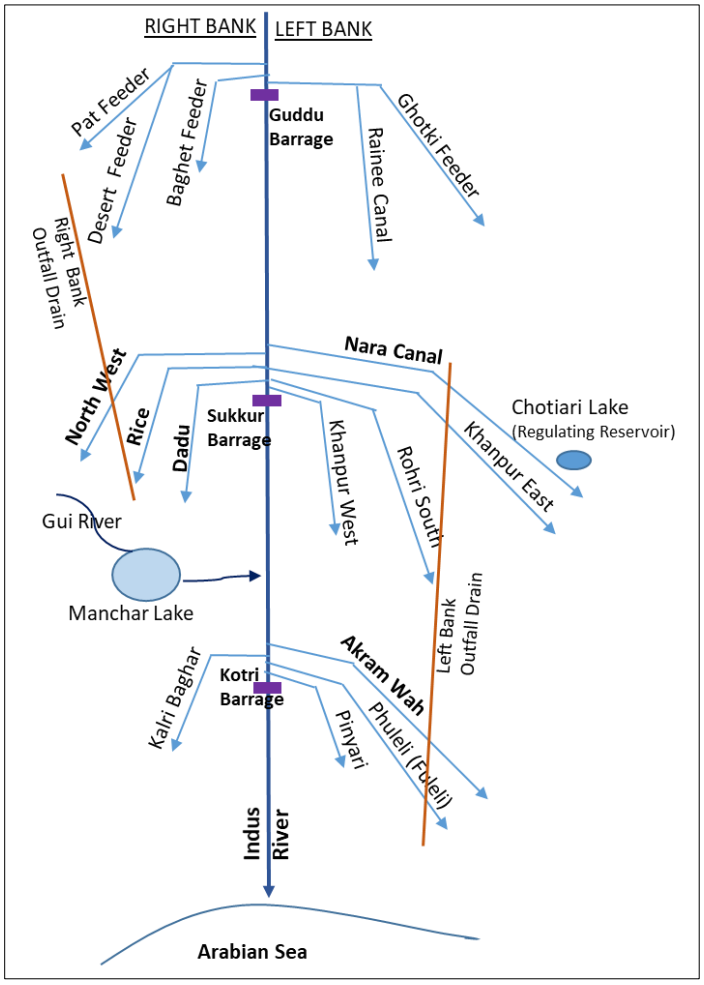


Figure E1: A Schematic View of Major Irrigation Canals in Sindh

Table E1. A Summary of Proposed Project Activities and Typical Subprojects

Component	Sub-Components	Typology of Subprojects	
		Soft Interventions (does not include civil works)	**Physical Interventions (includes civil works and E&S studies for future civil works)**
1: Water Resources Management ($17.3 Million)	1.1 Institutional development for Integrated Water Resources Management (IWRM) ($2.1 million)	Formulate new Water Resources Law. Transform the Irrigation Department into the Irrigation and Water Resources Department (IWRD) Comprehensive water pricing (*Abiana* system) reforms	Not applicable
	1.2 Sindh Strategic Water Plan ($4.0 million)	Preparation of a 'Strategic Water Plan' to address key watershed level environmental and social cumulative impacts and risks, including strategic directions on infrastructure development, water allocation, and water-related environmental and social ecosystem service priorities.	Not applicable. Cumulative Impact Assessment (CIA) will be an integral component of the SSWP
	1.3 Hydro-Agro Informatics (HAI) Program ($17.3 million)	Establishment of an 'HAI Center' to collect and monitor water and agriculture information (canal flows and levels, and quality, groundwater levels and quality, meteorology, crop production)	Not applicable
2: Water Service Delivery ($127.0 Million)	2.1 – Integrated Farmer Organization (FO) Area Development - SIDA ($ 16.0 million)	Training on Famer Organizations (FOs) on groundwater management and monitoring	**Rehabilitation/Modernization** of irrigation infrastructure on approximately 15 .FO command areas on the left bank of the Indus River. (in three AWBs – Ghotki, Nara and Left Bank). Each FO command area is approximately 5,000 ha in size. Typical construction works include regulators, long-crested weirs for better upstream water level control, new off-takes for water course associations (WCAs), earthworks on canal banks, rehabilitation of and addition of structures for community use (canal crossings Support for FOs fall under SIDA's mandate.
	2.2 – SIDA, AWB and FO Support ($15.0 million)	Capacity building of SIDA, Area Water Boards (AWB) and FOs to provide reliable services to farmers. Establishment of two new AWBs on the Right Bank	

Component	Sub-Components	Typology of Subprojects	
		Soft Interventions (does not include civil works)	**Physical Interventions (includes civil works and E&S studies for future civil works)**
		Training tools on canal operations	
	2.3 – Left Bank Main Canals Upgrading ($93 million)	Calibration of regulators at the head of main and distributary canals	**Rehabilitation** of the 116km-long Akram Wah Canal (reconstruction of regulators, new retaining walls in urban areas, rehabilitation of bridges) **Studies** on rehabilitation of Lower Nara Canal, including Chotiari regulating reservoir
	2.4. Right Bank Studies and small-scale high-priority works ($ 3.0 million)		**Studies** for rehabilitation of 3 Main Canals of Indus Right bank (Dadu, Rice and Northwest Canals) and Waarah Branch Canal (off-taking from NW Canal) and urgent rehabilitation of the most damaged structures.
3. **Agricultural Incentives and Investments** ($76.4 Million)	3.1 Integrated Development of 15 FOs supported under Component 2.1 ($16.6 million)	Training of farmers on climate-smart agriculture (CSA), and its promotion through Climate Business Field Schools Provision of budgetary support packages to farmers for replicating the learned CSA practices. Technology /Machinery Support for CSA practices: Provision of precision laser land levelling equipment to farmers	The irrigation and drainage infrastructure at the Water Course Association (WCA) level will be improved in the same 15 FO command areas in Component 2.1. Each FO command area has approximately 24 WCAs, with each WCA covering approximately 250 ha. Support for WCA fall under the Agriculture Department mandate.
	3.2 Financing Smart Subsidy Payments to farmers and facilitating wheat Procurement Reform ($27.0 million)	Providing farmers direct income support through smart subsidies (e-Vouchers) to small and medium-sized farmers in their efforts to move towards higher value, water-thrifty crops.	Not applicable
	3.3 Improving Agriculture Information and Technology Base ($13.1 million)	Establish a market data information collection station at the Hyderabad Agriculture Extension wing, including strengthening the crop reporting system. Strengthening research and extension systems in the following:	**Construction/Rehabilitation** of district-level agriculture extension and facilities for: • Modernization of extension and research facilities that are affected due to floods or lack the necessary basic infrastructure and basic facilities

Component	Sub-Components	Typology of Subprojects	
		Soft Interventions (does not include civil works)	**Physical Interventions (includes civil works and E&S studies for future civil works)**
		- Water-logging and salinity Productivity enhancement and resilience of saline soils of Sindh through a holistic approach. . Establishment of agriculture training programs for enhancing and developing the capacity and skills of agriculture experts/officials,	• Providing additional infrastructure in other district offices for ICT agriculture extension services.
	3.4 Developing Agriculture Value Chain ($13.2 million)	Identify value chains and associated constraints in the FO subproject areas. Technical Assistance on government's Warehouse Receipts (WHR) that enable farmers to access credit from formal financing institutions.	Supporting selected farmers and medium-sized agri-businesses through free technical assistance and partially subsidized investments (equipment, materials and infrastructure)
	3.5 Agriculture Delivery Unit Support ($6.6 million)	Establishment of the establishment of an Agriculture Delivery Unit (ADU) in the Department of Agriculture to implement the SWAT.	Not applicable
4. Project Coordination and Monitoring ($11.3 million)		The hiring of staff and consultants for project implementing agencies and capacity building.	Not applicable
5. Agriculture Flood Emergency Rehabilitation	US$107.0 million	Provision of financial support to facilitate agricultural production of small farmers following the 2022 floods.	Not applicable
6. Contingent Emergency Response (US $0):		Following an adverse natural event that causes a major natural disaster, the government may request the World Bank to reallocate project funds to support response and reconstruction. This component could also be used to channel additional financing from the World Bank should they become available for such an emergency	To be determined (TBD)

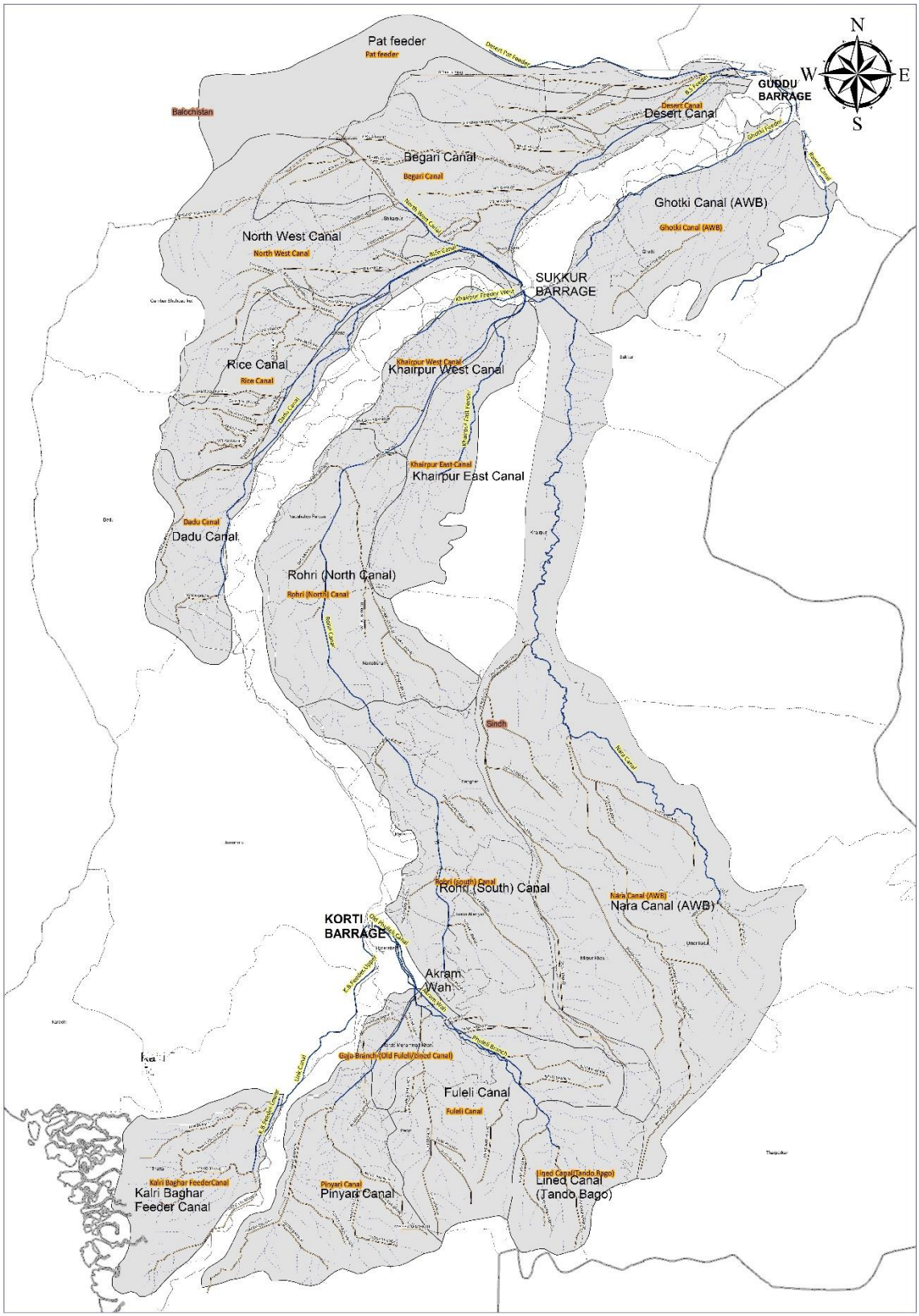


Figure E2: Location of Barrages and Canals in Sindh

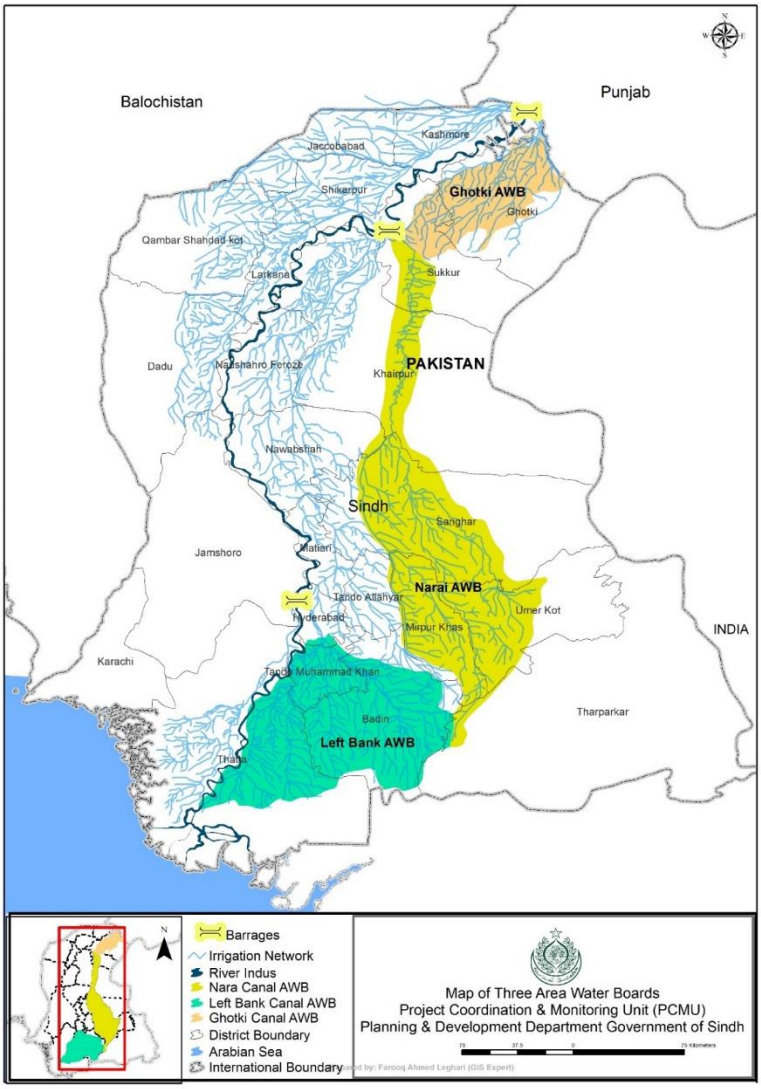


Figure E.3: Location of Area Water Boards in Sindh

Environmental and Social Assessment of Project Components

Table E2, Summary of Potential Environmental and Social (E&S) Impacts of SWAT, provides a summary of potential environmental and social impacts by sub-components. In general, Component 1 activities such as introducing policy reforms in water resources management and improving the water pricing system are expected to have significant positive environmental and social impacts. Component 2 activities such as rehabilitation of 116-km long Akram Wah canal and studies for rehabilitation of main canals on the Right Bank of the Indus Rivers (which may be implemented in future projects) are expected to have significant adverse environmental and social impacts due to large-scale civil works and resettlement. Modernization of irrigation and drainage at the FO level under Component 2 and at the WCA level under Component 2 are expected to have low to moderate negative environmental and social impacts.

An Environmental and Social Impact Assessment (ESIA) has been prepared for the Akram Wah based on the feasibility study. In early 2021, the Government of Sindh conducted a “anti-encroachment drive” (AED)

throughout the entire Sindh on the orders of the Sindh High Court, including along the Akram Wah canal right of way. Approximately 1,246 household were affected, with more than 90% experiencing significant impacts. Most of the AED affected households were poor, informal settlers who were displaced from their homes. To address these legacy issues, SIDA prepared an Akram Wah Social Management and Resettlement Plan (SMRP) which will: i) provide replacement of lost assets and an opportunity for AED affected households to improve their standard of living; and ii) pilot an approach to allowing AED affected households back on to the RoW in accordance with an Irrigation Department policy that was adopted in mid-2022.The general features of the Akram Wah subproject are presented in this ESMF, and the detailed social and environmental aspects are dealt with in the ESIA and SMRP.

For the remaining subprojects under SWAT, and in particular, the FO subprojects, the exact interventions, locations, designs, and technologies are pending and will be determined during project implementation. Hence, the present ESMF has been prepared for these subprojects to provide guidance to conduct detailed environmental and social screening and assessments once the design details are available. A Resettlement Policy Framework (RPF) has also been prepared to address the involuntary resettlement impacts of these subprojects, if any, and presented under a separate cover.

The present ESMF has been developed to (i) ensure all relevant environmental and social issues are mainstreamed into the design and implementation of the proposed subprojects; (ii) ensure compliance of the Project with government and World Bank requirements; (iii) screen the generic environmental and social impacts of each of the Project components; and iv) describe the methodologies to be followed for the preparation of the appropriate safeguard instruments required for the individual subprojects.

The unforeseen activities under Contingency Emergency Response (component 6) will be addressed through a separate set of environmental and social instruments that will be if and when prepared when this component is triggered.

Regulatory Framework and World Bank Requirements

The Sindh Environmental Protection Act of 2014 is the main legislative framework related to environmental protection in the province. Per this Act, the development of projects on irrigation infrastructure will need to be cleared by the Sinch Environmental Protection Agency (SEPA) following the procedures given in the Sindh Environmental Protection Agency (Review of IEE and EIA) Regulations, 2014. These regulations classify the projects into three categories (Schedules I, II and III) based on their scale of works for environmental assessments and clearances. The SWAT is subjected to the World Bank safeguard policies, and an environmental assessment of its subprojects should be prepared in compliance with Bank's Operational Policy (OP) 4.01. The requirements of SEPA to develop IEE and EIA follow within the framework of World Bank OP 4.01, and the ESIA documents prepared in compliance with the World Bank requirements will be accepted by SEPA for review and approval.

SWAT utilizes the World Bank Safeguard Policies, as opposed to the Bank's newer Environmental and Social Framework (ESF), because the project entered into the World Bank lending pipeline in late 2018. The present ESMF has been prepared in compliance with the World Bank OP 4.01 (Environmental Assessment). The Project has been classified as Category A. Other World Bank policies relevant to the SWAT include Natural Habitats (OP 4.04), Pest Management (OP 4.09), Physical Cultural Resources (OP 4.11), Involuntary Resettlement (OP/BP 4.12), Safety of Dams (OP/BP 4.37) and Projects on International Waterways (OP/BP 7.50). A gap analysis between World Bank Safeguards and its current Environmental and Social Framework (ESF) was carried out by the World Bank and identified that the preparation of a stakeholder engagement plan (SEP) and labour management procedures (LMP) and updating procedures for biodiversity assessments would help the ESMF also to comply with the principles of the World Bank ESF. Hence, the ESMF also includes SEP and LMP.

Environmental Setting

Location. The general area of influence of the SWAT project is the irrigated area in Sindh, covering approximately 5 million hectares. The irrigation infrastructure in Sindh consists of three barrages (Guddu, Sukkur, and Kotri) and their extensive irrigation network on the left and right banks through 14 main canals. The direct physical interventions of the SWAT will be implemented in the command areas of Ghotki (a left bank canal of Guddu barrage, managed by Ghotki AWB[3]), Nara (a left bank canal of Sukkur barrage, managed by Nara AWB), and Akram Wah and Fulleli (left bank canals of Kotri barrage, managed by the Left Bank AWB). The feasibility studies for main canal rehabilitation under Component 2.4 will be carried out on the three right bank canals of the Sukkur barrage. The policy and institutional support by the SWAT will be applicable to all irrigated areas in Sindh.

Physical Setting and Land use: The project interventions will be mainly located in rural areas dominated by agricultural lands, however, barrages are located in urban and peri-urban areas. All the initial sections of the canals defined by the presence of barrages are located in the urban and peri-urban areas (Sukkur city for Nara Canal and Hyderabad city for Akram Wah canal). The embankments are also dominated by trees and shrubs in some sections. The terrain is mostly flat. Beyond the canals' right of way (ROW), agriculture is practiced on a larger scale, with cotton, wheat, rice and sugar cane being the dominant crops in the area. Wheat is the largest cropped area, followed by rice, cotton and sugarcane. Cultivated areas are interrupted by large expanses of barren land. The agricultural land accounts for about half of the land use. The total agriculture area of three Project AWBs is about 2 million hectares.

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 summer season starts in April and ends in October (maximum temperatures reach up to 45 ^{o}C), while the winter begins in November and ends in March (with the lowest temperature up to 3 ^{o}C). The average annual rainfall in Sindh is 120 mm, with nearly 61 percent of precipitation falling in the monsoon months of July and August.

Water resources. The main source of water available to Sindh is the Indus River, and the irrigation system in Sindh draws water from the Indus River through Guddu, Sukkur and Kotri barrages. Canal water is the primary source of water supply in the catchment of irrigated areas in Sindh. Although the canal water is mainly used for irrigation purposes (about 26.6 to 41.7 MAF), it is also used for domestic consumption (1.2 MAF) and industrial uses (about 0.5 MAF). The groundwater is located in shallow depths and generally brackish, except near the canals and the Indus. The groundwater is being used for drinking and irrigation at some locations. There are also many important wetlands in Sindh and the important areas relevant to the SWAT are Manchar Lake and Indus Delta, as they will be benefitted from the overall SWAT activities. Manchar Lake is the largest freshwater lake in Pakistan, with an approximate area of 26,000 ha.

Biodiversity. According to the Integrated Biodiversity Assessment (IBAT) tool, there are 44 protected areas, 15 key biodiversity areas and 129 IUCN red list species in the areas covered by irrigation networks in Sindh. Although none of the proposed infrastructures in the SWAT are expected to be directly located within these protected areas, the overall SWAT activities will benefit the biodiversity of Manchar Lake and the Indus Delta. The ecosystem of Manchar seems to be an extremely resilient one. The submerged wetland vegetation survives and regenerates quickly after the lake dries out completely. Manchar Lake

[3] Area Water Boards (AWB) are quasi autonomous organizations under the Irrigation Department. They deliver water to the Farmer Organizations (FOs). The Farmer Organizations (FO) are legally constituted organizations responsible for managing the smaller distributary canals but rely upon the Irrigation Department to cover most costs, including the provision of technical staff. The FOs deliver water to Water Course Associations (WCAs). The WCAs are community organizations supported by the Agriculture Department.

also supports a major fishing industry in addition to feeding/nesting areas for waterfowl. The Indus Delta is the landmark of Pakistan's coastline, extending up to 150 km along the Arabian Sea, with an area of about 600,000 ha. The delta holds 97% of the total mangrove forests of Pakistan. Ecologically, the Indus Delta mangroves constitute a complex ecosystem by providing habitat, shelter and breeding ground for economically important marine plants, animals and migratory birds; protecting coastline and seaports from storms, cyclones and Tsunamis; meeting fuelwood requirements of local communities and fodder for their livestock; sustaining livelihoods of the coastal population of more than 100,000 people; and serving as a nursery for fish, shrimp and crabs, those spend at least a part of their lives in mangroves.

Environmental Challenges in Water Sector. The environmental challenges associated with the water sector in Sindh are:

- **Canal 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.
- **Wetlands**. Lakes and wetlands in Sindh are under excessive pressure and risk. The threats to the wetlands of Sindh are largely anthropogenic, namely related to unavailability of freshwater, 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.
- **Indus delta**. 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
- **Urban Water Supply**. Keeping in view rapidly growing population in urban areas, there are serious concerns about 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.
- **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, small fresh groundwater lenses, created by seepage from canals floating on the saline water, are the major sources of rural water supply. These small fresh water lenses are precarious and dependent on how the water in the canals is managed.

Socioeconomy. The irrigation canal network in Sindh is spread over 17 districts, and the interventions in the SWAT are expected to be implemented in all these districts. About 20 million people live in these districts, in which more than 70 percent of people live in rural areas. About 36 percent of employment in Sindh province is in the agriculture sector. 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.

Gender. 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. 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. 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 their livestock's well-being depend on it. Despite women's significant role in agriculture, such as crop production from sowing to harvesting stages and livestock rearing, they have traditionally been excluded from decision-making in irrigation management.

Screening of Potential Impacts and Risks

The proposed interventions in SWAT will directly benefit about 1.8 million people and 700,000 ha of agricultural land. The potential environmental and social impacts and risks of the SWAT interventions and proposed mitigation measures are summarized below. Environmental and social assessment will be carried out for each subproject, and the procedure for this assessment is described in the following sections. The project implementation units (PIUs) will be responsible for implementing the proposed mitigation measures.

Table E2. Summary of Potential Environmental and Social (E&S) Impacts of SWAT

(Scale of Impacts: High, Substantial, Moderate, and Low)

Component and Intervention Type	Potential E&S Benefit Levels	Potential E&S Adverse Impact Levels	Potential Risks	Proposed Mitigation Measures
Component 1: Water Resources Management				
Component 1 .1 Formulate new Water Resources Law (Technical Assistance)	**High:** The new water law will establish a legal foundation for integrated water resources management (IWRM) that will facilitate water-related environmental sustainability. By creating a legal foundation for water allocations, it will also help promote transparency and equity in water use.	**Low:** The new water law should not have any indirect adverse impacts.	A new water law might not be passed by the Sindh Assembly. The water law might not include enough focus on environmental sustainability and social equity.	Passage of the water law is a performance-based condition (PBC) associated with Bank financing of Component 1. The water law will be prepared in a consultative manner with all stakeholders and must be approved by the elected provincial assembly. This will help ensure a broad consensus The 2022 Sindh Water Policy highlights the importance of environmental sustainability and social equity, and the water law is expected to codify these principles.
Transform the Irrigation Department into an Irrigation and Water Resource Management Department (IWRD). (Technical Assistance)	**Substantial:** Strengthen the institutional capacity of the irrigation department with an IWRM mandate and expertise. Enhance the ability of the IWRD to provide better bulk water supply services. Thereby	**Low**: Improving organizational capacity for IWRM and water supply delivery should not have indirect adverse impacts.	Lack of commitment by the Irrigation Department to take on new mandates and new practices	The project will finance a comprehensive study to assess the capacities and roles of various Irrigation Department entities, including SIDA and AWB, and build consensus on necessary changes based on the 2022 Sindh Water Policy.

Component and Intervention Type	Potential E&S Benefit Levels	Potential E&S Adverse Impact Levels	Potential Risks	Proposed Mitigation Measures
	reducing water losses and improving distribution equity.			
Comprehensive Water Pricing Reform (Technical Assistance)	**Substantial.** Adjustments to water rates (*Abiana*) will encourage users to better consider the opportunity cost of water and potentially reduce water use. It will also provide more revenue for AWBs and FOs to better operate and maintain their canal and distributary systems, thereby reducing water use, water logging and soil salinity.	**Moderate**: Increased water rates may disproportionally affect small farmers and sharecroppers.	Political opposition may undermine pricing reforms. Water revenues might not be equitably distributed and used Some water users might challenge changes in water rates in courts Resistance from other stakeholders to acknowledge and accept to pay for ecosystem services.	Water rates have not been adjusted in two decades and currently are an insignificant cost for farmers who have poor quality service—thus creating a vicious circle. A gradual and moderate increase in water rates, combined with improvement in service provided by the project, should help start a virtuous circle. Water reforms will be comprehensive, including requirements for cities and industries, and considering farm size, thus allowing for differentiated rates based upon ability to pay. Studies for developing a Payment for Ecosystem Services (PES) scheme where private sectors that use ports could be charged for coastal protection, reduced sedimentation/dredging costs, and extension of mangrove cover as a result of efficient IWRM

Component and Intervention Type	Potential E&S Benefit Levels	Potential E&S Adverse Impact Levels	Potential Risks	Proposed Mitigation Measures
Component 1.2 Preparation of a "Sindh Strategic Water Plan" (Technical Assistance)	**High**: The plan will assess and address key water and environmental issues in Sindh, considering cumulative impacts. Provide strategic directions to the government departments on infrastructure development, water allocation, and water-related environmental priorities. Sustainable management of water resources in the province through the assessment and management of cumulative environmental and social impacts and risks.	**Low**: Properly formulated SSWP should not generate any adverse impacts but rather provide strategic direction to Sindh on how to reduce cumulative water-related environmental degradation.	Inadequate coverage of environmental and social issues in the SSWP. Inadequate data to project needs of different users Lack of proper consultation with stakeholder groups, including marginalized and vulnerable groups. The Sindh government may not adopt or utilize the SSWP.	The scope of work for SSWP is included in ESMF and highlights the importance of including environmental and social issues in the SSWP. The SSWP will include a cumulative impact assessment of water and agricultural practices in Sindh's irrigated areas. The first task in the SSWP is to prepare a Stakeholder Engagement Plan to ensure adequate consultations with key groups. Adoption of the SSWP is a Project Development Objective (PDO) indicator.
Component 1.3 Establishment of Hydro-Agro Informatics Program (Goods and Technical Assistance) .	**High**: Providing reliable, transparent, and actionable information for water services, water resources management, and agricultural advisory services should help to better manage water, increase agricultural productivity, and better manage floods and droughts.	**Low:** No adverse environmental or social impacts are anticipated due to the provision of information services.	Lack of capacity or incentives for the Irrigation and Agriculture Department to collect and process information.	A management contract will be provided to a university to operate an "HAI Center," which will be responsible for analyzing, processing, and providing information services. The quasi-independent center will be able to attract and maintain high-quality professionals. The data collection capacities of the Irrigation Department and the Agriculture will be boosted through project funding.

Component and Intervention Type	Potential E&S Benefit Levels	Potential E&S Adverse Impact Levels	Potential Risks	Proposed Mitigation Measures
Component 2: Water Service Delivery				
Component 2.1 Modernization of Irrigation Infrastructure in 15 Farmer Organization (FO) Command Areas. (Civil works, each FO command area around . 5000 ha)	**Substantial:** FOs will be able to distribute water more equitably and efficiently, reducing water losses and decreasing water logging and associated soil salinity.	**Moderate**: General construction-related impacts associated with small civil works such as soil erosion and sedimentation, dust and noise pollution, generation of waste, groundwater pollution, traffic and road safety, and occupational health and safety risks, etc. Low: Inadequate drainage causing water logging Moderate: Disagreements between FOs and SID on the management of modernized infrastructure	Lack of commitment by FOs to employ irrigation modernization practices. FOs may not have sufficient O&M funds to manage new infrastructure. Degradation of land caused by water logging	Selection of subprojects in consultations with AWBs and FOs on a demand-driven basis. Technical capacity development of FOs Civil works designs to include drainage plans Develop and implement FO-specific ESMPs and RAPs (if required) in accordance with ESMF and RPF. Passage of water pricing reforms is a performance-based condition (PBC) associated with Bank financing of Component 2.
Component 2.2 Capacity building of AWBs, FOs, and SIDA. (Technical Assistance)	**Substantial**: Improved capacity and coordination at all three levels SIDA, AWB, FO will help to reap full social and environmental benefits of the irrigation modernization program and support IWRM.	**None:** This involves only training and capacity building.	Organizations may lack incentives for enhancing their capacity. Women may not be able to fully benefit from training programs.	FOs will be selected on a demand-driven basis for inclusion in the project. AWB institutional reforms will promote transparency and accountability, which will motivate AWB management to adopt a more service-oriented approach. Gender Action Plan includes provisions for promoting female professional participation in SIDA and AWBs.

Component and Intervention Type	Potential E&S Benefit Levels	Potential E&S Adverse Impact Levels	Potential Risks	Proposed Mitigation Measures
				Gender Action Plan includes provisions for promoting female participation in FO Committees.
Component 2.3 Rehabilitation of Akram Wah Canal (Civil Works)	**High**: Restoring the original canal flow capacity and improving associated water control structures to enable more effective distribution of water within the command areas, securing irrigation supplies for 462,000 people and drinking water supplies for over 2 million.	**High**: Significant construction environmental impacts, occupational health and safety and gender-based violence issues associated with large-scale civil works. Social risks are high. Addressing the legacy issues of approximately 1239 households affected by the 2021 anti-encroachment drive along Akram Wah Canal requires the implementation of the SMRP. .	Implementation of the SMRP may not proceed smoothly, interrupting construction progress. Construction can only take place for a limited period each year so as not to disrupt the water supply. Contractor may not follow ESMF provisions	ESIA/ESMP and SMRP have been prepared for the Akram Wah subproject and approved by the Government of Sindh. Continuous meaningful and effective stakeholder consultations, from subproject project identification to completion and disclosure of project documentation. Independent resettlement monitoring consultants will track SMRP implementation; robust Grievance Redress Mechanisms have been established. An Akram Wah Project Implementation Consultant (PIC) will be contracted to support construction and monitor compliance with ESMP.
Component 2.4 Investment Preparation Studies for Renovation of Right Bank Main Canals (Technical Assistance) and small-	**High**: Renovation of Right Bank canals is the first and most important step to improving irrigation service to 900,000 hectares of farmland. Small-scale emergency works will be undertaken to prevent	**Substantial**: Although this activity is only technical assistance, the nature of the works is similar to Akram Wah in Component 2.3 above, with potentially significant construction	Social and environmental issues may not be considered in Right Bank Main Canal technical design studies.	Preparation of ESIA and RAP, in compliance with ESMF and RPF in parallel with technical feasibility studies ESIA and RAP must meet World Bank policy requirements to be considered for future financing.

Component and Intervention Type	Potential E&S Benefit Levels	Potential E&S Adverse Impact Levels	Potential Risks	Proposed Mitigation Measures
scale emergency works (Civil Works)	the collapse of critical structures or canal embankments.	impacts and resettlement issues.		Emergency civil works will be subject to environmental and social screening and the Environmental Code of Practice as presented in the ESMF.
Component 3: Agriculture Incentives and Investments				
Components 3.1 Integrated agricultural development of the same 15 FOs supported under Component 2.1. (Technical Assistance and Small Civil Works)	**Substantial**: Improved on-farm irrigation systems (less than 250 ha) will reduce water losses and decrease water logging and associated soil salinity. Climate-smart agricultural practices will reduce water use, improve soil quality, enhance productivity, and boost resilience. Training will be provided on pesticide management.	**Low**: Very small-scale civil works, for example, installation of small pre-cast irrigation ditches by farmer groups (i.e., Water Course Associations (WCA), will have minor construction impacts.	WCAs may not maintain small-scale infrastructure. Women may not be able to fully benefit from training programs.	WCAs will be supported on a demand drive basis and must contribute labor to infrastructure construction, thus increasing ownership. Separate training sessions for female farmers to ensure culturally appropriate training. SIDA will contract project implementation consultations to supervise construction activities and ensure compliance with ESMF ECPs. Integrated Pest Management Plans will be developed for each FO subproject, including training for farmers on appropriate pesticide and fertilizer use.
Component 3.2 Financing smart subsidy payments to farmers and facilitating wheat procurement reform. Subsidies provided through an e-voucher	**Substantial**: Promotion of high value and water-thrifty crops, such as fruits, vegetables, oilseeds, pulses, etc. and that are suitable for the relevant agro-ecological zone, will reduce water use and increase farmer incomes.	**Low:** Subsidy payments will have no direct adverse environmental impacts but may, in some cases, result in increased pesticide use to protect more valuable crops.	Subsidies may not provide sufficient incentives for farmers to switch to high-value water-thrifty crops. Wheat procurement reform may not be	Developing smart subsidy regulations is a performance-based condition (PBC) associated with Bank financing of Component 3.2 Wheat procurement reform is a performance-based condition

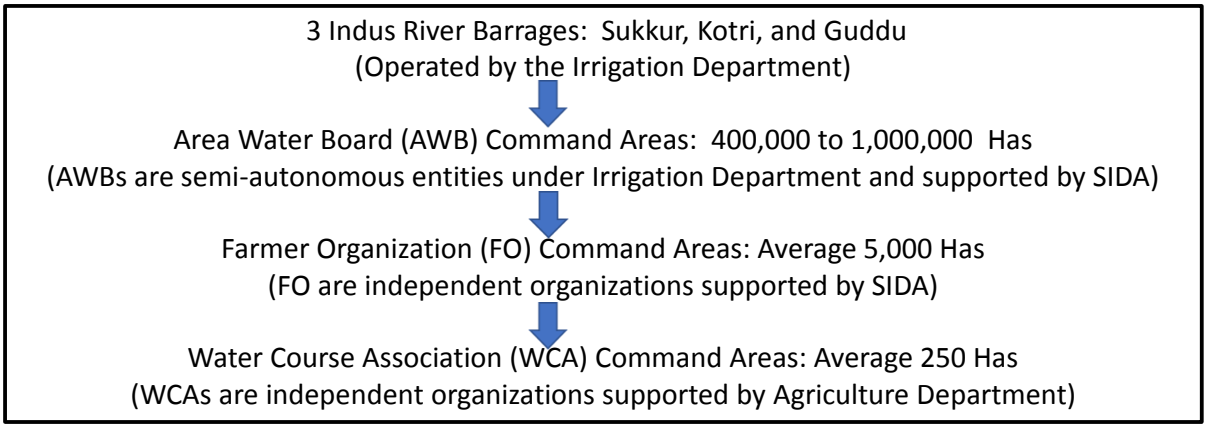
Component and Intervention Type	Potential E&S Benefit Levels	Potential E&S Adverse Impact Levels	Potential Risks	Proposed Mitigation Measures
system; and (ii) direct income support through the banking system to small farmers growing water-thrifty crops.		Seeds treated with pesticides might be ingested with related human health impacts.	successful, limiting fiscal space for transfer to smart subsidy scheme. Women or poor farmers without land titles might be excluded from subsidy programs. Subsidy program might not be demand and time driven	(PBC) associated with Bank financing of Component 3.2 Smart subsidy scheme will start off as a relatively small pilot program to learn by doing and to adjust program design before scaling up. Special provision in the smart subsidy scheme to ensure access to sharecroppers and women farmers. Famers receiving smart subsidies will receive agricultural extension information as well as market information with access to direct support by local extension officials if requested. Only non-pesticide seeds will be eligible for support through the e-voucher scheme.
Component 3.3 Improving the agricultural information and technology base (Goods and Technical Assistance)	**Substantial:** Improving agricultural information systems and enhancing agricultural research will help Sindh with transition to high value water thrifty crops and ensure more sustainable irrigated agriculture. Water logging and salinity program will help Sindh address one of	**Low:** No physical works are anticipated under this component.	Information generated may not be used in a productive manner. Agricultural research may not be focused on Sindh's most pressing agro-ecological issues.	The hydro-agro informatics (HAI) program in Component 1 will draw upon agriculture information to help provide useful water and agricultural services. Adoption of a new Agricultural Research and Extension Policy is a performance-based condition (PBC) associated with Bank financing of Component 3.3

Component and Intervention Type	Potential E&S Benefit Levels	Potential E&S Adverse Impact Levels	Potential Risks	Proposed Mitigation Measures
	its most pressing environmental problems.			
Component 3.4 Developing Agriculture Value Chain. Supports farmer producer groups to address regulatory, infrastructure and technical bottlenecks for high value crops. (Goods and Small Works)	**Substantial**: Reduces value chain constraints to higher value, water thrifty crops. Improve productivity and quality of produce, reduce post-harvest loss, and increase value addition Promote project assisted as well as organic growth of agri-support businesses and services Address the financial constraints facing producers by providing access to loans financial institutions through warehouse receipts (without selling their produce)	**Low**: Only small-scale works, and goods will be included in the component, for example, construction of local warehouses or processing equipment.	Farmers' groups may not organize to create producer groups to take advantage of opportunities. Marketing and financing channels may not be fully accessible to allow the shift to new crops. Farmers might find Warehouse Receipt Systems complicated and cumbersome	Agriculture Department provides value chain mapping and analysis of selected agricultural commodities and supports the creation or strengthening of farmer producer groups. Adoption of a new Warehouse Receipt regulations is a performance-based condition (PBC) associated with Bank financing of Component 3.4
Component 3.5 Agriculture Delivery Unit (ADU) support (Technical Assistance)	**None**: Supports Component 3 implementation.	**None**: Supports Component 3 implementation.	N/A	N/A
Component 4: Project Monitoring and Coordination				
PCMU Unit Support (Technical Assistance)	**None**: Supports overall project implementation.	**None**: Supports overall project implementation.	N/A	N/A
Component 5: Agricultural Flood Emergency Rehabilitation				
	High: Small farmers will be able to resume agricultural production after suffering financial loss due to 2022 floods, thus increasing	**Low:** Small farmers will utilize normal agricultural practices, but there is the potential for occasional	Given the scale and speed of these activities targeting flood affected	Using NGOs and local community institutions to identify eligible beneficiaries and monitor

Component and Intervention Type	Potential E&S Benefit Levels	Potential E&S Adverse Impact Levels	Potential Risks	Proposed Mitigation Measures
	incomes and contributing to food security.	localized overuse of agricultural chemicals.	small farmers may be challenging	distribution and use of financial support. Employment of a comprehensive Grievance Redress Mechanism. Small farmers will be provided information, and access to agricultural extension, on safe use of agricultural chemicals

Institutional Arrangements

SIDA, FOs and WCAs. The Sindh Water Management Ordinance (SWMO) of 2002 helped to establish a stronger foundation for participatory irrigation management with the creation of the Sindh Irrigation and Drainage Authority (SIDA) to serve as a change agent within the Irrigation Department; Area Water Boards (AWBs) to serve as semi-autonomous organizations under the Irrigation Department responsible for the management of the main canal command areas; Farmer Organizations (FOs) which are organized at the distributary canal network and include constituent Water Course Associations (WCAs). Understanding the structure of this sprawling irrigation system is important for understanding the SWAT project design, and a schematic is presented below



Project Implementing Units. The Project will be implemented by three existing Project Implementing Units (PIUs), as shown in the following table. The PIU is responsible for all aspects of project management for its respective component, including procurement and contract management, financial management, safeguards, monitoring and evaluation under the overall supervision of the PCMU.

Table E3. Project Implementation Units

Component	Parent Department	PIU	Partner Entities
1. Water Resources Management	Planning and Development (PDD)	Project Coordination and Management Unit (PCMU)	Irrigation Department Agriculture Department Environment Department Disaster Management Authority Civil Society and Research Institutes
2. Water Services	Irrigation Department	Sindh Irrigation and Drainage Authority (SIDA)	Agriculture Department Area Water Boards (AWBs) Farmer Organizations Water Course Associations Farmers
3. Agriculture Subsidies and Investments	Agriculture, Prices, and Supply	Agricultural Development Unit (ADU)	SIDA Food Department Agriculture Dept Directorates: Research, Extension, and Water Management Farmers and Agi-Business
4. Project Coordination and Monitoring	Planning and Development (PDD)	Project Coordination and Monitoring Unit (PCMU)	All of the above

5. Agricultural Flood Emergency Rehabilitation	Agriculture, Prices, and Supply	Agricultural Development Unit (ADU)	Agriculture Dept Extension Directorate.

All the PIUs have existing environmental and social staff who have extensive experience with Bank-financed projects. The PCMU has a Deputy Director for Environment and a Deputy Director for Social. SIDA has an Environmental Management Unit (EMU) with six specialists, a Deputy Director, an Environmental Specialist, an Ecologist, a sociologist and two Environmental Inspectors. The ADU/PIU has only one Environmental and Social Safeguards Specialist working under SAGP. The ADU/PIU will hire two additional staff - a junior environmental specialist and a junior social specialist, to support the existing safeguard specialist. After completion of the project, AWBs will be responsible for the management of canal infrastructure. Currently, there are no safeguard specialists in the AWB teams, and the Project will support the hiring of a social specialist in each AWB. Each PIU will also contract project implementation consultants (PICs), which will help implement its specific component. Each PIC will appoint dedicated environmental, social, health and safety (ESHS) staff to ensure the implementation of ESMF and subproject-specific ESIAs/ESMPs. PIC staff will include an Environmental specialist, an Occupational Health and Safety Specialist, an Ecologist, Social Specialist, and ESHS site Inspectors.

E&S Procedures for Subprojects

The step-by-step procedure 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 the following table.

Table E4. E&S Procedures for Subprojects

Step	Activity	Description of the Activity	Timing/Status	Responsibility
1	Screening	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	PIUs (EMU of SIDA and ADU Agriculture Department) will conduct a screening exercise (**Annex 2**) whenever new subprojects 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 For subprojects that do not involve any civil works, stakeholder consultations will be carried out in accordance with the Stakeholder Engagement Plan	During Feasibility and E&S assessment studies	PIUs (with the support of PIC)

Step	Activity	Description of the Activity	Timing/Status	Responsibility
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 and parallel to feasibility studies	PIUs with the support of PIC and ESIA Consultants
4	Consultations and Disclosure	Consultations with the stakeholders (including affected communities) prior to E&S studies and after completion of draft ESIA/ESMP and RAP/ARAP. Disclosure of the ESIA and RAP (including translated summaries) on PIU's website and on the external website of the World Bank	During E&S studies After completion of ESIA/ESMP and RAP/ARAP	PIUs with the support of PIC
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 – Before construction	PIUs. 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 PIUs 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 and reporting of compliance by the Construction supervision consultants and PIUs	During Construction	E&S staff of PIUs will review and approve the C-ESMPs and OHS Plans. ESHS Staff of Contractor will implement the plans. E&S staff of PIUs and PIC will supervise the implementation of these plans

Subproject Screening Criteria

A screening exercise (Annex 2) will be carried out for all the proposed subprojects once they are identified through a reconnaissance site visit. The purpose of this screening exercise is to categorize the subprojects

into low, moderate, substantial and high-risk categories, based on the baseline environmental and social features of the area and anticipated risks during the subproject implementation. If the screening process concludes that the proposed subproject is a high-risk category, an ESIA will be prepared. If the subproject is a substantial risk category, an ESIA or site-specific Environmental and Social Management Plan (ESMP) will be prepared. If the screening process concludes that the subproject is a low to moderate risk category, the generic ESMPs in the ESMF (Annex 3) will be used. The generic ESMPs and templates for ESIA and ESMPs are prepared to ensure the requirements of SEPA IEE and EIA regulations. ESIA documents prepared in compliance with the World Bank requirements will be accepted by SEPA for review and approval. If the subproject is likely to cause resettlement impacts, a RAP will also be prepared.

Preparation of ESIAs, ESMPs and A/RAPs

The ESIA and ESMP templates have been prepared (Annexes 3 and 4), which will guide the design and implementation of the substantial and high-risk projects. Based on the initial screening of proposed investments, it is anticipated that most of the subprojects in Component 3 are likely to fall into the moderate and low-risk categories. Hence, standard Environmental and Social Management Plans (ESMPs) have been prepared for all potential subprojects under Component 3 (**Annex 3**) to address generic impacts during their implementation, which can be readily adapted for all low and medium risk projects. Further, the Environmental Code of Practices (ECPs) to address all generic construction impacts have been prepared and presented in **Annex 1**, which will be attached to the bidding documents of all construction works along with the ESMPs.

The ECPs are prepared following Good International Industry Practices (GIIP) to address construction-related impacts. The ECPs prepared for the Project are Waste Management (ECP 1), Fuels and Hazardous Goods Management (ECP 2), Water Resources Management (ECP 3) Drainage Management (ECP 4). Soil Quality Management (ECP 5), Erosion and Sediment Control (ECP 6), Topsoil Management (ECP 7), Topography and Landscaping (ECP 8), Quarry Areas Development and Operation (ECP 9), Air Quality Management (ECP 10), Noise and Vibration Management (ECP 11), Protection of Flora (ECP 12), Protection of Fauna (ECP 13), Protection of Fish (ECP 14), Road Transport and Road Traffic Management (ECP 15), Labor Influx Management and Construction Camp Management (ECP 16), Cultural and Religious Issues (ECP 17), Workers Health and Safety (ECP 18), Instream Construction Works (ECP 19) and COVID-19 Health and Safety Plan (ECP 20).

The detailed procedure to prepare RAPs is given in the RPF, presented under a separate cover. The ESIAs, ESMPs and RAPs will be submitted for World Bank and Sindh EPA clearance after appropriate consultation with stakeholders and disclosure before starting construction works of respective projects.

The cost of implementing ESMF has been estimated at USD 1.5 million, not including Akram Wah ESIA/ESMP or SRMP. It will also cover hiring environmental and social staff in the PIUs and implementing the SEP. Detailed cost estimates for managing environmental and social risks will be provided in the ESMPS and RAPs of respective subprojects.

Labour Management Procedures

The project will engage direct, contracted, and primary supply workers. The estimated number of direct workers, such as officials and staff, of each implementing agency (PCMU and PMUs) will be around 25. The contracted workers will include the workers of contractors, who will be engaged in the implementation of the civil works and the staff of consultants engaged in carrying out feasibility studies and construction supervision. The exact number of contracted workers will be known during the implementation stage. The primary supply workers will be engaged in the direct sourcing of goods or materials essential for the core functions of the sub-project. The number of community primary supply

workers will also be known during the implementation. The main labor risks associated with the project are related to the potentially hazardous work environment, such as working with heavy machinery and working in large canals, child labor and forced labor, unclear terms and conditions of employment for the labour involved in construction works, absence of a grievance mechanism for labour to seek redressal of their grievances/issues labor influx and associated community health and safety risks, including Sexual Exploitation and Abuse (SEA)/Sexual Harassment (SH) risks and the capacity of the implementing agencies to manage and mitigate these risks. Labour Management Procedures (LMP) have been prepared to address these risks as part of the project ESMF. It comprises details relating to provisions under various applicable labor laws; procedures for managing various workers, including contractor's workers; provisions of GRM to address labor concerns/grievances and issues relating to OHS, and a sample code of conduct.

Stakeholder Engagement Plan

Stakeholders are categorized into three categories. Project-affected persons directly affected by land acquisition due to the loss of arable lands, crops, fruit and wood trees, structures, income and livelihoods due to rehabilitation works and project beneficiaries positively affected by the project. Other interested groups include area Water Boards, Farmers' Organizations, local and district governments, and civil society organizations. The disadvantaged and vulnerable groups include the poor and marginalized, which include small landholders of arable land, agriculture tenants and affected households below the poverty line. FO-level Information Centers (FICs) will be established in the subproject areas. The Project stakeholders, particularly PIUs, PICs, Contractors, sub-contractors and service providers, will use the FICs to disseminate and disclose information related to subproject activities. Further direct communication will be established with the affected households through phones, emails and one-on-one meetings. Special efforts will be made to engage women and vulnerable groups through focus group meetings. A Stakeholder Engagement Plan (SEP) is annexed to the ESMF.

Gender Action Plan.

A Gender Action Plan that identifies key gender gaps and proposes actions to close those gaps is included as an annex in the ESMF. The key action items include: (i) implementing programs that allow women to play a more significant managerial and technical role in the Irrigation Department, SIDA, and the Agriculture Department; (ii) requiring that women be actively engaged in decision-making within FO and WCA organizations; and (iii) providing special training on climate-smart agriculture for women under Component 3.

Grievance Redress Mechanism

A grievance redress mechanism (GRM) is being established by all implementing agencies of SWAT to provide a systematic and transparent set of arrangements to enable local communities, people affected by the project activities, contractors, employees, and other stakeholders to raise grievances and suggestions and seek resolution of complaints relating to corresponding components/subcomponents of the project. Each PIU has a multi-tier grievance registration and redress mechanism to address complaints ranging from mild to severe nature. The system encourages complaints to be handled at the lowest level in time bound period, but in case of dissatisfaction, complaints can be forwarded to higher levels where GRM committees of relevant PIUs would deliberate over the cases. PCMU will handle all project-related complaints related to Component 1: 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 ADU. SIDA will institute and manage GRM for Component 2: Water Service Delivery. Likewise, Component 3: Smart Subsidies and

Agriculture Investments will be overseen by ADU. For SIDA, the first tier will be set up at the project level, and the second tier will be at the PMU level. The committee members will include the Project Director and social specialist of SIDA, the director and chairman of respective AWBs, representatives of PAPs, contractors and supervision consultants. For ADU, the first tier of GRM will be set at the local level under the Chairmanship of the district-level director PIU. The second tier will be formed at the PMU level under the Chairmanship of the Project Director. The third tier will be established at the PCMU level under the chairmanship of the Project Coordinator. The committee members will include E&S specialists from PMU, local agriculture government officials and representatives from the community. If the affected person is not satisfied with the decision of GRC, they, as a last resort, may submit the complaint to a court of Law. The risk of gender-based violence (GBV) in the project is screened as low as the construction activities will be carried out mostly by local labour, and interaction between the construction labor force and the women is expected to be limited due to the conservative culture in the region. The contractor's code of conduct shall cover clauses related to avoiding gender-based violence, sexual exploitation and abuse, and sexual harassment. The code of conduct will be included in the worker's contract agreement, and any violation of the code of conduct will lead to termination of employment. Complaints/reports on gender-based violence or harassment will be collected and addressed through the above GRM in a partnership with local civil society organizations.

Consultation and Disclosure

Two rounds of stakeholder consultations were conducted during the preparation of this ESMF, one at the initial stages of preparation and the second after completion of the draft ESMF. Initial consultations were held in April 2021 with AWBs of Ghotki, Nara and Left Bank canals, FOs of these three AWBs, Sindh EPA, Public Health and Engineering Department, Forest and Wildlife Department, Livestock and Fisheries Department, Irrigation Department, Agriculture Departments, and PIUs. In addition to these consultations, a gender-specific consultation workshop was carried out with the AWBs, FOs, UN Women, ILO, and a women's NGO. All these consultations were carried out through video conferences and telephonic interviews due to the prevailing covid-19 situation in the country. All the stakeholders realized that water is scarce and that it needs to be managed much more efficiently. They appreciated the proposed activities under the SWAT and recommended that the proposed policies, particularly the water prices, should not adversely affect poor farmers and domestic users, and strong technical support is needed for the FOs and manage the proposed canal modernization works. Farmers also suggested that the project should include provision for rehabilitation of water courses and land levelling for improving agricultural productivity and water efficiency. Smart subsidies should be given to farmers for expensive equipment to prepare the land and post-harvest processes. They suggested a shift in agriculture practices and preference for water-thrifty crops would occur only if government policies supported the shift, strong markets are developed, and there is demonstrated benefit.

The second round of consultations was carried out in August 2021 with the AWBs, FOs, and WCAs to disclose the draft ESMF and obtain feedback from all the relevant stakeholders. Further, a workshop was conducted on 24th August 2021 at the SIDA office in Hyderabad with all the relevant stakeholders, including AWBs, FOs, PIUs, EPA, Public Health and Engineering Department, Forest and Wildlife Department, Livestock and Fisheries Department. The overall feedback from the participants is very positive, and they agreed that the draft ESMF has adequately addressed all the potential environmental and social issues of the SWAT. The participants recommended continued consultations throughout the project implementation and provided some suggestions for the successful implementation of the SWAT. They suggest that FOs and WCAs are to be continuously engaged in selecting and implementing all the project activities, including payments to the contractors, to ensure ESMPs are implemented to their

satisfaction. FOs and WCAs need training and capacity development in implementing the project activities. The stakeholders will be consulted throughout the project implementation, during subproject identification, preparation of feasibility and E&S studies, disclosure of E&S instruments, and subproject implementation. The relevant sub-project related information will be disclosed publicly through FO-level Information Centers.

The ESMF has been disclosed on the PIU websites, and the updated ESMF will also be disclosed on the PIUs and World Bank external websites. The executive summary of the ESMF will be translated into the Sindhi language and will be published on the PIU websites, and hard copies of these documents will be made available at local AWB offices for public access. Stakeholder consultations will be carried out regularly during all stages of the project implementation in accordance with the project's stakeholder engagement plan. The ESIA and RAP documents to be prepared for proposed subprojects will also be consulted upon and disclosed on the PIU and World Bank external websites and made available to the local communities by placing them at local AWB and FO offices.

1 Introduction

Sindh Water and Agriculture Transformation Project (herein after referred to as the **SWAT** or the **Project**) is the proposed project by the Government of Sindh. The Project Coordination & Monitoring Unit (PCMU) of the Planning and Development Department (PDD) 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. 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 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 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 Social Management and Resettlement Plan (SMRP)have been prepared for one of the subprojects, Rehabilitation of Akram Wah Canal. The RPF, ESMP and SMRP are available under separate covers.

1.1 Background[4]

Irrigated agriculture is the mainstay of Sindh's rural economy. Sindh is the second largest province in Pakistan with a population of 51 million. Nearly 52 percent of Sindh's population lives in rural areas and poverty is pervasive. Agriculture is crucial to household welfare in Sindh, accounting for about 24 percent and 70 percent of provincial GDP and employment respectively.[5] Sindh is the most downstream province of the Indus River, upon which it relies almost entirely to meet its water needs for agriculture, urban and rural water supply, and industry.

Addressing the water-agriculture nexus in Sindh is fundamental to rural development, environmental sustainability, and climate resilience. Irrigated agriculture is the mainstay of Sindh's rural economy but has remained stagnant over the last decade. Agriculture productivity, measured in terms of total factor productivity which considers the combined set of land, labor, capital, and resources, has remained stagnant over the last decade.[6] The provision of irrigation services is locked in a century-old paradigm that is unable to meet agriculture's needs or ensure environmental sustainability. Irrigated agriculture in Sindh is in a crisis that will be further exacerbated by climate change unless profound changes are simultaneously introduced in the agriculture and water sectors.

Sindh suffers from extremely low levels of agricultural water productivity. Agricultural water productivity, measured in terms of either kilograms of crop per cubic meter (crop per drop) or revenue per cubic meter (rupee per drop), is low in Pakistan in general and particularly so in Sindh. This low agricultural water productivity in Sindh is driven by a combination of factors. First, crop yields for major crops are approximately 15 - 20 percent lower than global averages. Second, there is an excessive reliance on low value, water-thirsty crops which account for 80 percent of cropped land. Third, inappropriate water management practices such as over-irrigation at the head of canals result

[4] Project Appraisal Document of SWAT

[5] Abdul Wajid Rana and Heman Lohano (forthcoming), *Sindh Water and Agriculture Sector Public Expenditure Review*. World Bank.

[6] Ibid.

in water logging, soil salinization, and downstream water scarcity. It is estimated that around 60 percent of the water withdrawn from the Indus River in Sindh is wasted.[7].

Poor water management is undermining environmental sustainability and impacting economic growth and public health in Sindh. Prior to the development of the Indus Basin Irrigation System (IBIS), the Indus River was a braided river in its lower stretches supporting a rich riverine habitat, culminating in the world's fifth largest delta with extensive mangrove forests. Reduction of flows along the Indus River, approximately 90 percent of which is used by agriculture, has resulted in almost no water now reaching the Indus Delta. Agricultural development and the reduction of freshwater flows has caused the Delta to shrink by an astounding 92 percent over the last century.[8] Inappropriate agricultural water management has resulted in water logging and salinity that affects around half of the irrigated land, generating reduction in yields on the order of 30-50 percent on affected land. A 2015 World Bank study estimated that water-related agricultural soil degradation reduces Sindh's annual GDP by around 2.4 percent, while the loss of mangroves has resulted in an annual loss of 0.7 percent. Natural disasters, including floods and droughts, account for an additional average annual loss of 1.7 percent of GDP.[9] Water scarcity in the downstream parts of the canal network reduces the supply of water to vulnerable towns and villages, contributing to low levels public health.

Sindh needs to shift to higher value, water thrifty crops to increase farmers' incomes and boost agricultural water productivity. Sindh's agriculture is based primarily on low-value, water-thirsty crops which constitute the following shares for cropped land: wheat (30 percent), rice (22 percent), cotton (17 percent), and sugarcane (9 percent). Its abundant sunshine, rich soil, and supply of water from the Indus River are conducive to growing higher value, water-thrifty crops such as fruits, vegetables, pulses, oilseeds, condiments, and flowers but these account for only 22 percent of total cropped land. Yet transition to these crops is hindered by a variety of inappropriate agricultural policies and government interventions in input markets such as seeds, fertilizers, and irrigation, and output markets such as wheat and sugar that favor low value, water thirsty crops.[10] Agricultural value chain development for higher value crops is still in the nascent stage. The World Bank financed Sindh Agricultural Growth Project (SAGP), closed in 2021, helped to catalyze these value chains and the SWAT project will build upon this foundation.

Agricultural productivity for all crops also needs to accelerate to increase farmers' incomes and boost agricultural water productivity. Productivity in terms of kilograms of product per hectare is generally low in Pakistan, indicating tremendous potential for increasing yields. For example, the percent yields in Pakistan with respect to China are wheat (52 percent), rice (54 percent), cotton (43 percent), and sugar cane (81 percent).[11] This poor performance of irrigated agriculture is driven by a host of factors including limited adoption of modern technologies, poor agriculture support services, inefficient water delivery, land degradation, poorly functioning agricultural markets, land tenure arrangements and general political economy factors that resist changing the status quo. The World

[7] Ibid.

[8] Siyal, A.A. (2018). *Climate change: Assessing impact of seawater intrusion on soil water and environment on Indus delta using GIS & remote sensing tools*. US. Pakistan Center for Advanced Studies in Water (USPCAS-W), MUET, Jamshoro, Pakistan

[9] Sanchez-Triana, Ernesto, et. al (2015) *Sustainability and Poverty Alleviation: Confronting Environmental Threats in Sindh, Pakistan Directions in Development.* World Bank.

[10] Abdul Wajid Rana and Heman Lohano (forthcoming), Sindh Water and Agriculture Sector Public Expenditure Review. World Bank.

[11] Ibid.

Bank financed Sindh Irrigated Agriculture Productivity Enhancement Project (SIAPEP), which will close in 2022, focused on addressing these challenges and the SWAT will build-upon these efforts.

Sindh depends on the IBIS to meet its agricultural, domestic, and industrial water needs. The multi-purpose canal network in Sindh starts off with three large barrages on the Indus River. The on-going World Bank-financed Sindh Barrages Improvement Project (SBIP), scheduled to finish in 2024, is helping to improve the safety of this vital infrastructure upon which the province depends. These barrages divert water into 14 main canals, 114 secondary canals, and 1,400 distributary canals. These distributary canals in turn feed approximately 44,000 water courses. The gross command area of the irrigation system is approximately 5 million has, with the actual irrigated area averaging around 3.6 million has based on water availability. Almost 50 percent of the command area does not have drainage facilities. This is a serious constraint to crop production since much of the agricultural land is flat with low natural drainage. High water losses at the farm level and canal seepage, coupled with the effects of climate-induced droughts, have resulted in water logging and salinization with close to 30 percent of agriculture land salt-affected, creating a serious threat to the sustainability of irrigated agriculture. Much of the groundwater in Sindh has high levels of salinity, although a thin lens of freshwater provides an important source of drinking water for rural communities and supplemental irrigation.[12]

Sindh's irrigation system urgently needs to be modernized. Irrigation management principles in Pakistan, and Sindh in particular, were established during the colonial period and have not fundamentally changed since then. The Sindh Irrigation Act of 1879 still governs most irrigation operations in Sindh. The original operating principle was to proportionally distribute water on a rotation basis and according to the availability of water in the Indus River, with the amount of water allocated to each watercourse based upon its area. The goal was to promote the production of basic crops to help ensure food security. Currently, the irrigation system cannot even meet the original principle of equitable distribution due to infrastructure deterioration and management deficiencies. This has resulted in inequitable allocation of water, over-irrigation at the head of canals, often resulting in water logging and salinization, and water shortages at the lower reaches of the canal network. Sindh's multi-purpose canal system needs to be modernized, in terms of infrastructure, operations, and institutions, to meet the needs of agriculture, cities, and industry in the context of a growing population, expanding economy and changing climate. The World Bank financed Sindh Water Sector Improvement Project (WSIP), which closed in 2020, renovated some of the main canal infrastructure, but much more needs to be done and SWAT will continue to support the modernization program.

In 2022 the GoS is considering a new Water Policy. This new policy represents a call to action to implement the following activities that will be supported under SWAT, including: (i) creating a unified legal framework that supersedes the 1879 Irrigation Act and the 2002 SWMO; (ii) establishing an IWRM system that includes all water users and takes into account environmental sustainability and climate resilience; (iii) gradually adjusting and extending the participatory irrigation approach to all 14 main canals; (iv) modernizing the operation of the canal network to meet multiple purposes; and (v) adjusting water rates to ensure water users pay an appropriate share of costs.

Sindh is facing enormous climate resilience challenges. Sindh province lies at the tail end of the Indus River and the front line of a rising sea. The entire IBIS is dependent on snowmelt and glaciers from the

[12] Sindh Planning and Development Department (2016), *The Irrigation Management Strategy for Irrigated Agriculture of Sindh Province*.

western Himalaya's which will be profoundly affected by a changing climate. Sindh's irrigated agriculture is particularly vulnerable to the following climate impacts: (i) changes in seasonal flow patterns in the Indus River affecting availability of irrigation water; (ii) reduced productivity of crops and livestock due to heat stress; (iii) increased irrigation requirements due to higher levels of evapotranspiration; (iii) increased frequency and intensity of extreme climate events (floods, droughts); and (v) advancing saltwater intrusion, affecting coastal agriculture, forestry and biodiversity. [13] The SWAT project will help Sindh improve its climate resilience through promotion of climate smart agriculture, better management of increasingly scarce water resources, and helping to better cope with more frequent and severe floods and droughts.

Gender is a key issue for agriculture and irrigation. Despite women's significant role in agriculture, women have traditionally been excluded from decision-making involving cropping decisions or irrigation management due to social norms. SIDA has attempted to help improve on the status quo by promoting Women Farmers Groups and requiring female participation in AWBs and FOs. These efforts, however, are still in their infancy. Moreover, the percentage of female professionals in the agriculture and irrigation sectors is quite low, partially reflecting the low levels of women with academic qualifications and workplace inequities that result in low entry and retention rates. The SWAT project includes an ambitious gender action plan ensure women farmers receive access to training; promotes representation of women in AWBs, FOs, and WCAs; and promotes professional development of women in the two main implementing agencies, SIDA and the Agriculture Department,

1.2 Sindh Water and Agriculture Transformation Project

The project development objective is to increase agricultural productivity and improve water resources management to support rural development and environmental sustainability. SWAT focuses on three AWBs on the Left Bank Canals of the Indus River: Ghotki (with a command area of 381,000 Ha), Nara (1,047,946 Ha) and Left Bank (592,548 Ha). SWAT will also focus on completing the "last mile connections" in the canal network upgraded through the recently completed Bank-funded Water Sector Improvement Project (WSIP)[14] and ongoing Sindh Barrages Improvement Project (SBIP)[15]. In addition, SWAT will introduce modernization concepts for canal operation and irrigation service that will help Sindh make better use of these infrastructure investments. The Sindh Agricultural Growth Project (SAGP) closed in 2021 and focused on value chain development for high-value crops, and activities under SAGP will also be strengthened under the SWAT. The detailed description of the project is given in Section 2.2

1.3 Preliminary Environmental and Social Screening 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

[13] Ahmad, Mobin-ud-Din, et al. (2020). *Sindh water outlook: Impacts of climate change, dam sedimentation and urban water supply on irrigated agriculture.* Technical Report. Sustainable Development Investment Portfolio project. CSIRO, Australia.

[14] The Water Sector Improvement Project (WSIP), closed in 2020, financed the renovation of the main canal networks for the three AWBs under SWAT.

[15] The on-going Sindh Barrages Improvement Project (SBIP), scheduled to close in 2024, is improving the safety of the three large barrages on the Indus River which feed the Sindh irrigation system.

Wah has been completed, and the detailed engineering designs are in progress; and hence ESMP and SMRP 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 interventions and designs of these facilities. These feasibility studies will be carried out during the Project 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 project 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

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), 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/PMU Agriculture Department), Muhammad Amin Khushk (Ecologist, SIDA), Shakeela Leghari (Sociologist & Participation Specialist, SIDA), and 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 Project Development Objectives are to increase agricultural water productivity in selected Farmer Organization command areas, establish an institutional framework for integrated water resources management, and facilitate the recovery of small farmers from the 2022 floods.

2.2 Project Components

The Project has six components that are described below.

2.2.1 Component 1: Water Resources Management ($17.3 million)

Objectives of Component 1: The overall objective of this component is to help establish the institutional framework for integrated water resources management.

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.

Component 1.1 Policy and Institutional Reforms ($2.1 million)

This subcomponent involves the formulation of a water resources law for Sindh province, the restructuring of the Irrigation Department into the Irrigation and Water Resources Department (IWRD), and comprehensive water pricing reforms

- **Water Law:** Sindh does not currently have a water resources law Instead, the three main items of water legislation currently in force are the Irrigation Act, 1879 (IA), the Sindh Water Management Ordinance 2002 and the Sindh Environmental Protection Act, 2014 (SEP Act). A new legal framework in the form of a water resources and irrigation act is required to create a unified framework for water resources management that recognizes both: (i) the multi-functional nature of the canal network, and (ii) the need for better management of water as a natural resource. In accordance with the Sindh Water Policy, it is expected that a multi-sectoral Sindh Water Resource Commission will be established to help coordinate the sustainable management of water resources in the province. The development of new legislation will be undertaken based on extensive stakeholder consultation with the Government, private sector, and civil society based on an agreed roadmap. The draft text will be finalized for submission to the Government accompanied by a detailed commentary and an outline of the subordinate legislation necessary for the implementation of the new act.
- **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 new Water 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 IWRD.

- **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.

Component 1.2 Sindh Strategic Water Plan ($4.0 million)

Building upon the new Sindh Water Policy, this component will support the preparation of the first ever "Strategic Water Plan" (SSWP). It is expected that the SSWP will be institutionalized and prepared on a periodic basis (every 5 to 10 years). The plan will address key water and environmental issues, including strategic directions on infrastructure development, water allocation, and water-related environmental priorities. The SSWP will be prepared under the coordination of the PCMU and with support relevant departments, including the Irrigation Department and the Agriculture Department. The SSWP should be formally adopted by the Sindh government through the to-be established Sindh Water Resources Commission. Future SSWPs are expected to be prepared under the coordination of the IWRD after it has been suitability strengthened through Component 1.1 Extensive stakeholder consultations, communication, and media outreach will be employed throughout the preparation of the SSWP. Preparation of the Plan will be supported by the Hydro-Agro Informatics program (Component 1.3).

Component 1.3 Hydro-Agro Informatics (HAI) Program ($17.3 million)

Insufficient information is hampering the ability of Sindh to properly deliver canal water services, manage water and environmental resources, and support agricultural growth. The HAI Program will help Sindh build the foundation needed for filling this information gap through application of new tools for monitoring both water and agriculture. This integrated approach will help Sindh leap-frog into a modern water and agricultural management system where decisions across the scales are informed by continuous, reliable, and accessible data.

The project will support a "HAI Center" which will be a service provider for the IWRD, Agriculture Department, Environment Department, and Provincial Disaster Management Authority (PDMA). These departments will collect the ground-based information and send to the Center where the collected ground data will be processed and complimented with remote sensing data, into a series of data products and tools to allow the users including the departments to make better management decisions. FAO, through its GCF funded project "Transforming the Indus Basin with Climate Resilient Agriculture and Water Management" will provide additional support to the HAI program.

The HAI program will utilize a sophisticated GIS based platform with associated databases that will include the following data elements: i) remote sensing; ii) canal flow monitoring; iii) groundwater monitoring; iv) environmental information; and v) agrometeorological monitoring. Services envisioned to be provided through the HAI Center in collaboration with relevant departments include: i) crop monitoring and productivity reports; ii) canal flow monitoring reports; iii) water balance reports; iv) flood monitoring and mapping; v) drought monitoring; and vi) agro-met communication

to farmers. The HAI Center will also be responsible for measuring agricultural water productivity in the pilot FO subprojects.

2.2.2 Component 2: Water Service Delivery ($127 Million)

Objectives of the Component: The overall objective of this component to improve the delivery of canal water services to enhance agricultural water productivity and to improve overall water resources management.

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 – Integrated FO area Agriculture Development - SIDA (US$16 million)

Description of Subcomponent Activities

The project aims to finance around 15 integrated FO area agricultural development subprojects in the 3 AWB areas where the previous project (WSIP) improved the main canal networks: Ghotki, Nara, and Left Bank AWBs. An average FO command area is around 5,800 ha (14,000 acres) and includes 24 WCAs which average around 250 ha (600 acres). In the Sindh administrative system, the Irrigation Department supports the AWB, and the FO canal networks up to the WCA off-take point; the Agriculture Department supports the WCA canal network as well providing agricultural technical assistance. In the past the Agriculture Department investments were not synchronized with the Irrigation Department investments. This created some inefficiencies as the entire network at all three levels—AWB, FO, and WCA, needs to be upgraded to reap full benefits.

SWAT will address this issue by ensuring that investments under Component 2.1, which are managed by SIDA, and investments under Component 3.1 which are managed by the Agriculture Department, are co-located in the same FO command areas. This will help to directly address the water-agriculture nexus. One of the key PDO indicators is improving agricultural water productivity in these 15 FO subprojects, and thus this will require the close collaboration between SIDA and Agriculture Department. At least two of the FOs will also be selected for intensive pilot to conjunctively manage surface water and groundwater within the FO command areas; successful implementation of two pilots is an intermediate results indicator.

The total cost of the FO subprojects is thus US$ 30.0 million, with half managed by SIDA (Component 2.1) and other half managed by the Agriculture Department (Component 3.1). The FO subprojects were broken into two components to facilitate financial management and procurement, but they are in fact “integrated FO Area Development” subprojects. These 15 FO subprojects represent less than 5 percent of the total number of FOs in the three AWB areas—and thus can be considered as pilot subprojects. Activities under Component 3.2, Smart Subsidies and Wheat Procurement Reform, and Component 3.4, Developing Agricultural Value Chain, will also take the FO subprojects into account to boost overall agricultural productivity.

The FO subprojects will be community driven development activities supported by SIDA and the Agriculture Department. The FOs will be selected based upon a set of criteria such as: i) location in the canal network to ensure quality service from the AWBs; ii) organizational strength of the FOs and willingness to modify it rules and regulations to meet the modernization requirements; iii) signing a “FO Area Development Plan” with SIDA and the Agriculture Department; and iv) signing an Improved Water Delivery Agreement (IWDA) with the AWB.

Irrigation modernization investments under Component 2.1 at the FO level include i) new head regulators and flow calibration; ii) long crested weirs for better upstream water level control; iii) new WCA off-takes that allow for flow control and measurement; iv) earthworks on canal banks to restore minimum freeboard and ensure access to offtakes; v) groundwater monitoring instruments (piezometers) at FO level. Other investments that may considered include: i) "social" structures such as canal paths, crossing, and access structures; ii) canal compaction to reduce seepage; iii) FO offices; and iv) tube wells for conjunctive management of groundwater. Other improvements may be considered on a case-by-case basis. SIDA will contract project implementing consultants (PIC-Modernization) to support social mobilization, engineering design, environmental management, and resettlement (if required).

Subcomponent 2.2 –AWB and SIDA Support (US$15 million)

This subcomponent will strengthen the capacity of AWB to deliver a reliable water delivery service to the FOs, and the capacity of SIDA to support FOs. This will a mix of institutional support, training, and technical tools with a focus on behavioral changes. Specific activities include: i) financing the incremental operating costs for SIDA and the AWBs on a declining basis; ii) implementing institutional reforms for the AWBs and FOs as outlined in the Sindh Water Policy; iii) supporting the establishment of two new AWBs on the Right Bank of the Indus River; iv) training and development of tools for improving canal operations and irrigation service delivery; and v) support for behavioral changes through field level leadership program.

Subcomponent 2.3 – Left Bank Main Canals Infrastructure ($93 million)

This component will finance the renovation of Akram Wah Canal, a 116 km long canal with a command area of 187,000 ha (462,000 acres) that also supplies bulk water to many cities, towns, and villages—including Sindh's second largest city Hyderabad. The renovation will restore the original canal flow capacity and improve associated water control structures to enable more effective distribution of water within the command areas. This will complete the main canal renovation for the three AWB command areas that are the focus of the irrigation modernization program under SWAT.

The component will also finance studies for improving the operation of the main canal networks, such as increasing the regulating capacity within the canal network including using Chotiari reservoir to improve flow distribution between the main branches of the Nara canal system. Where physical investments are required, the component will finance the necessary environmental and social studies per the ESMF (including dam safety for Chotiari reservoir) and RPF. Depending upon the size the investments, these could be financed either the first phase of SWAT project or follow-up projects.

Subcomponent 2.4 –Right Bank Studies and Emergency Works ($3 Million)

The canal network on the Right Bank of the Indus River Indus suffers from a lack of investment over the past decades and the canals are in a dilapidated condition. An investment program to upgrade the main canals—similar to the investments under WSIP which focused on the Left Bank, are required as a starting point to address the water-ag nexus on the Right Bank. The Right Bank command areas are plagued by low levels of agricultural productivity, excessive levels of soil salinization, and wide-spread poverty. The largest and previously most ecologically important freshwater lake in Pakistan, Manchar Lake, has been rendered biologically dead.

The component will finance the detailed studies for the renovation of the three main canals on the Right Bank supplied from Sukkur Barrage (Dadu, Rice and Northwest Canals), as well as the Warah Branch canal. The total command area for these canals is around 800,000 ha (2 million acres). The technical studies include feasibility studies, design, and tender document preparation. An ESIA/ESMP

will be prepared for the investment program along with RAPs that will meet World Bank policy requirements. The preparation of safeguard documents will follow the processes laid out under the ESMF. The second project in the SWAT SOP may consider financing the actual investments. In addition, this component includes a provision of funds for urgent rehabilitation of the most damaged structures that are in near-collapse condition.

2.2.3 Component 3: Agricultural Subsidies and Investments ($76.4Million)

This component will contribute to increasing agricultural water productivity by i) investing in climate smart agricultural investments and training at the WCA level; ii) adjusting the agricultural subsidy system to promote the transition to high value, water thrifty crops; ii) improving the knowledge and information base, with a focus on innovative approaches to dealing with water logging and soil salinity; iii) reducing value chain constraints to higher value, water thrifty crops.

Component 3.1 Integrated FO Area Agricultural Development (US$16. million)
This component supports the same set of 15 FO subprojects presented in Component 2 with investments that are channeled through the Agriculture Department. It builds upon the experience of SIAPEP and will be managed by the Directorate of Water Management. The dual objectives of these activities are to improve water management at the WCA level and promote climate-smart agriculture.

Improving water management at WCA level: A community driven development process will be employed to help WCAs, and individual farmers adopt the most appropriate water-related investments. Example investments include watercourse rehabilitation, installation of high efficiency irrigation system (HEIS), increasing precision land leveling services, reclamation of salt affect soils, rehabilitation of on-farm access drains, construction of water storage ponds, solarization of lift pumps on watercourses, etc.

Based upon SIAPEP experience, there will be clear criteria for financial support for different types of investments. For community-owned assets, such as the WCA canal network, the project will finance all material costs while the farmers will contribute skilled and unskilled labor. For investments where the assets are owned by individual farmers, such as high efficiency irrigation systems, and precision land levelling the farmers will contribute 50% of the total costs.

Promoting Climate Smart Agriculture. Training and support will be provided to farmers to help them adopt climate smart agriculture practices to help them achieve the triple outcomes of increased productivity, climate resilience and reduced emissions. These practices include ridge sowing, crop rotation, green manuring, use of biological control agents, raised bed cultivation, alternate wetting and drying, use of improved/certified varieties, mulching including retaining of crop residue, zero tillage, integrated soil fertility management, inter-cropping etc. These practices will be applied as appropriate to major cropping systems of the project area which include rice- wheat, cotton – wheat, and sugarcane etc.

The component will carry out a comprehensive training program, which will include establishment of demonstration sites, group training of farmers using the Farmer Field School (FFS) approach and post-training support for replication of the practices on their farms. To ensure participation of women, the project will hold separate sessions for women farmers during the FFS in activities where they are traditionally involved in farming. To achieve the intended scale of FFSs, the project will train men and women field staff of the Agriculture Department under specially organized “training of trainers”

(TOTs) to run the FFSs in the field. These TOTs will be conducted by specialists drawn from the Agriculture Department, local universities, research organizations and the private sector. To help achieve the scale of replication, the project will retain educated and /or good local farmers among the FFS training participants and use them, in support of the government field facilitator, for coordinating the replication of the practices on farmers' fields.

Training for female leadership will be programmed in both Components 2.1 and 3.1. The training program will be done in close collaboration of the ongoing FAO-GCF project in Sindh, benefiting from their experience in the design and developing training materials. Participation of women in the FO and WCA governance structures will also promoted through the project, with the aim of have women representatives in at least 30% of the FO and WCA organizations.

Subcomponent 3.2 Smart Subsidy (US$27.0 million)

This component pilots a smart subsidy program that explicitly targets small and medium-sized farmers in their efforts to move towards higher value, water thrifty crops. It also supports reform of the provincial wheat procurement and strategic reserve system to free up fiscal space that can be used for more productive agricultural investments, such as expanding the smart subsidy scheme. Actual expenditures for the smart subsidies will serve as the only eligible expenses under this component. Support for designing and implementing this component will be provided through Component 3.5, ADU support.

Smart Subsidy Program: The program will help incentivize small farmers to plant higher value, water thrifty crops such as fruits, vegetables, oil seeds, pulses, etc. and that are suitable for the relevant agro-ecological zone. FAO recently completed an updated agro-ecological zoning plan for Sindh that will help guide these investments. Support would be provided to farmers that plant high value water thrifty crops through two mechanisms: i) e-voucher to subsidize seed varieties; and ii) cash transfer through a branchless banking service after validation process. The use of agriculture e-vouchers and cash transfers are well-established practices in Pakistan. The smart subsidy program will be targeted primarily at small and medium-sized farmers.

Wheat Procurement and Strategic Reserve Reform: The current level of government wheat procurement is around 1.4 MT. It is estimated that the actual reserve requirement is around 0.7 MT to maintain a 3-month reserve for food security purposes. A Public Expenditure Review (PER) for the Sindh agriculture and irrigation sectors indicated that the provincial government provides subsides to support the wheat procurement system on the order of PKR 5 billion (US$ 31.0 million) per year. The subsidy is regressive in that it supports wealthier middlemen and the banking system and keeps the price of wheat low for all consumers regardless of income level. Moreover, the system influences agricultural cropping decisions by distorting price signals for wheat. At the national and provincial level, the government is moving towards a more targeted approach that directly subsidies the purchase of food by poor people.

The wheat procurement and strategic reserve system is managed by the Sindh Food Department (SFD). Since the SFD is not an implementing entity, technical assistance for the SFD shall be channeled through the PCMU under Component 4. The SFD will be supported to improve its analytical and forecasting capacity to make its policies more responsive to changes in the local and international markets. A wheat market monitoring system will be established in SFD to track: i) public and private storage capacity; ii) public and private stocks district-wise; iii) global, regional and domestic markets

for wheat and wheat flour price; iv) ensuring predictability of supply, storage capacity and monitoring domestic and international price; and v) taking prompt mitigating measures to meet any shortages

Subcomponent 3.3 Improving Agriculture Information and Technology (US$13.1 million)
This component will improve the provincial agricultural information system which, among other things, will help in the implementation of the smart subsidy program and wheat procurement reform process. It will also fund an all-out effort related to support applied research and pilot activities to deal with soil salinity and water logging.

The component consists of three separate activities as noted below and will be coordinated through the Agriculture Department's Directorate of Research. The HAI program presented in Component 1.3 will also help generate information that will feed into these efforts. The component will finance technical assistance, equipment, new information systems, and incremental operating costs. This improved knowledge base will facilitate overall policymaking, as well as implementation of the proposed wheat procurement and strategic reform

Improving Sindh agriculture statistics by i) promoting application of ICT and GIS technologies in data collection; ii) establishing a mechanism to ensure timely data sharing among different levels of policy making; iii) filling the identified data gaps (e.g., lack of crop area and production data by canal command area and irrigation modes; post-harvest losses; etc.); iv) using digital platform to broaden and simplify the data access to society; and v) capacity building.

Strengthening Sindh crop monitoring and reporting*:* The goal is to improve the accuracy of yield measurement estimates for major crops and expand this to include other crops such as pulses, oilseed, fruits, and vegetables. This requires improving on-ground measurements through crop-cut experiments (an assessment method employed by to accurately estimate the yield of a crop or region during a given cultivation cycle) and remote sensing approaches. This will involve close collaboration with the Pakistan Space & Upper Atmosphere Research Commission (SPARCO) and the HAI Center to synergize the remote sensing and ground crop survey activities.

Strengthening the marketing price monitoring*:* This will support improvement in the current market information collection, processing, and dissemination. A well-functioning market information system will facilitate the wheat market reform. Strong inter-department coordination is required for the activity implementation and PCMU will provide needed assistance.

Establishing an Integrated Water Logging and Salinity Program*.* The main purpose of the program will be to implement on-the-ground solutions for the management and utilization of waterlogged land and saline soil and groundwater. Hence the focus of the research under this component will be field-based and aimed at establishing sustainable partnerships between farmers, researchers, and commercial suppliers. A portfolio of interventions will be considered: engineering solutions (such as drainage improvements, including for major road infrastructure); land contouring and management (such as ridge and furrow farming with drip irrigation and organic farming techniques); bio-saline drainage and agriculture; and aquaculture. The program will utilize competitive grants to fund output-oriented field research projects that include training, dissemination of good practices, and potentially scaling up of good practices. A competitive grants program will be controlled by an autonomous board consisting of stakeholders from farmers, private sector, NGOs, and government. Scientists and institutes from within Pakistan and abroad will be encouraged to partner with Sindh-based entities.

Component 3.4 Developing the Agriculture Value Chain (US$13.2 million)

This will support small- and medium-farmers and medium-sized agribusinesses to address value chain constraints in horticulture, fruit, vegetable, pulses, and oil seed markets. The focus is on strengthening linkages between producers and the market. The objective is to increase the area of high value, water thrifty crops, improve productivity and quality of produce, reduce post-harvest loss, and increase value addition. This will help contribute to higher agricultural water productivity and higher income for farmers.

The component will build upon the experiences of the SAGP which was implemented through the Directorate of Agriculture Extension. Activities financed under this component include: i) assessing different project areas, with priority given to the FO subproject areas, and markets to identify candidate value chains and associated constraints; and ii) supporting farmers through free technical assistance and partially subsidized investments (up to 60 percent and a US$ 15,000 cap) against a positive list of eligible expenditures. Following the SAGP model, a framework agreement will be signed with selected suppliers to make rolling supply of identified technologies (equipment, machinery, infrastructure and materials etc.) available to farmers on a demand basis. Support to medium-sized agribusinesses through free technical assistance and partially subsidized investments (up to 40 percent and a US$ 100,000 cap). These agribusinesses will be selected through a competitive process in which preparation of a proper proposal including a business plan will be mandatory.

Lessons learnt from SAGP, and other donor financed projects in Sindh will be incorporated into the design and implementation. These lessons include improving market access, employment of ICT technology, provision of demand-driven technology packages, and customized trainings (including exposure and exchange visits) etc. In SWAT, collaboration with leading processors, exporters, and progressive traders will be promoted. Appropriate linkages will be made with the European Union funded “Growth for Rural Advancement and Sustainable Progress” which focuses on strengthening small-scale agribusinesses in Balochistan and Sindh provinces.

***Warehouse Receipts (WRH)*:** WRH is key element of value chain development. One important aspect of value chain development is to address the financial constraints facing producers and enterprises. Smallholder farmers, sharecroppers and tenants often do not have access to formal finance, primarily due to lack of collateral. Consequently, they resort to borrowing from informal sources through market intermediates at an exorbitantly high interest rate. This increases their cost of production which ultimately reduces farm profitability. Likewise, Pakistan’s current agricultural commodity wholesale marketing system is ill-equipped and riddled with imperfections, inadequacies, and distortions that deprive the growers of due value of their produce. Prices of the agricultural commodities are at their lowest levels during harvest season, and farmers can’t hold the harvested products for a variety of reasons, including: i) need to settle outstanding loans associated with current crop; ii) need to buy inputs for next cropping season; and iii) lack of storage facilities. Non-transparent pricing for farmers is the norm because of the concentration of market power among certain intermediaries.

The GoP has recently introduced a WHR regime in the country to help provide access to formal finance for small farmers. The Security and Exchange Commission of Pakistan (SECP) has formulated regulations for establishing Collateral Management Companies (CMC). The CMCs will accredit warehouses for storing the agricultural commodities and issue WHR of the stored products to their owners. These WHRs will enable farmers to access credit from formal financing institutions i.e., commercial, and micro finance banks. In addition, this mechanism would prevent farmers from distress sale of their crops during harvest season. WHR regime will further help in establishing direct

linkages amongst multiple sellers and buyers through the web-based trading system of PMEX. One CMC has already been incorporated in the country by obtaining license from the SECP under the CMC Regulations (2019) and many such companies are expected to come up soon. However, regulatory bottlenecks are restricting the development of the WHR business at the federal and provincial level. At the federal level, the SECP has promulgated Standard Operating Procedures (SOPS) and warehousing guidelines.

The project will provide technical assistance to help Sindh overcome provincial regulatory constraints including: i) reducing provincial tax on warehousing of agricultural products; ii) developing a system for expeditiously responding to SECP's consultations in preparing future contracts for agricultural products and food items for their electronic trading by PMEX; iii) strictly enforcing exemption on Market Committee Cess (i.e. tax) for warehouse transactions outside of formal secondary wholesale markets (i.e. *mandies*); and iv) identifying ideal locations for the development of warehouses.

Component 3.5 Agriculture Delivery Unit Support (US$6.6 million)

The project will support the establishment of an ADU in the Department of Agriculture under the direct supervision of the Secretary/Additional Secretary (Technical). The ADU has two broad mandates. First to serve as the PIU for the SWAT project responsible for all procurement and financial management activities under Component 3. Since this component includes the participation of different directorates within the Agriculture Department, the ADU will ensure coordination between these entities—as well as coordination with SIDA (Component 2) and PCMU (Component 1) as required. The second mandate of the ADU is to provide technical assistance for achieving the agriculture-related performance based conditions (PBCs).

52. The ADU will draw on existing staff resources of the Agriculture Department, particularly the program management staff from SAGP and SIAPEP. The ADU will also contract a Project Management Consultant (PMC) to provide overall support, and contract individual consultants with policy expertise to support the PBCs.

2.2.4 Component 4: Project Coordination and Monitoring ($11.3 Million)

This component will support the activities of the PCMU, which is in the PDD. The PCMU has two roles: i) implementing Component 1; and ii) as the overall project coordination and monitoring unit for the project. Specific activities in this component include the following.

Project Management and Technical Assistance. The PCMU will be assisted by a Project Management Consultant firm and individual consultants for technical, safeguards, procurement, and financial management oversight functions. FAO will provide technical assistance to ensure linkages with their ongoing activities in Sindh, including the GCF-funded project "Transforming the Indus Basin with Climate Resilient Agriculture and Water Management" and European Union funded project "Growth for Rural Advancement and Sustainable Progress (GRASP)".

Wheat Procurement Reform Support. The Sindh Food Department (SFD) is responsible for managing the provincial wheat procurement reform process. The SFD is not an implementing entity under the project. The PCMU will therefore support the SFD in matters related to wheat procurement and strategic reserve reform through the contracting of consultant services for technical assistance and other related expenditures. The PCMU will also collaborate with the SFD on managing the reform transition process.

Incremental Operating Costs. The PDD is typically not an implementing department but rather oversees provincial planning and development activities. The PCMU, however, will assume the role of an implementing entity for Component 1 and coordinate multiple departments under SWAT. Component 4 therefore includes budget to cover the incremental operating costs, including staffing, incurred by the PCMU to support the implementation of SWAT.

2.2.5 Component 5: Agricultural Flood Emergency Rehabilitation Component (AG-FERC, US$107 million).

The project was in an advanced stage of preparation when the 2022 floods struck Pakistan. To respond to the emergency, the project was quickly redesigned and US$107 million was allocated to the AG-FERC and Components 1-4 were subsequently downscaled to maintain overall World Bank financing of US$310 million. The World Bank authorized the application of Paragraph 12 of Section III of the IPF Policy for the Use of Condensed Procedures (Projects in Situations of Urgent Need).

This component will provide financial support to small farmers affected by the 2022 floods reestablish their agricultural production, with an emphasis on the 2022-2023 Rabi crop. It will also finance supporting services provided by NGOs and consultants, as well as the incremental operating costs incurred by the Agriculture Department. The Rabi crop is usually sown in winter and harvested in the spring. The cash transfers will be targeted towards flood affected small farmers with landholdings less than 12.5 acres. The size of the cash transfer has been estimated to help cover the basic inputs required by farmers immediately (seed and fertilizer), however the farmers will have the flexibility to allocate the money according to their needs. For instance, some farmers may allocate part of their resources for land preparation.

Component 6: Contingent Emergency Response (US $0): Following an adverse natural event that causes a major natural disaster, the government may request the World Bank to reallocate project funds to support response and reconstruction. This component could also be used to channel additional financing from the World Bank should they become available for such an emergency.

2.3 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.**

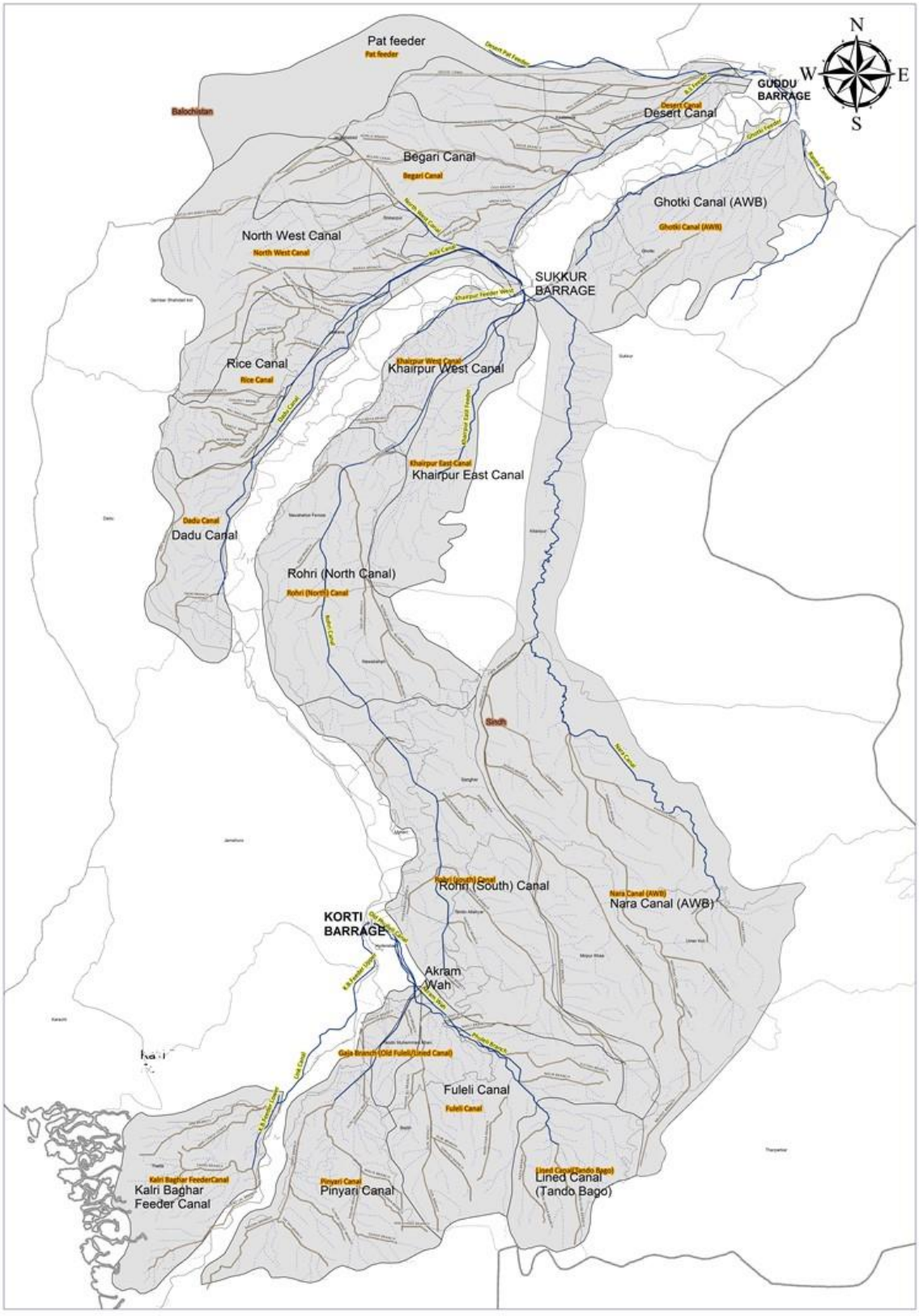


Figure 2.1: Location of Barrages and Canals in Sindh

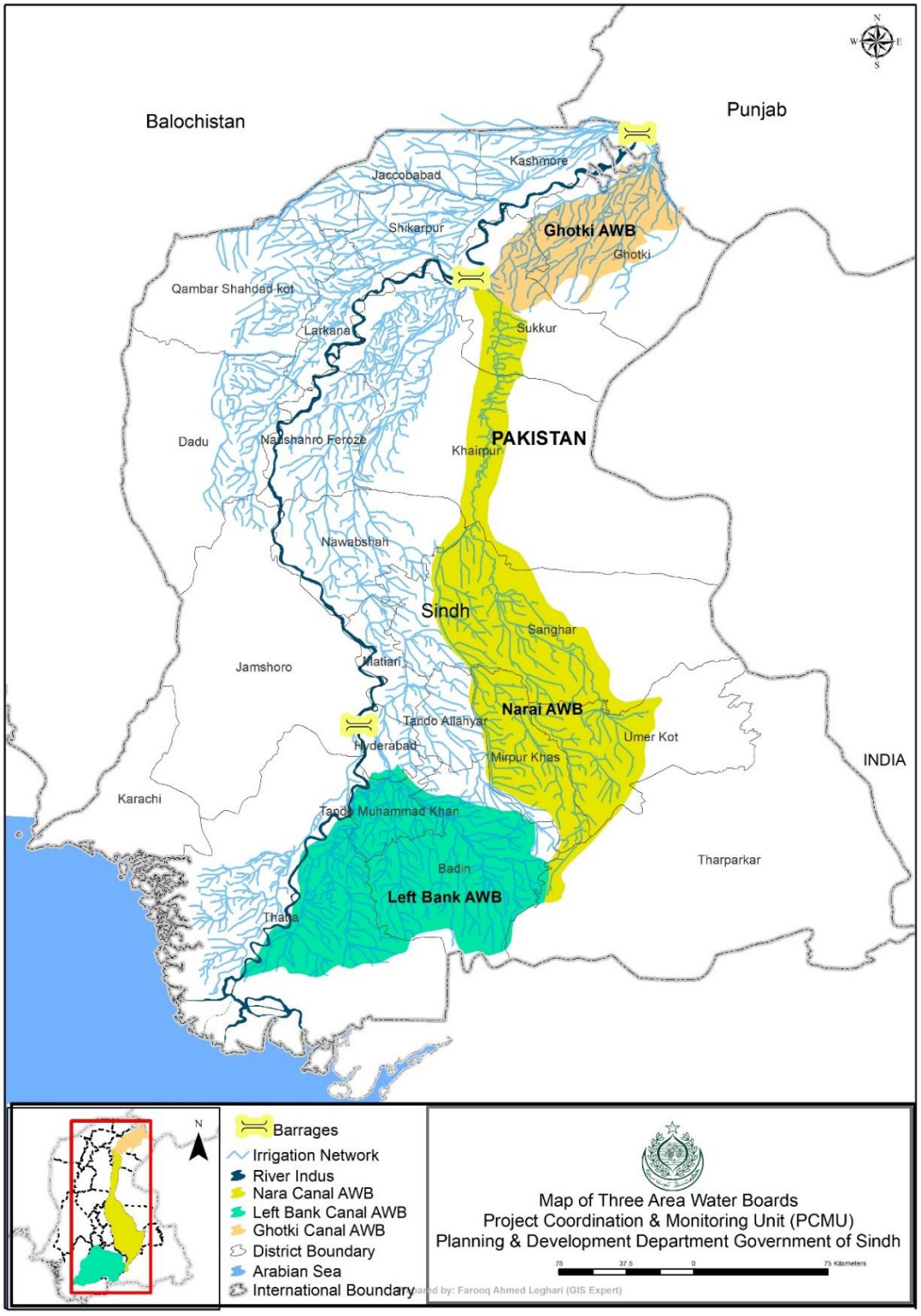


Figure 2.2: Location of Area Water Boards in Sindh

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.

The policy identified six 'burning issues', 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.

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.

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) 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. The climate and hydro-agro informatic program under Component 1 will be designed considering this policy.

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. The studies for rehabilitation of Nara Canal (Component 2.3) shall ensure compliance with this policy

3.2.3 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.

3.2.4 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 requirements to develop IEE and EIA follow within the framework of World Bank OP 4.01, and the ESIA documents prepared in compliance with the World Bank requirements will be accepted by SEPA for review and approval.

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) (ESIA prepared in compliance with the World Bank safeguard policies also meets the requirements of IEE. Hence SEPA accepts and review of ESIAs for environmental approvals).	Construction-related activities under **Subcomponent 2.1 -** "Integrated FO area Agriculture Development - SIDA" 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, The above works will be small-scale irrigation systems, and hence will fall into Schedule I requiring IEEs.
SCHEDULE II, F (2)	Irrigation and drainage projects serving 15,000 hectares (ha) and above	Environmental Impact Assessment (EIA) (ESIA prepared in compliance with the World Bank safeguard policies also meets the requirements of EIA. Hence SEPA accepts and review of ESIAs for environmental approvals).	Rehabilitation of the Akram Wah Canal ***(under subcomponent 2.3)*** has a command area of 187,000 ha, and hence falls in Schedule II. The cost of rehabilitation works will also be more than Rs. 100 million and hence this subproject will not fall into the Schedule 1. EIA is required for this subproject Nara Canal under **Subcomponent 2.3** and 3 Main Right Bank Canals (Dadu, Rice and NW Canals) under **subcomponent 2.4** have a command area above 15,000 ha. Hence all these subprojects will also fall into Schedule II requiring EIA. The works involved in the rehabilitation of main canals will primarily include rehabilitation of embankments, canal lining, and repair or replacement of hydraulic structures. The average command area of FOs is about 5000 ha– less than 15,000 ha mentioned in Schedule II. Hence, the FO subprojects under S**ubcomponents 2.1** require IEEs. -

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 (ESIA or site-specific ESMP prepared in compliance with the World Bank safeguard policies also meets the requirements of this schedule. Hence SEPA accepts and review of ESIAs for environmental approvals).	• Construction-related activities under **Subcomponent 2.1 -** 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), The above works are small-scale construction works related to buildings and roads, and hence will fall into Schedule III. A generic ESMP will be needed for these subprojects
SCHEDULE III, d	On-farm dams and fish farms	Environmental Screening (through check list) and generic ESMP	Improving On-Farm Water Management ***(under subcomponent 3.1)*** • Construction of high-efficiency irrigation system
SCHEDULE III, h	Lining of existing minor canals and/ or water courses	Environmental Screening (through check list) and generic ESMP	**–** Following rehabilitation works in about 300 water courses under Integrated FO area Agriculture Development - AWB" ***(Subcomponent 3.1)*** • 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	Desilting of about 50 farm drains ***(under subcomponent 3.1)***

3.2.5 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.

3.2.6 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.
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.

LAA Section	Description
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.

3.2.7 Other Relevant Environmental Legislation

An overview of other relevant legislation relevant to the environmental and social aspects of the Project is presented in **Table 3.3**.

Table 3.3: Other Relevant Social and Environmental Legislation

Legislation / Guidelines	**Brief Description**	**Relevance to the Proposed Subprojects**
Pakistan Labour Policy 2010	policy recognizes that workers and employers must enjoy reasonable benefits as can be sustained by the economy without suffering set-backs.	Forced labour and child labour will not be allowed
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	Workers shall be protected from risks associated with wastewater discharges and emissions
Sindh Bonded Labor System (Abolition) Act (2005)	The Bonded Labor System (Abolition) Acts seek to eradicate bonded labor practices prevailing in the respective provinces.	Bonded/forced labour will not be allowed
Sindh Minimum Wages Act 2015 for Unskilled	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	Labour wages should be paid in accordance with this act

Legislation / Guidelines	Brief Description	Relevance to the Proposed Subprojects
Workers Ordinances (1969)	employed, either directly or through a contractor, in his commercial or industrial establishment	
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/ESMPs 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 game reserves where hunting and spoiling of its natural landscape and environment is prohibited.	No personnel or staff related to the project, including contractor staff, will be allowed hunting or otherwise disturbing wildlife.
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

Legislation / Guidelines	Brief Description	Relevance to the Proposed Subprojects
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/-[16].	The subprojects need 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.
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.
Pakistan Antiquity Act, 1975	It requires that all accidental discoveries are reported to the federal Department of Archeology. It also makes the	Chace-finds are to be reported to provincial archaeological departments

[16] 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
	federal government the owner of all buried antiquities discovered from any site, whether protected or otherwise.	
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.	Children aged below 18 will not be engaged in construction works

3.2.8 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**.

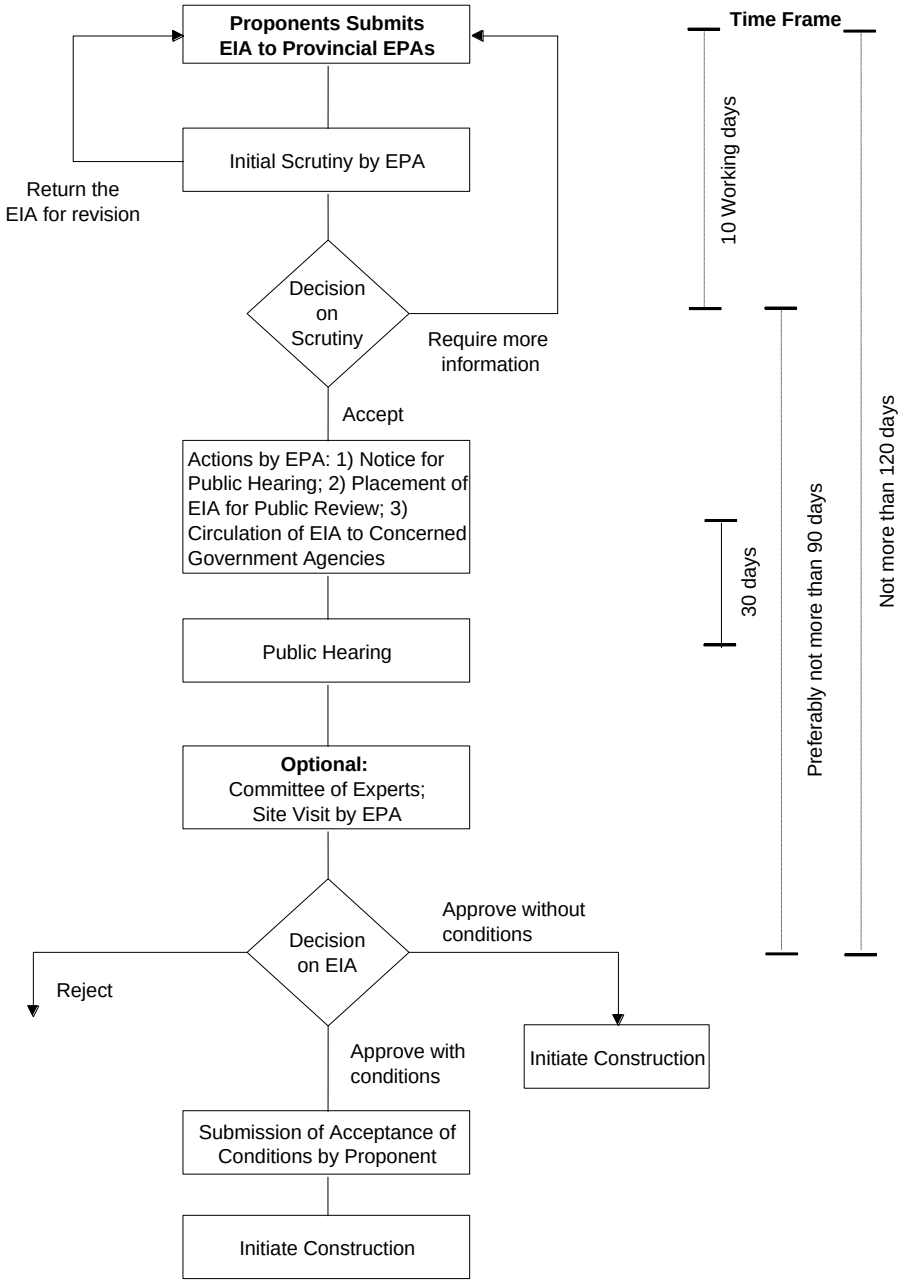


Figure 3.1: EIA Review and Approval Process

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 3.4** provides details of how each policy applies to the proposed investments under the Project.

Table 3.4: 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 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,	PCMU has prepared this ESMF and RPF for the proposed Project since the exact locations of the proposed facilities are not yet known. The classification of the subprojects in accordance with OP 4.01 is based on risk category. While the classification of subprojects in accordance with SEPA 2014 is based on threshold (size of works) category. The ESIA documents prepared in compliance with OP 4.01 also meet the requirements of SEPA to for IEE or EIA documents. SEPA will accept ESIA documents for review and environmental approvals. PCMU will prepare ESIAs and A/RAPs for the

OP/BP	Triggered	Explanation	Proposed Actions to be taken up by PCMU
		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.	subprojects during preparatory phases while carrying out the feasibility studies. The documents will be submitted for World Bank and SEPA 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. PCMU will develop a Strategic Water Plan to address the key issues identified in this paper and ESMF. The ToRs of the study will be reviewed and cleared by the Bank.
Natural habitats (OP4.04/ BP4.04)	Yes	The river stretches between Guddu Barrage 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. 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.	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 impact on the wildlife-protected areas.
Pest Management (OP4.09)	Yes	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.	An Integrated Pest Management Plan (IPMP) is developed and implemented under the Bank-funded Sindh Agriculture Growth Project (closed in 2021).

OP/BP	Triggered	Explanation	Proposed Actions to be taken up by PCMU
			SWAT will continue to implement this IPMP.
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 components 2.1 and 2.2, 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 2.3 is known, site-specific Social Management and Resettlement Plan (SMRP) has been prepared. It was consulted upon (involving all stakeholders, including local communities and vulnerable groups). It will be approved and disclosed locally and at the Bank's Image bank before project appraisal. 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.	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. The PCMU and SIDA have developed the SMRP for Akram Wah AED affected.
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.

OP/BP	Triggered	Explanation	Proposed Actions to be taken up by PCMU
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 kilometers) 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 International Waterways	Yes	This policy is triggered since the project activities rely on the water from the Indus River, which is an international waterway. Project activities will be limited to renovation of existing irrigation facilities to improve agriculture water productivity and the activities are not expected to increase water abstraction from the Indus River. Thus, (i) the project will not adversely impact the quantity or quality of water in the international waterway and (ii) the project investments will not be adversely affected by the other riparians' possible water use. Therefore, the project falls within the exception to the notification requirements as set forth in paragraph 7(a) and 7(b) of OP 7.50. The exception to the notification requirement was approved by the South Asia Regional Vice President on Month, XX, 2022. In addition, according to Article VII of the Indus Waters Treaty of 1960 between India and Pakistan, the World Bank has concluded that a notification by Pakistan to India under paragraph (2) of the said Article is not required, as the project will not cause interference with the waters of any of the rivers and will not materially affect India.	
Consultations and	Yes		PCMU has consulted with various

OP/BP	Triggered	Explanation	Proposed Actions to be taken up by PCMU
Disclosure			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 proposed physical interventions in SWAT will be primarily implemented in three Area Water Boards, covering an area of about 2.02 million hectares (or 2020 square kilometers), on the Left Bank Canals of the Indus River: Ghotki (Ghotki Feeder canal with a command area of 381,000 Ha), Nara (Nara canal with a command area of 1,047,946 Ha) and Left Bank (Akram Wah and New Fuleli canals with a command area of 592,548 Ha). However, the proposed activities in Component 1 (Water Resources Management) that includes policy, institutional, and hydro-agro information reforms will be applicable to all command areas 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. Therefore, the project area or project influence area of the SWAT covers all command areas of the three barrages in the Sindh province.

Table 4.1 presents details of districts that are covered under 3 AWBs, where the physical interventions will be implemented. **Table 4.1** details the districts that are covered in entire SWAT influence area in relation to the irrigation coverage by barrages, main canals. A total of 23 districts of Sindh falls under this irrigation network. The locations of districts that fall under the canal command areas, are shown in **Figure 4.1**.

Table 4.1: Areas under the SWAT Physical Interventions

AWB	Canals	Districts	Sub-districts (*talukas)*
Ghotki	Ghotki Feeder	Ghotki, Sukkur	Sukkur City, New Sukkur, RohriSaleh Pat, Pano Aqil
Nara	Nara	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.
Left Bank	Akram Wah and New Fulleli	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

Table 4.2: Canal Command Areas of Sindh and SWAT influence area

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

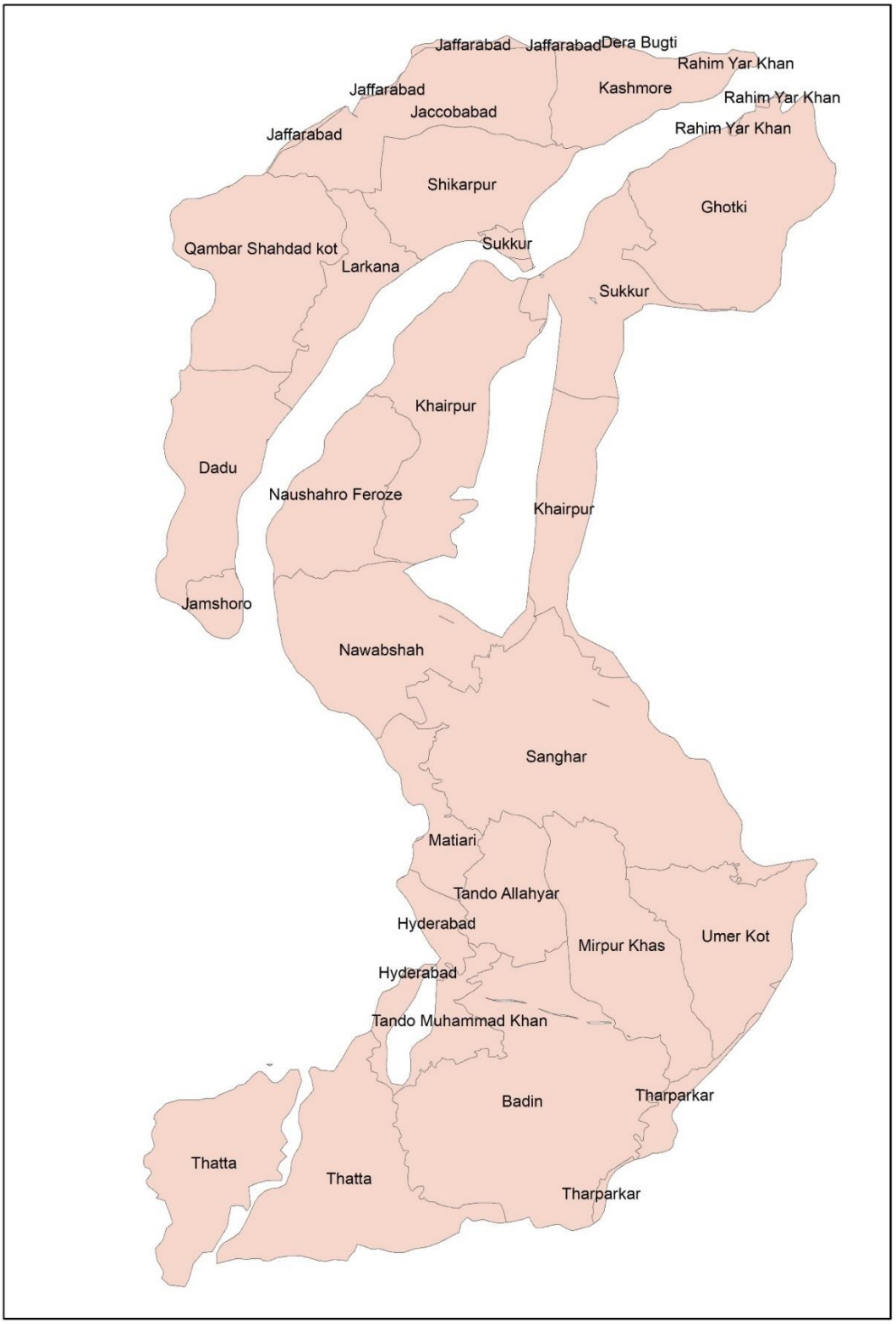


Figure 4.1: Project Influence Area of SWAT

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 kilometers (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.

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 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.

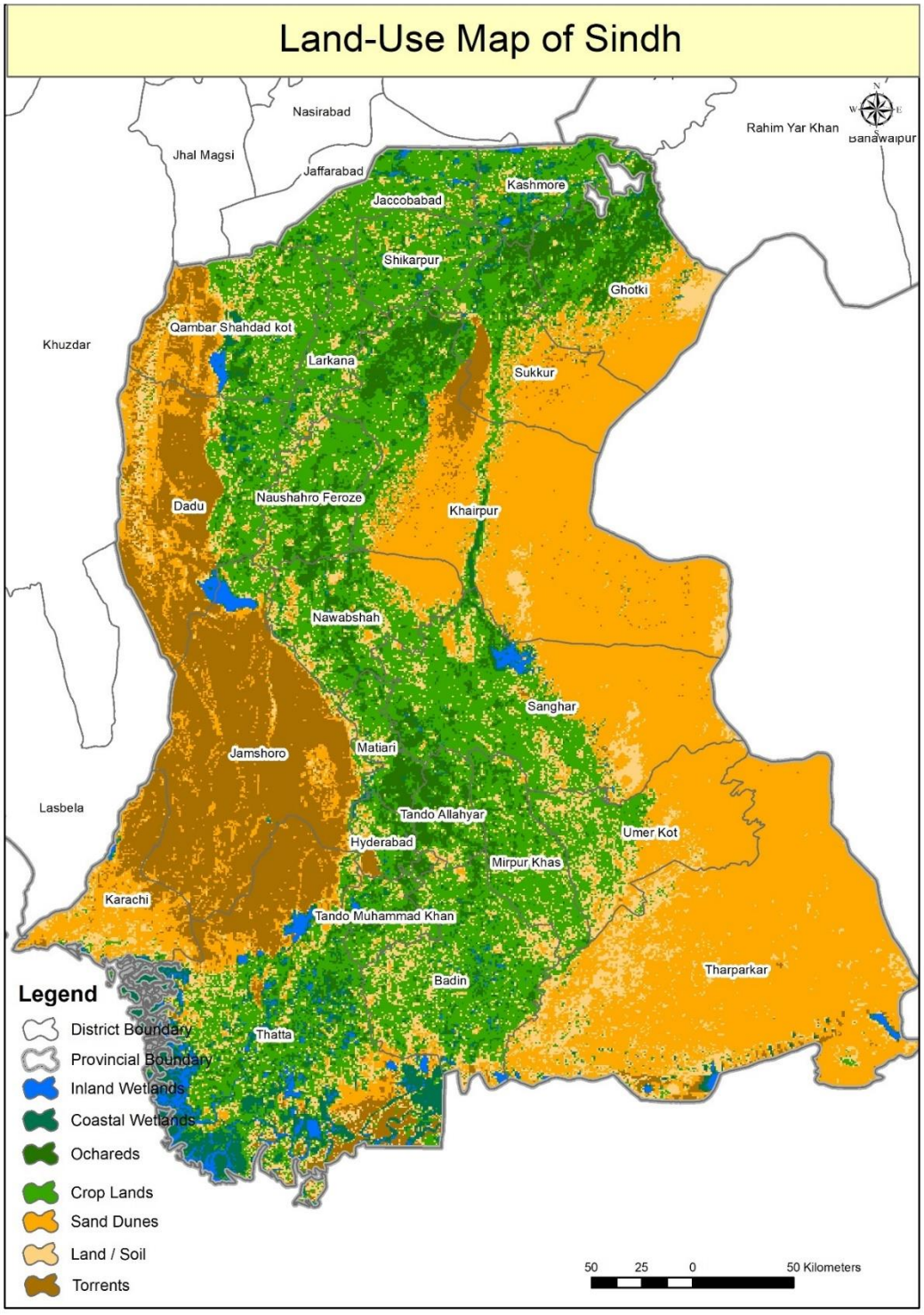


Figure 4.2: Land use Map of Sindh Province

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. [17]

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. [18] Though smaller, they are important for an important and relatively vulnerable part of the population of the province.

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.

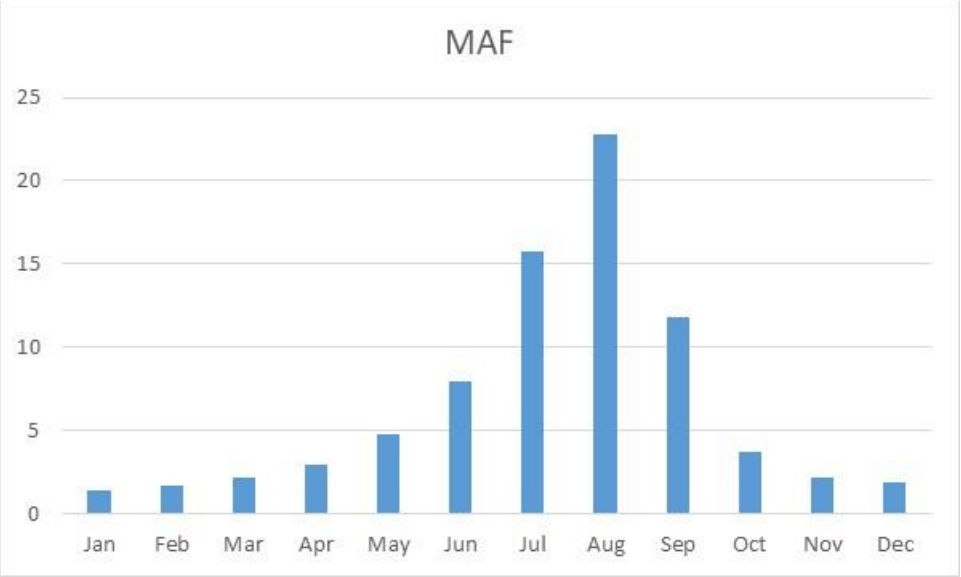


Figure 4.3: Mean Monthly River Discharges at Sukkur

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**.

[17] Sindh Water Policy, Draft, March 2021
[18] Sindh Water Policy, Draft, March 2021

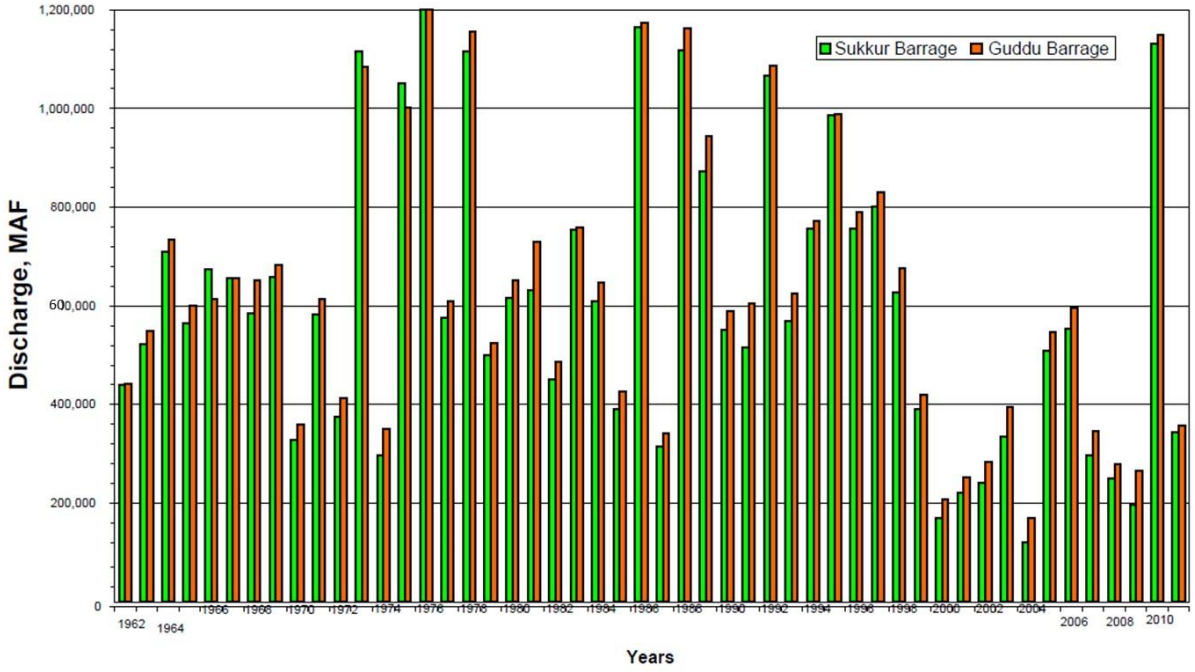


Figure 4.4: Annual Maximum Flow at Sukkur and Guddu Barrage from 1962- 2010

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 mound 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 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. [19] 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[20]. 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[21]. 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[22]. 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[23]. 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[24].

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[25].

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-

[19] Ibid

[20] 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)

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

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

[23] 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.

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

[25] Sindh Water Policy, Draft, March 2021

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[26].

4.2.8 Water Usage and Quality[27]:

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 naturally occurring lead or arsenic.

4.3 Biological Environment

4.3.1 Ecological Screening of the Project Influence Area

An ecological screening exercise has been carried out to identify the key biodiversity areas and protected areas around the catchment of irrigated areas in Sindh 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 irrigation network area of Sindh. The list of threatened species that can be found within the the catchment of irrigated areas in Sindh is presented in **Table 4.3**.

Table 4.3: Threatened Species in the Catchment of Irrigated Areas in Sindh

	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

[26] 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*

[27] Sindh Water Policy, Draft, March 2021

	Species name	Common name	IUCN Category
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 irrigation catchment area of canals in Sindh given in **Table 4.4** and are shown in **Figure 4.5**.

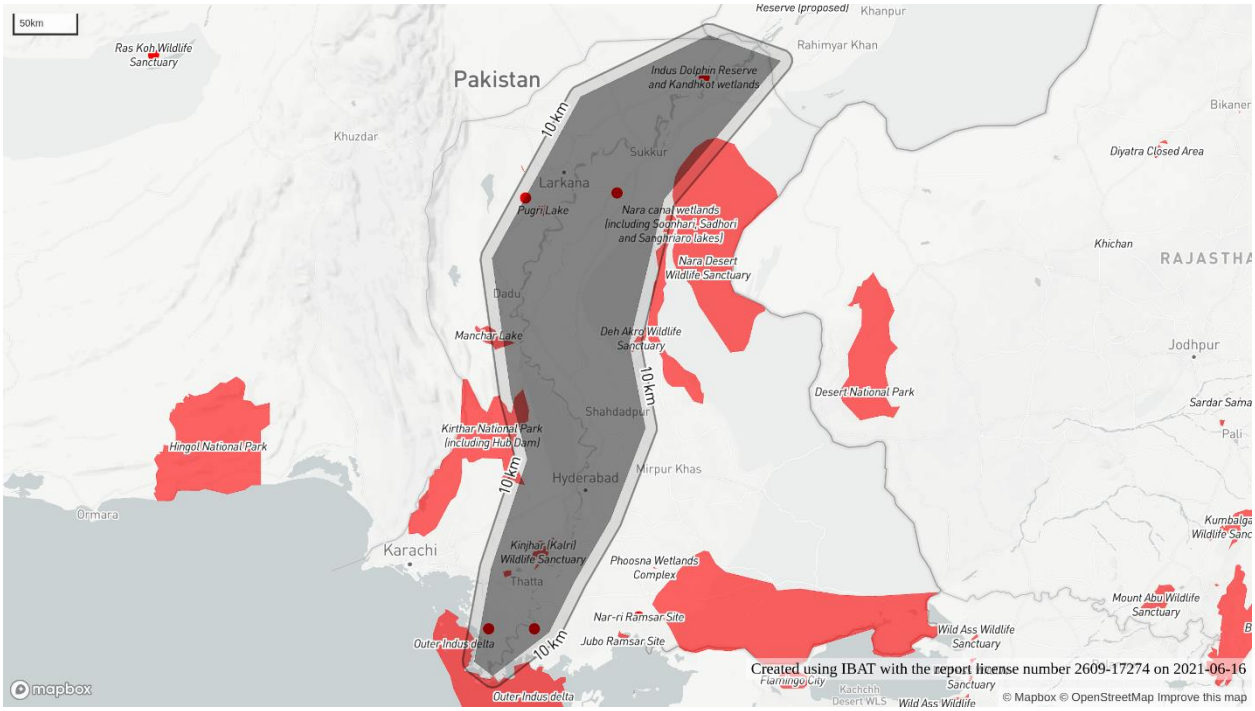


Figure 4.5: KBAs in and around the Irrigated Areas in Sindh

Table 4.4: KBAs in and around the Irrigated Areas in Sindh

	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 irrigated areas in Sindh given in **Table 4.5** and are shown in **Figure 4.6**. Most of the protected areas are the lakes in the floodplains and delta of the Indus. None of the proposed subprojects are expected to be located within the protected areas.

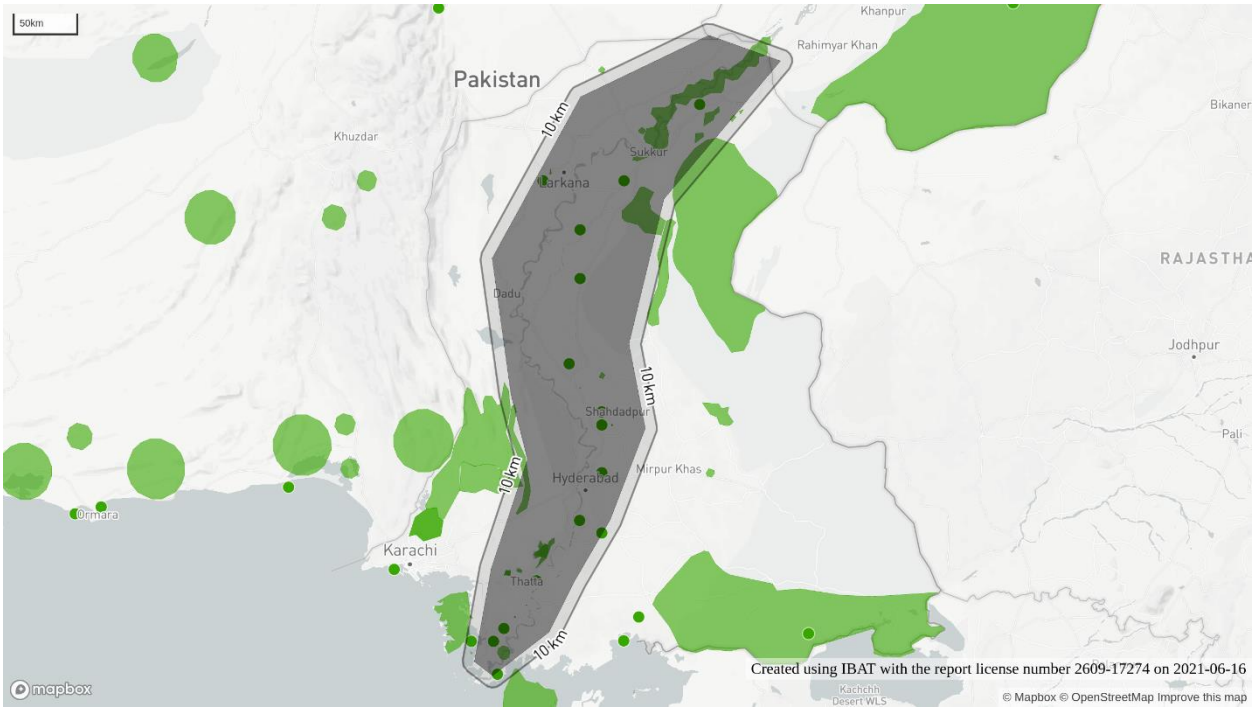


Figure 4.6: Protected Areas in and around Irrigated Ares in Sindh

Table 4.5: Protected Areas in and around the Irrigated Areas in Sindh

	Protected Area	Type	IUCN Designation	Characteristics, and location
A	**International Importance**			
1	Deh Akro-II Desert Wetland Complex	Ramsar Site, Wetland of International Importance		Natural inland wetland ecosystem comprising 36 lakes and unique desert habitat. Located in Nawabshah district.
2	Indus Dolphin Reserve	Ramsar Site, Wetland of International Importance		Indus river stretch between Guddu and Sukkur barrages with dolphin habitat
3	Indus Delta	Ramsar Site, Wetland of International Importance		Mangrove and delta ecosystem
4	Drigh Lake	Ramsar Site, Wetland of International Importance	IV	A small, slightly brackish lake with extensive reed marshes and rich aquatic vegetation situated in the Indus floodplain. An important bird breeding area. Located in Qambar Shahdadkot District
5	Haleji Lake	Ramsar Site, Wetland of International Importance		An artificial freshwater lake with fluctuating water levels, fringed by brackish seepage lagoons and supporting abundant aquatic vegetation. One of the most important breeding, staging and wintering areas for waterbirds. Located in Thatta district
6	Kinjhar (Kalri) Lake	Ramsar Site, Wetland of International Importance	IV	A freshwater lake on Indus floodplain. important breeding, staging and wintering areas for waterbirds. Located in Thatta district
B	**National Importance**			
1	Takkar	Wildlife Sanctuary	IV	Located in Khairpur District. No human settlements. Presence of foxes, jackals, jungle cats, chinkara deer, houbara bustard, and falcons.
2	Keti Bunder South	Wildlife Sanctuary	Not Reported	Mouth of Indus. Famous for water birds
3	Sadnani	Wildlife Sanctuary	IV	Located in Thatta District
4	Marho Kotri	Wildlife Sanctuary	Not Reported	Located on Arabian Sea coast along Indus River

	Protected Area	Type	IUCN Designation	Characteristics, and location
				Delta. Presence of mangroves.
5	Langh (Lungh) Lake	Wildlife Sanctuary	Not Reported	Located in District Kambar Shahdadkot. 98 acres lake with presence of water birds
6	Munarki	Wildlife Sanctuary	IV	
7	Shah Lando	Wildlife Sanctuary	IV	A lake, located in Thatta District
8	Kirthar	National Park	II	Situated in the Kirthar Mountains in Jamshoro District. The park's fauna comprises Persian leopards, striped hyenas, Indian wolves, ratels, urials, chinkara gazelles and rare Sind wild goats.
10	Haleji Lake	Wildlife Sanctuary	IV	Freshwater lake on Indus delta.
11	Gulsher Dhand	Wildlife Sanctuary	IV	A lake in Sanghar District
12	Samno Dhand	Wildlife Sanctuary	IV	Located in Sanghar District,
13	Khadi	Wildlife Sanctuary	IV	
14	Hadero Lake	Wildlife Sanctuary	IV	Located in Thatta District. It is an important brackish wetland, where waterfowl occur
15	Gullel Kohri	Wildlife Sanctuary	IV	Located in Thatta District, Sindh
16	Keti Bunder North	Wildlife Sanctuary	IV	Mangrove forest on Indus delta
17	Nara Desert	Wildlife Sanctuary	IV	Brackish water lakes Located in Mirpurkhas District
18	Khat Dhoro	Wildlife Sanctuary	IV	Located in Khairpur District.
19	Kot Dinghano	Wildlife Sanctuary	IV	
20	Bijoro Chach	Wildlife Sanctuary	IV	Located in Thatta District
21	Mohabat Doro	Wildlife Sanctuary	IV	Located in Naushahro Feroze District
22	Norange	Wildlife Sanctuary	IV	Located in Thatta District
23	Cut Munarki Chach	Wildlife Sanctuary	IV	Indus delta lake
24	Majiran	Wildlife Sanctuary	IV	Located in Thatta District

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 catchment of irrigated areas in Sindh 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 2000According to recent estimates by Sindh Wildlife Department in 2019, the reserve holds a population of 1,419 dolphins[28]. Whereas in 1975, only 150 dolphins were recorded from this reserve, signifying the conservation efforts carried out so far.

[28] https://tribune.com.pk/story/1950668/blind-dolphin-survey-reveals-55-increase-population

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[29]

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;
- 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

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

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[30]

Manchar Lake (**Figure 4.7**) is the largest freshwater lake on the right bank of the Indus, in Jamshoro and Dadu Districts. 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. It is located west of the Indus River, in Jamshoro District and Dadu District

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.

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.

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's share in total employment is 35.8 percent.

[30] 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

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.

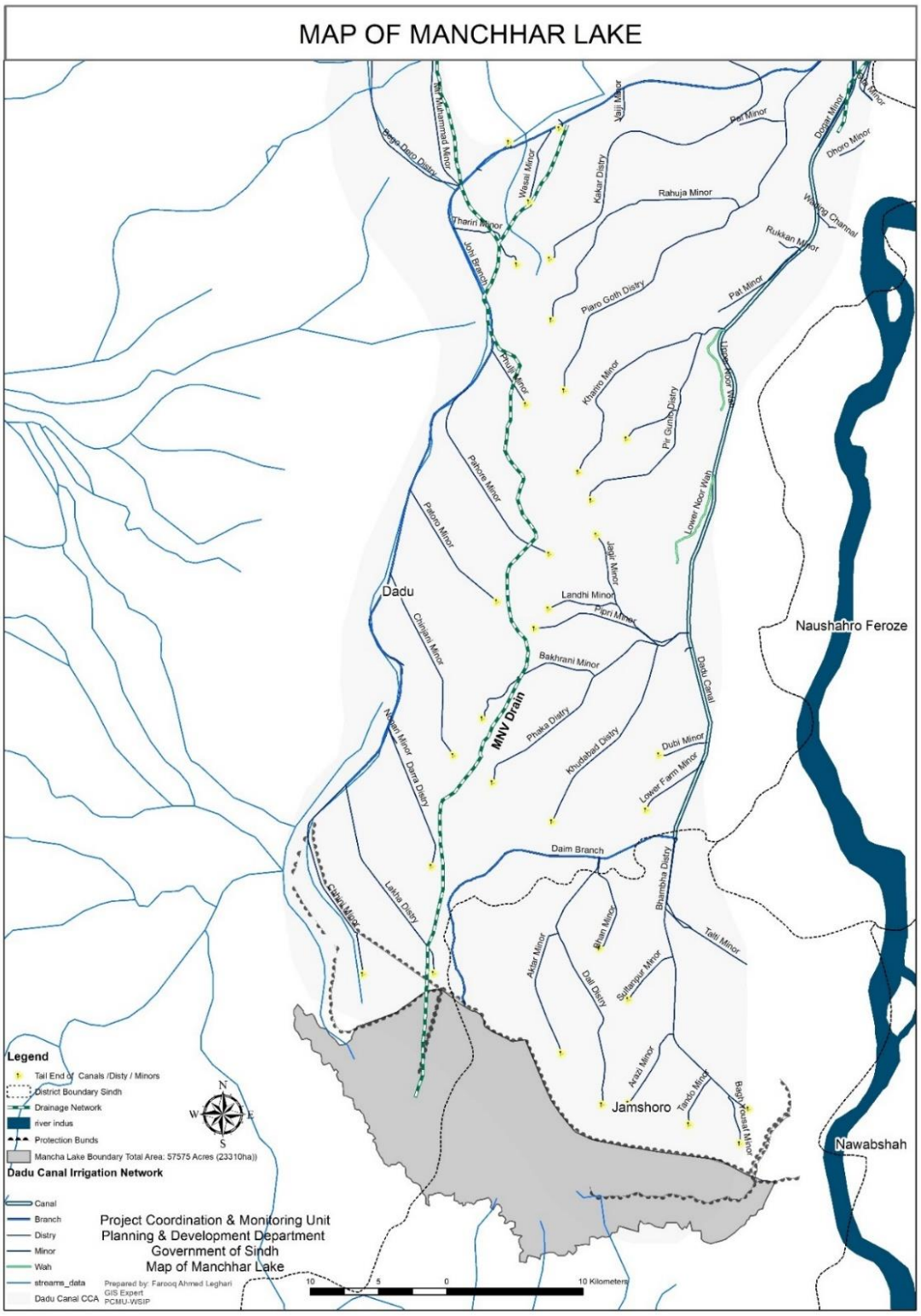
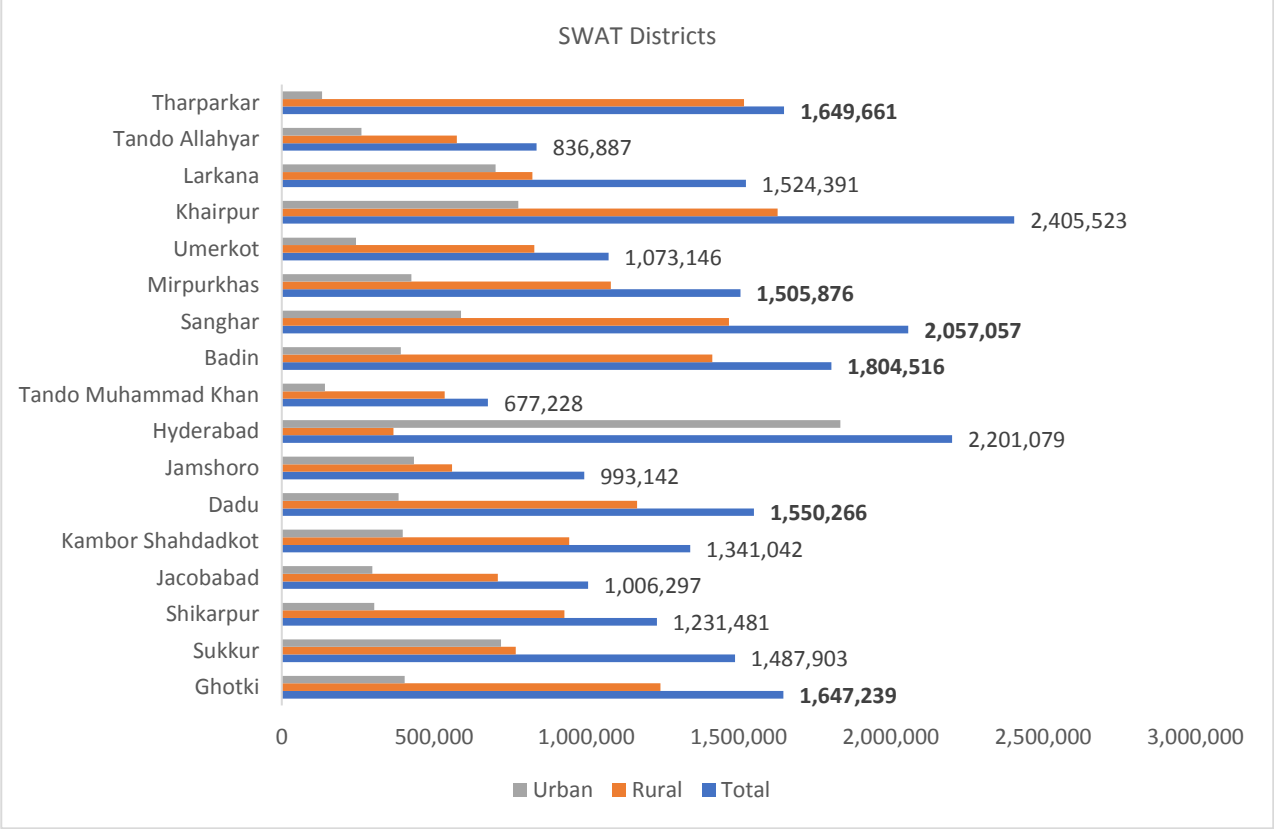


Figure 4.7: Map of Manchar Lake

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[31]. The overall labor force participation stands at 50 percent, out of which male participation is 81.9 percent, and female participation remains at 14 percent[32]. The SWAT project is expected to be implemented in 17 districts with an estimated population of 25 million.

With SWAT's focus being on the rural areas, **Figure 4.8** 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.

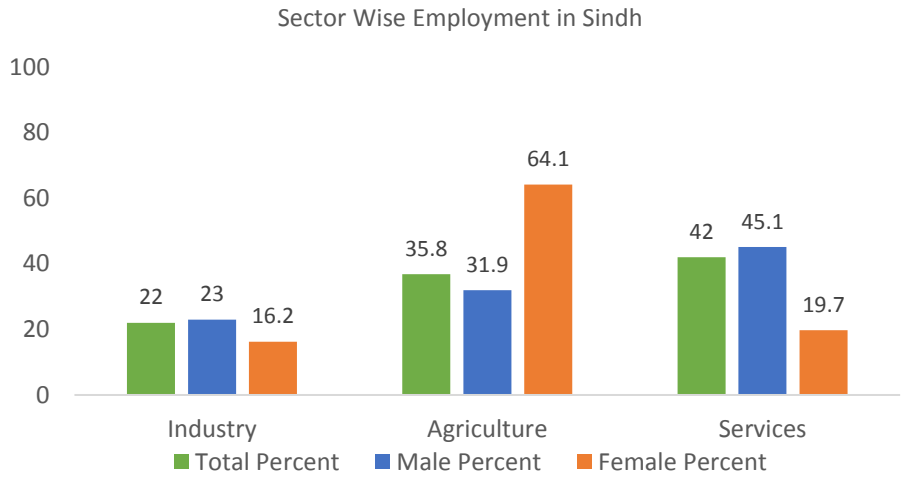


Source: Population and Housing Census 2017, Pakistan Bureau of Statistics (PBS)

Figure 4.8: Population of Project Districts

In terms of labor, 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. Overall, women's labor participation in Sindh stands at 14 percent. Out of this, 64.1 percent of the total female force is employed in agriculture, 16.2 percent in the industry, and 19.7 percent in the services sector[33].

[31] Development Statistics of Sindh 2019, Sindh Bureau of Statistics
[32] Pakistan Employment Trends 2018, PBS
[33] Ibid



Source: Pakistan Employment Trends, 2018, PBS

Figure 4.9: Sector-wise Employment in Sindh

Pakistan is currently in the midst of a demographic transition bringing more 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 is growing in net terms by around 800,000 people each year, comprising about 1 million new entrants and 200,000 retirees. To ensure these new entrants can find good jobs, the pace of job creation will need to increase; for the six years between FY09 and FY15, the number of jobs in Sindh increased by less than 1 million each year, reflecting an average annual growth rate of 1.4 percent. There is a particularly urgent need to increase the number of formal jobs in Sindh and women's participation in the labor force[34].

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[35]. 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

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[36]. 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

[34] Overview of Sindh Growth Strategy, August 2017, World Bank
[35] Ibid
[36] Pakistan@100 From Poverty to Equity, Policy Note March 2019, Silvia Redaelli. World Bank

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.

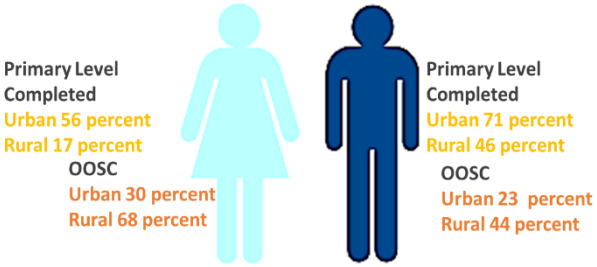
The Multidimensional Poverty Index 2014-15 shows a high incidence of poverty in most of the project districts. The low levels of human development are also evident in agricultural practices and water delivery systems. In Sindh, average yields are lower than—as low as about 50 to 70 percent— the yields in other countries with similar agro-climatic and water conditions, such as Turkey, Egypt and, in the case of cotton, Uzbekistan[37]. 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.

[38]. 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.



Source: PSLM 2018-19 Survey

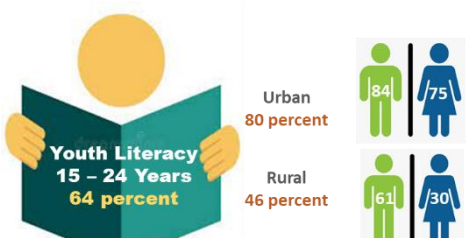
At the district level, school participation rates vary but are low for most districts. The indicators for primary education show high urban/rural and extreme gender disparities. Table 4.6 shows the net enrolment rate at the primary level in the project districts.

Table 4.6: School Enrolment in the Project Districts

S.No.	Net Enrolment Rate at Primary Level Including Katchi - Project District Wise -Percentage					
		Urban		Rural		Total
	Project Districts	Male	Female	Male	Female	
1	Ghotki	58	54	44	23	38
2	Sukkur	62	61	41	30	45
3	Shikarpur	63	53	37	31	39
4	Jacobabad	57	53	40	16	34
5	Kambar Shadadkot	66	52	45	32	48
6	Khairpur	54	45	50	36	45
7	Dadu	64	62	55	46	53
8	Sanghar	64	55	47	28	43
9	Larkana	56	39	48	30	45

[37] Overview of the Sindh Growth Strategy, August 2017, World Bank
[38] https://www.unicef.org/pakistan/education

10	Mirpurkhas	57	58	35	19	34
11	Umerkot	59	60	43	27	41
12	Tando Allahyar	64	62	42	29	45
13	Hyderabad	62	59	51	43	58
14	Tando Mohammad Khan	26	26	36	24	29
15	Jamshoro	57	52	40	40	44
	Tharparker	51	34	44	31	38
	Badin	53	38	29	16	28
	Source: PSLM 2019-20					

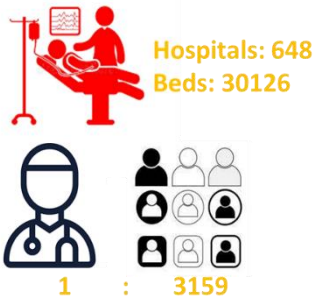


Source: PSLM 2018-19 Survey

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. Other health care services in Sindh include dispensaries, M.C.H.S, T.B Clinics, Leprosy Clinics, Maternity Homes, Homoeo Dispensaries, Trauma Emergency Centers, *Unani Shifa Khana* (herbal), Government-run urban health centers and urban health units, and basic health units and rural health centers. Table 4.7 shows the number of basic health units and rural-urban centers in the project districts as per the 2016 Health Profile:

Improved health facilities and services, together with an awareness of preventive care, are required to improve the health indicators in the province. 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[39]. The last column in Table 4.7.presents the status of Full Immunization Coverage in the project districts

District	Basic Health Units and Rural Health Centers	Bed Capacity	Full Immunization Coverage (%)
Ghotki	37	128	69.79
Sukkur	31	106	40.26
Shikarpur	45	182	28.61
Jacobabad	30	78	17.36
Kambar Shadadkot	32	128	54.14
Khairpur	94	272	46.12
Dadu	51	174	78.34
Sanghar	68	190	66.05
Larkana	33	104	68.78
Mirpurkhas	43	126	41.83
Umerkot	38	142	56.92
Tando Allahyar	17	52	50.6
Hyderabad	21	76	56.87
Tando Muhammad Khan	18	66	21.44
Jamshoro	25	140	59.12
Tharparkar	42	113	24.72
Badin	50	192	44.17

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[40].

Table 4.7: Health Profile in the Project Districts

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[41]. Micronutrient deficiencies remain overall high in rural areas of Pakistan. National Nutrition Survey (NNS) 2018 shows that almost one in eight

[39] Multiple Indicator Cluster Survey 2014, Sindh Bureau of Statistics
[40] Multiple Indicator Cluster Survey 2014, Sindh Bureau of Statistics
[41] Ibid

adolescent girls is underweight. Adolescent boys are more affected than adolescent girls, with one in five underweight.

Women of Reproductive Age (WRA) 15–49 years bear a double burden of malnutrition. At the provincial level, 22.6 percent of WRA[42] are undernourished. Similarly, the highest number of "severe food insecure" households are in Sindh.

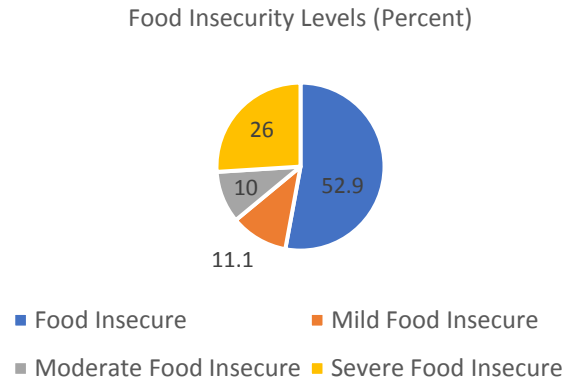


Figure 4.10: Food Insecurity Levels in Sindh Province

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. Swat project districts included in this category are Jamshoro, Kambar Shahdadkot, Badin, Dadu, Sanghar, with Tharparkar and Umerkot experiencing extremely critical levels of acute malnutrition[43]. 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

[42] NNS 2018

[43] 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 10 districts to make the province free of open defecation by 2025 under the Sanitation Policy 2017. The SWAT project districts that fall under this program include Sukkur, Mirpur Khas, Khairpur, Hyderabad, Ghotki, Jamshoro, and Tando Allah Yar. However, 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.

Despite women's overwhelming participation in the agriculture sector of Sindh, the enabling environment for rural women's participation in productive spheres needs to be strengthened to allow them to 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. Typically, rural women in Sindh 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[44] , 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 reported to be 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

Development Statistics of Sindh 2019 reports that there are 74 technical and polytechnic institutions in Sindh, out of which 65 are male and 9 female institutions. In 2017-2018, overall enrollment in these institutions was 34,321. Female enrolment in the same period was reported to be 1,353. There are 40 commercial training institutions that are all male. Vocational training institutions were reported to be 139, out of which 100 are female. However, of overall enrolment in vocational training institutions, female enrolment stands at 48 percent. Table 4.8 presents technical and vocational facilities in the project districts.

Table 4.8: Technical Institutions in the Project districts

[44] Labor Force Statistics 2017-2018

District	Male Technical Colleges/Polytechnic Institutions	Female Technical Colleges/Polytechnic Institutions	Commercial Technical Training Institutions	Male Vocational Training Institutions	Female Vocational Training Institutions
Ghotki	2	0	1	0	1
Sukkur	2	1	2	2	5
Shikarpur	2	0	2	3	3
Jacobabad	1	0	1	1	3
Kambar Shadadkot	3	0	2	1	3
Khairpur	3	0	3	1	6
Dadu	2	0	2	2	7
Sanghar	4	0	3	1	5
Larkana	2	0	1	4	7
Mirpurkhas	1	0	2	2	3
Umerkot	1	0	1	1	1
Tando Allahyar	1	0	1	1	1
Hyderabad	4	1	2	2	4
Tando Muhammad Khan	1	0	0	0	1
Jamshoro	1	0	1	1	3
Tharparkar	1	0	1	1	1
Badin	4	0	1	2	4
Source: Development Statistics of Sindh 2019					

v) Health Issues Due to Bad Agricultural Practices

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, 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).

Historically, 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, Women Farmers Groups (WFGs) were formed under the WISP project by SIDA. . However, these WFGs were not recognized under any law, and SIDA was asked to have them incorporated in FOs. Very few became part of the FOs, whereas the rest disintegrated. 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 the Sindh 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 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 design.

4.4.5 Gender-Based Violence (GBV)

i) Legal Framework

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 the development and safeguarding of their rights. Though the outreach is limited and needs to be expanded, 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's 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[45]. Shortage of water, water logging and salinity are primary reasons for land being fallow. Table 4.9 illustrates land use status in project districts

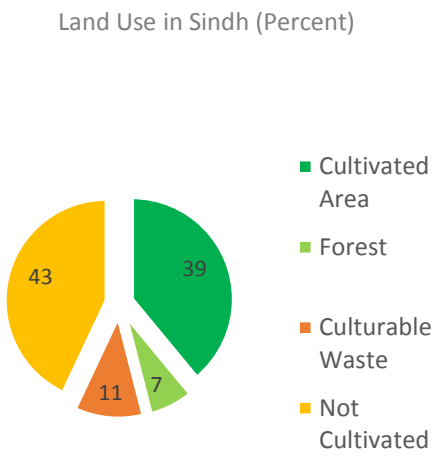


Table 4.9: Land use in the Project districts

Sr. No	District	Cultivated Area	Net Area Sown	Fallow	Percent Fallow
1	Ghotki	237,068	185,326	51,742	21.8
2	Sukkur	162,090	73,347	88,743	54.75
3	Shikarpur	112,440	98,664	13,776	12.25
4	Jacobabad	109,256	95,322	13,934	12.75
5	Kambar Shadadkot	311,677	85,844	225,833	72.46
6	Khairpur	266,661	190,291	76,370	28.63
7	Dadu	318,681	141,404	177,277	55.63
8	Sanghar	387,677	212,909	174,768	45.08
9	Larkana	45,436	49,410	3,947	8.67
10	Mirpurkhas	253,393	141,363	112,030	44.21
11	Umerkot	296,663	72,995	223,668	75.40
12	Tando Allahyar	105,502	66,304	38,198	36.20
13	Hyderabad	57,566	29,469	28,097	48.80
14	Tando Muhammad Khan	143,297	50,940	92,357	64.45
15	Jamshoro	88,891	64,210	24,681	27.76
16	Tharparkar	352,197	154,542	197,655	56.12
17	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

[45] Land Utilization Statistics 2013-2014, PBS

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)[46]. 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. T**able 4.10** shows the share of Sindh's in the above-mentioned crops in the total production systems.

Table 4.10: 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
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 4.11)

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 the 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.

[46] Agriculture Marketing Information Service 2018-2019

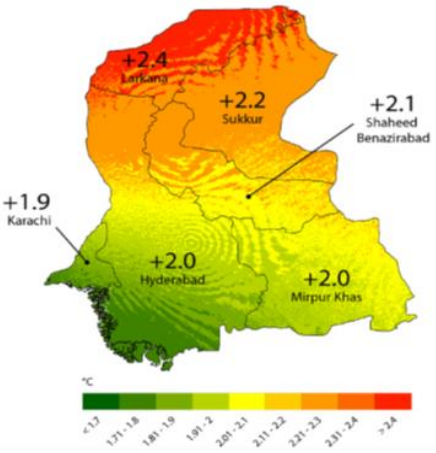
- *Zone B2* lies in the command area of four perennial canals (Rohri, Khairpur Feeder East and West and Nara) of the Sukkur barrage covering districts Khairpur, Naushero Feroze, Sanghar, Hyderabad, Mirpurkhas, and Tharparkar. The major *Kharif* crops of the zone are cotton and sugarcane, followed by 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 increase 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 4.11** presents major and minor crops grown in the project districts

Table 4.11: 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. This is an important asset in an agricultural economy. In Pakistan land holdings are commonly categorized as small, medium and large based on their acreage. Overall, the average farm size in Sindh is small. The Agriculture Census 2010 gives a district-wise breakdown of land holding sizes in different brackets. Based on the data in the Census, 82 percent of farms fall into the brackets of up to 12.5 acres with overall farm area under this category only 37 percent. Medium and large landholdings are limited, but their overall farm area is more.

As land productivity in Sindh is less, the State Bank of Pakistan issued a separate classification of small farmers in the province in an effort to benefit and improve the living standards of rural communities. In Sindh, farmers with holdings up to 16 acres were clubbed under the category of subsistence holding. For the purpose of this ESMF and future reference for SWAT activities, it has been decided, in consultation with the PCMU, that the State Bank of Pakistan Classification of Land Holdings for Sindh province will be used as follows:

- Subsistence Holding up to 16 acres
- Economic Holding above 16 acres to 64 acres
- Above Economic Holding 64 acres plus

(P.S: District wise breakdown of land holdings are not given in this report as the brackets given in the 2010 Census are different than those of the State Bank)

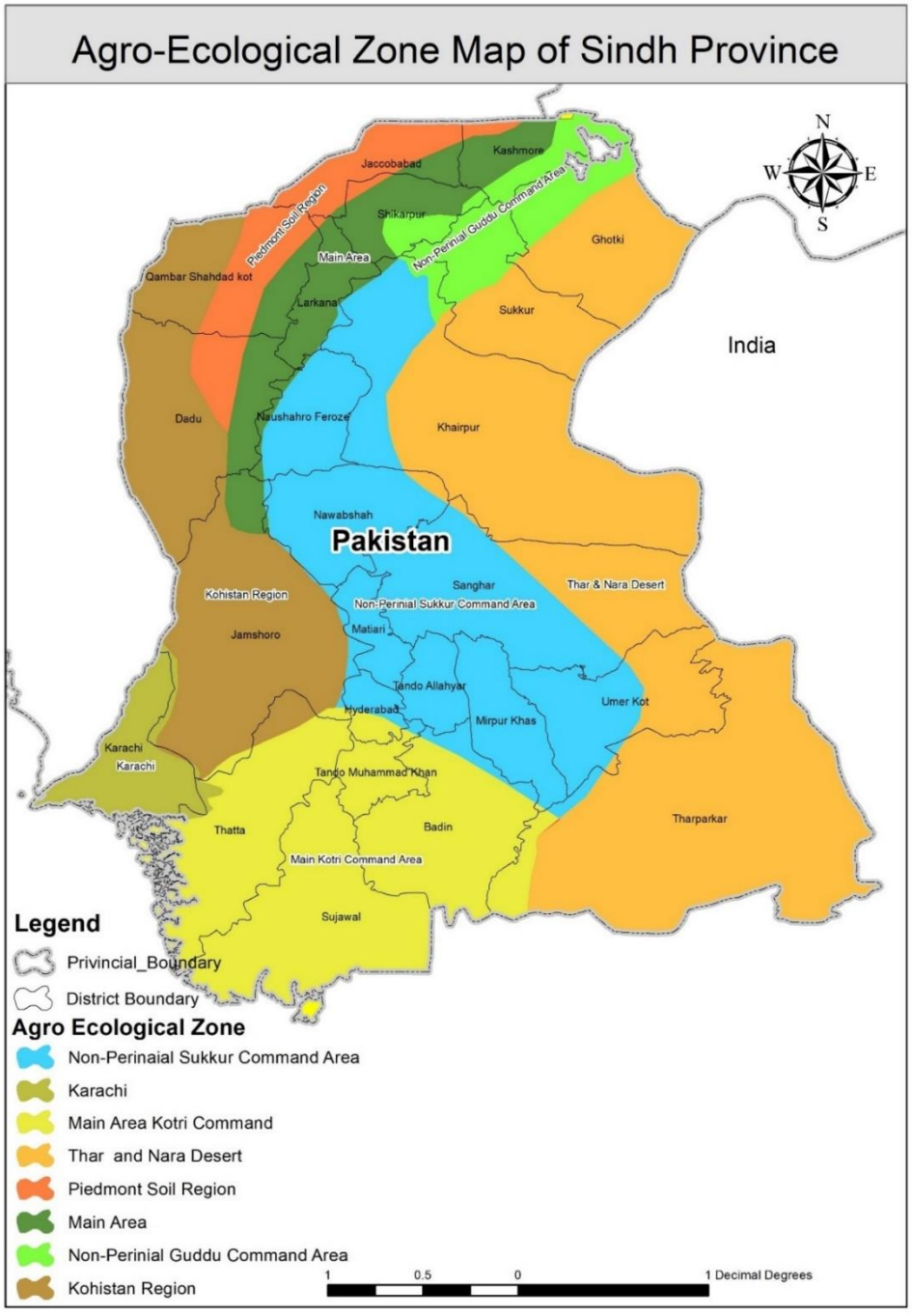


Figure 4.11: Agro-Ecological Zones of Sindh

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[47]. As for wheat, too, a small farmer is likely to

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

farm half his land and makes about PKR 14,500 to 17,200 per acre[48] 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 earning 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**
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 a poor capacity of public service providers. District-level extension services exist but are usually accessible to those with references and approaches 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[49]. 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
- The common use of sub-standard, banned, and counterfeit input supplies

[48] Ibid

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

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 levelling, 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.

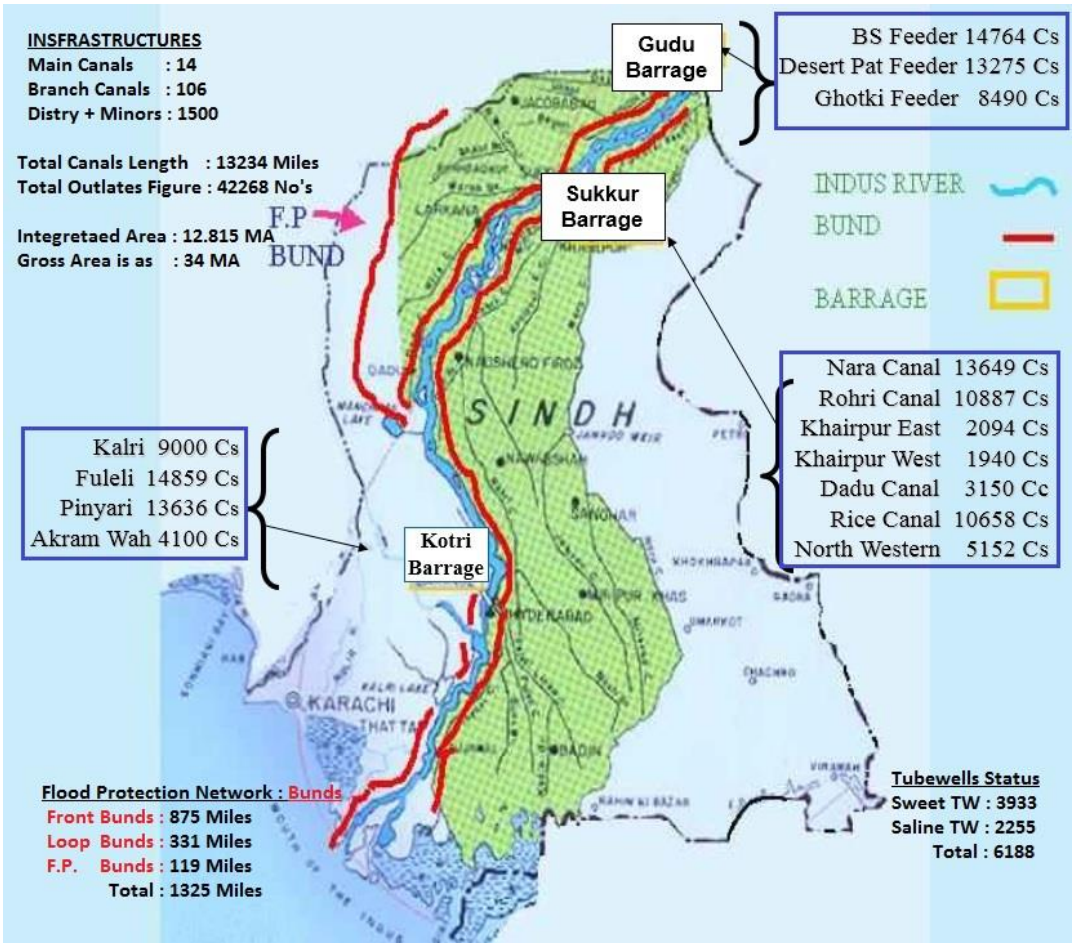
ix) Markets for Agriculture Produce and Issues

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-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, 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 the 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 products 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 chillies 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, chillies 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. In Sindh, it 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	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

	well as the collection of their share of *abiana* from respective FOs	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 make 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)	The 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 leaseholders agree to form it, and the boundary of the area under DBG falls in the catchment area of the drainage system.	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

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 Water/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 are 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

SWAT aims to address the above issues through multiple interventions. Water Pricing Reforms aims to revise *abiana* rates to increase revenue generation. As IWRD is formed through the institutional reforms, the roles and responsibilities of AWBS, FOs, and WCAs will be more aligned to address water distribution and maintenance of irrigation infrastructures. Rehabilitation of Akram Wah Canal, modernization of distributaries and repairs of watercourses with increased capacity development and participation of farmers, will address issues related to efficient and equitable distribution of water as well as O&M. Solidyfying information and technology base on water and agricultural output will enable the relevant departments to make informed decisions related to water uses.

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.[50]

[50] 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**:[51]

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).

[51] 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	Benefits	Adverse Impacts and Risks	Mitigations
Component 1: Water Resources Management			
Component 1.1: Policy and Institutional Reforms			
– Formulate new Water Resources Law	– The new law will help to create a unified framework for water resources management that recognizes both: (i) the multi-functional nature of the canal network, and (ii) the need for better management of water as a natural resource – Sustainable management of water resources in the province keeping in mind the current service the future uses such as urban development – Improved water quality in water bodies including river, canals and wetlands by through actions such as zero tolerance on effluent dumping into water bodies, proper sanitation, and waste disposal – Protection of freshwater lenses that are vital to provide water to local rural settlements. – Minimize the risk of flooding or waterlogging by integrating urban planning and urban infrastructure development	– 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. – The 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 – The legal framework might not fully incorporate specific water needs/rights of different users, like domestic users and industries	– 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. – Inclusion of different users as well as domestic users, including women and their representatives, in consultations at all levels – Train and develop women leaders to recruit women farmers in WCAs and FOs through continuous advocacy – Representation of Women Farmers/Water users mandatory in WCAs, FOs, and AWBs

Project Activities	Benefits	Adverse Impacts and Risks	Mitigations
	with water resource management – improve flood management water management in the canal system		
– Restructuring the Irrigation Department into an Irrigation and Water Resource Management Department (IWRD).	– Strengthen the institutional capacity of the irrigation department with additional expertise – Increased expertise to provide professional irrigation services – creating water resource management functions and expertise within the IWRD	– 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 – Less representation of female workforce and inadequate facilities for them at workplace	– 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 – HR policies of IWR Department to promote equal opportunities to females and other minorities – Office space to have proper facilities, like washrooms, nursing, and praying areas – Develop anti-harassment/sexual harassment and whistleblowing policies
– Comprehensive Water Pricing Reform	– Water rates can be estimated based on the water use. This helps the small farmers in paying lesser amounts based on their use – Deters the farmers to use high-water use crops due to increased prices for high water use – Promotion of low-water use crops – Increased revenue collection to the FOs, which can be used for	– Lack of meaningful engagement of all stakeholders for reform on Abiana system. – Exclusion and discrimination of vulnerable groups, including women, 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.	– Comprehensive 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

Project Activities	Benefits	Adverse Impacts and Risks	Mitigations
	better management of canals, and attending emergency repairs – Water could be saved that can be used to serve tail areas, to restore environmental flows, to secure water for a variety of needs and to even expand the area under irrigation		– 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			
– Preparation of a "Strategic Water Plan" on a periodic basis (every 5 to 10 years)	– The plan will assess and address key water and environmental issues in Sindh such as sustainability of water resources, availability of surface waters, water logging, agricultural return flows and drainage, urban and rural drinking water supply, decline of wetlands and the Indus delta. An overview of the strategic water and environmental issues of Sindh that will be dealt by the proposed plan are given in Annex 9. – Provide strategic directions to the government departments on infrastructure development, water allocation, and water related environmental priorities	– Lack of meaningful engagement of all stakeholders for the preparation of the plan. – Elite capture by landowners 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 COVID-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

Project Activities	Benefits	Adverse Impacts and Risks	Mitigations
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).	– Modernization of water and agricultural management system where decisions across the scales are informed by continuous, reliable, and accessible data – Government and farmers can make better management decisions – Boost overall agricultural productivity – The water and crop related data will be centralized at province level to help better planning – Strengthen close coordination among various departments – Data collected by various departments will consolidated at a central point so that authentic data will be finalized regarding water use, crops, agriculture input and output. – The income from agriculture sector can be estimated properly. – Crop per drop as average on provincial level can be better estimated. – The best agriculture practices can be introduced on basis of consolidated data	– 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. – Obfuscation or heavy controls on dissemination of data	– 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 – Develop and publish policies on internal standards for data collection, privacy and use – Use representative sampling methodology at all phases of data collection to include farmers and female users from different Socio-Economic Classes (SECs) – Where applicable, present gender and SEC segregated data

Project Activities	Benefits	Adverse Impacts and Risks	Mitigations
– **Monitoring *& Data Generation*** (Remote Sensing and GIS; Canal Flow and Level Monitoring; Groundwater Monitoring; Water-Environmental Monitoring; Agrometeorological Monitoring, and Drainage Water Quality and Quantity Monitoring).	Remote sensing and GIS – The dynamic flow of water in canals can be estimated to find out the proper average flow against crop demand. – Planning of sustainable and regular flows – Planning of flood and drought control Canal Flow Monitoring: – Crop cultivation as per existing crop zone can be ensured. – Crop cultivation & harvesting timing length from head to tail of the canal can be observed. – Water theft from canals networks can be controlled. – Equitable water distribution at canals head to tail can be maintained. Water and Environmental Monitoring: – Canal water pollution can be monitored to take actions on the polluters. – Examine the level of water pollution and effect on crops and community. Agro-meteorological Monitoring: – The farmers can have proper information from a central point to plan the cultivation (in respective agro-ecological	– Usage of inappropriate or uncalibrated tools or malfunctioning of tools used for monitoring. – Lack of competency of staff engaged for monitoring, record 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) – Heavy controls on dissemination of data	– 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 and recording, and assign specific staff for this purpose in each relevant department – Clearly defined roles and responsibilities of the departments engaged in this exercise – Assign a committee comprising of experts to arbitrate conflicts

Project Activities	Benefits	Adverse Impacts and Risks	Mitigations
	zones) as per climate conditions of the year Drainage Monitoring – Drainage water flow can be estimated. – Cultivation of specific crops from less harmful drainage water can be planned in dry areas or during scarcity of canal water. – Proposer use and disposal of drainage water –		
Component 3: Agriculture Subsidies and Investments			
– **Pilot Subsidy Program** – Providing farmers with smart subsidies vouchers –	– Promotion of high value and water thrifty crops by providing subsidies to these crops – incentivize small farmers to plant higher value, water thrifty crops such as fruits, vegetables, oil seeds, pulses, etc. and that are suitable for the relevant agro-ecological zone	– 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 – Bad or poor agricultural practices reduce the productivity of new crops – Poor and less educated farmers might not be able to access the subsidy program effectively – Untimely distribution of e-vouchers to farmers – Women or poor farmers without land titles might be excluded from e-voucher or subsidy programs – Inadequate marketing and delivery channels or poor returns on investments might discourage small farmers from continuing with water-thrifty crops. – Weak public-private partnerships to leverage on home-grown agricultural commodities	– Strengthen the grievance management systems – Conduct Needs Assessment of subsidies for farmers in the project districts – Develop farmer/demand centric e-voucher schemes and distribution plans with special emphasis on the needs of poor and women farmers – Conduct Value Chain Analysis of selected crops and develop strong extension service programs for the selected value chains (seed banks, processing tools and equipment, pest control materials etc.) – Develop special programs for small farmers to increase agricultural productivity, like land levelling services

Project Activities	Benefits	Adverse Impacts and Risks	Mitigations
		– Unrestrained/unchecked supply of unregistered/banned and untested agricultural inputs can impact productivity and reduce the land quality – Establishment of processing plants/industrial units on prime agricultural land	– Develop agro-processing industry parks/zones in selected districts without compromising fertile agricultural tracts. Develop a robust marketing strategy for new crops and processed agricultural products – Build capacity of institutions and regulatory bodies and implementing agencies to effectively monitor agricultural inputs supply – Encourage transfer of land ownership to women through incentives and subsidies – Recognize the role of women farmers through better and representative data collection and gender-segregated presentation – Incentivize women-led dairy and agri-businesses – Make women farmers visible by highlighting their successes through media campaigns – Develop strong marketing and communication strategy of this component in local language and disseminate information using different channels
Component 3.2: Improving Agriculture Information and Technology			

Project Activities	Benefits	Adverse Impacts and Risks	Mitigations
– **Establish Market data information collection station**	– The data about crop cultivation as per crop zone, cropping intensity, crop yields, crop diversification, crop water requirement etc. can be used for further planning to get more production from available water. – Crop water demand and supply equilibrium can be maintained – improving the knowledge and information base, with a focus on innovative approaches to dealing with water logging and soil salinity;	– Inadequate/fake data collection and research in waterlogging and salinity – Inadequate outreach programs in disseminating the information – Less educated and small farmers unable to comprehend market-oriented data	– Provision of adequate research and training facilities – Institute quality check systems in data collection, entry, and tabulation stages – Recruitment of qualified staff and training them in the latest research techniques conduct regular outreach and training programs for farmers on market-driven approaches, including digital marketing
Component 5: Agriculture Flood Emergency Rehabilitation			
– Provision of financial support to facilitate agricultural production of small farmers following the 2022 floods.	Small farmers will be able to resume agricultural production after suffering financial loss due to 2022 floods, thus increasing incomes and contributing to food security.	– Low: Small farmers will utilize normal agricultural practices, but there is the potential for occasional localized overuse of agricultural chemicals. – Given the scale and speed of these activities targeting flood affected small farmers may be challenging	– Using NGOs and local community institutions to identify eligible beneficiaries and monitor distribution and use of financial support. – Employment of a comprehensive Grievance Redress Mechanism. – Small farmers will be provided information, and access to agricultural extension, on safe use of agricultural chemicals –

5.2 Potential E&S Implications of Sindh Water Policy

Potential E&S implications of the proposed draft Water Policy are given in Table 5.2.

Table 5.2: 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 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 the 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 of 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

Policy Objectives	Action Points	E&S Implications
		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 inter-communal conflicts and clashes and a rise in harassment of women and children Groundwater, 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.
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	Whereas introducing the private sector can mitigate budgetary constraints for public water utilities, 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

Policy Objectives	Action Points	E&S Implications
	stimulated and at the same time also regulated	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 5.3**. A detailed and project-specific impact assessment will be carried out while conducting ESIAs or preparing ESMPs of the individual subprojects.

Table 5.3: Potential E&S Impacts and Risks During Construction

Subproject Activity	Potential Benefits	Screening of E&S Impacts and Risks	Potential Mitigation Measures
Component 2.3 Left Bank Main Canal - Rehabilitation of left bank canals (Akram Wah, Lower Nara Canal) and emergent works on right bank canals - This section also covers general environmental and social impacts of all major civil works in the project	Restore the original canal flow capacity and improve associated water control structures to enable more effective distribution of water within the command areas. Rehabilitation of Akram Wah Canal will complete the main canal renovation for the three AWB command areas that are the focus of	Canal rehabilitation works, particularly embankment works, require a huge amount of borrow material. Development of borrow areas will affect the natural landscape, environment and local land use	The borrow areas are to be developed in the barren lands that are preferably owned by the governments. 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

Subproject Activity	Potential Benefits	Screening of E&S Impacts and Risks	Potential Mitigation Measures
	the irrigation modernization program under SWAT		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.	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

Subproject Activity	Potential Benefits	Screening of E&S Impacts and Risks	Potential Mitigation Measures
		Contractors will use a wide variety of hazardous materials such as fuels, chemicals, paints, batteries, etc. The storage and 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.	management of recyclable and hazardous waste. Disposal of the garbage at the existing municipal land disposal sites.
		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 in case of any accidents (covering all types of minor and major injuries and fatalities).

Subproject Activity	Potential Benefits	Screening of E&S Impacts and Risks	Potential Mitigation Measures
		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 Impacts on the mobility of women	Measures to protect the privacy of women and girls by the contractor, sub-contractors and service providers Provision of training and socialization of Code of Conduct for workers in local languages Provision of cultural sensitization training for workers regarding engagement with the local community Contractors hire workers through a systematic process managed by the HR office and avoid hiring "at the gate" to discourage the spontaneous influx of job seekers and migrant workers. Workers should be hired from the local communities
		Child labour and school dropout	Ensuring that children under 18 years of age are not employed directly or indirectly on the project. Local community provided with information on contractor's policies and Code of Conduct
		Gender-based violence, including sexual harassment, child abuse and exploitation	▪ Contractor Code of Conduct developed, incorporated into workers' contracts, and training and socialization on it provided to workers ▪ Mandatory and regular training for workers on required lawful conduct in the local community and legal consequences for failure to comply with laws; ▪ Commitment/policy to cooperate with law enforcement agencies investigating perpetrators of gender-based violence; ▪ Creation of partnership with local civil society organization to report workers' misconduct and complaints/reports on gender-based violence or harassment through the Grievance Mechanism;

Subproject Activity	Potential Benefits	Screening of E&S Impacts and Risks	Potential Mitigation Measures
			▪ Provision of opportunities for workers to regularly return to their families; ▪ Provision of opportunities for workers to take advantage of entertainment opportunities away from local rural communities.
		Increased risk of communicable diseases (including STDs and HIV/AIDS)	Screening worker influx for communicable disease and providing treatment, as appropriate, to reduce exposure to the local population ▪ Vaccinating workers against common and endemic (locally prevalent) diseases; ▪ Contracting of an HIV service provider to be available on-site in high-risk areas, where worker numbers are above a certain threshold; ▪ Implementation of HIV/AIDS education program; ▪ Information campaigns on STDs among the workers and local community; ▪ Education about the transmission of diseases, age of consent in the project area, and reminder about Code of Conduct
		Improper drainage can affect the surrounding agricultural land	Incorporate the drainage considerations in the design stage
		Infrastructure damaged by influential farmers and water distribution disrupted through Direct Outlets	Legal action against those damaging the infrastructure FOs are given magisterial powers to take action against perpetrators by filing FIR
		Community exposure to work hazards	Barricade the work areas with hard fencing to prevent the entry of community in the construction areas. Placing adequate signboards and flagmen to divert the community away from the construction works.

Subproject Activity	Potential Benefits	Screening of E&S Impacts and Risks	Potential Mitigation Measures
			Community awareness programs on construction-related hazards, including awareness programs in schools
		A temporary disruption in water supply during repair and rehabilitation	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 (e.g., through temporary water diversion works around the construction works or pumping of water from upstream to downstream or carrying out works during the canal-closure period).
Rehabilitation of Selected distributaries under Component 2.1 Improve last-mile water service delivery by rehabilitation of water courses and high-efficiency irrigation system under Component 3.1	Improve irrigation services throughout the command area including tail end farmers and enhance the agricultural productivity. Increased agricultural productivity will enhance the economy of the farmers and reduce the poverty in the region. Water could be saved that can be used to serve tail areas, to restore environmental flows, to secure water for a variety of needs and to even expand the area under irrigation	General construction-related impacts such as soil erosion and sedimentation, dust and noise pollution, generation of waste and wastewater discharges, surface and groundwater pollution, traffic and road safety, occupational health and safety risks, and community 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. Please see the mitigation measures, covering all types of environmental and social impacts, under Component 2.3 of this table
		Irregular profile and zigzag alignment of banks with many points of weakness; variable cross-section of water channels; silt deposition causing restrictions in flow and overtopping; trees, shrubs, and vegetation growing in	Rebuilding or realigning watercourses to increase conveyance efficiency by reducing seepage, evaporation, and operational losses Construction of washing ghats and animal ponds to prevent damage and pollution

Subproject Activity	Potential Benefits	Screening of E&S Impacts and Risks	Potential Mitigation Measures
		watercourses; damage caused by rodents and farm animals; Bank cutting and plugging for water extraction	Construction of water storage ponds, solarization of lift pumps on watercourses Installation of hand pumps in communities to prevent extraction of water from water courses for domestic use
		Farmers do not contribute to the maintenance of watercourses	Strengthening WCAs and building their soft, financial and technical capacity to manage and maintain water courses Financial assistance to farmers for maintaining water courses Capacity development of women farmers and increasing their participation in WCAs
		Fragmentation and unlevelled land causing spills and drainage issues	Installation of high-efficiency irrigation system (HEIS), increasing precision land levelling service, reclamation of salt-affected soils, rehabilitation of on-farm access drains,
Promoting Climate Smart Agriculture under Component 3.1	Increase in efficiency of irrigation water use Increased agricultural productivity.	Farmers might take too long to shift from conventional agricultural practices to CSA practices	Establishing demonstration sites to showcase crops and CSA practices to groups of farmers, drawn from FOs and WCAs, using the Farmer Field School approach Introducing CSA in salinity-affected lands to demonstrate improved productivity that can prompt acceptance of CSA practices amongst farmers. Training women and small farmers and incentivizing them to adopt to high-value crops through smart agriculture
		Farmers do not get access to required tools and services for CSA	Capacity development of the Agriculture Department in providing technical assistance to farmers in CSA
		Friction between/amongst Engineers of Irrigation Department, AWB, and FOs over the management of	Roles and responsibilities of water bodies redefined as the department are restructured to avoid duplicity

Subproject Activity	Potential Benefits	Screening of E&S Impacts and Risks	Potential Mitigation Measures
		modernized branch canals/distributaries	Contracts to be developed in local languages and shared with FOs. Bills of contractors to be approved upon clearance from FOs
		FOs unable to effectively manage modernized distributaries	Undertaking pilot project to determine the capacity of FOs Capacity development of FOs in soft, financial, and technical skills
		Tailenders being apprehensive of hydraulic structures that can allow upstream to control flows in the distributaries	Regular and timely elections of AWBs to ensure representation of tail-enders Regular meetings of FOs with AWBs to discuss irrigation related issues Robust and transparent GRM system, including digital, to timely address grievances
		Grievances over the allocation of water and the release of water	AWB, FOs, and WCAs meet regularly to decide water needs and timings and develop proper schedules based on crop requirements
		Improper O&M might lead to deterioration of new hydraulic structures	Setting budgets for regular maintenance and preventive care of new hydraulic structures Improving abiana collection to generate revenue for O&M
		Lack of drainage might result in waterlogging and salinity	Incorporate the drainage element at the design stage
Component 3.4 Developing Agriculture Value Chain	Reduce value chain constraints to higher value, water thrifty crops. Improve productivity and quality of produce, reduce post-harvest loss, and increase value addition Address the financial constraints facing producers and enterprises by providing access to loans financial institutions through	Gaps in simultaneous investments in productive capacities, business skills, and infrastructure development to create an enabling environment for value chain development	Value chain mapping and analysis of selected agricultural commodities for comprehensive Value Chain Development Provide partial financial investment to agri-entrepreneurs through a competitive process Build technical capacity of farmers and processors in value addition

Subproject Activity	Potential Benefits	Screening of E&S Impacts and Risks	Potential Mitigation Measures
	warehouse receipts (without selling their produce)		
		Market uptake weak of new crops or value-added agri-products	Strengthening market information sources and services to enable farmers/processors/agri-entrepreneurs to be demand-driven Promote digital market platforms like Pakistan Mercantile Exchange (PMEX) for trading agricultural commodities Introduce smart technologies and facilitate farmers in using e-commerce and e-trading platforms together with traditional approaches of marketing and distribution

5.4 Screening of Potential Resettlement Impacts of Physical Interventions

Potential resettlement impacts are expected in the project, mainly from the rehabilitation of canals, including minor canals and distributaries. The right of way of canals and the canal embankments in Pakistan, including Sindh, are occupied/encroached by the squatters. The resettlement impacts and the entitlement matrix are discussed in detail in the RPF.

5.5 Strategic Overview of Water-Related Environmental Issues in Sindh Province

5.5.1 Strategic Environmental Issues in Water Sector in Sindh

A detailed Strategic Overview of water and environmental issues in Sindh is given in Annex 9. The strategic environmental issues in the water sector in Sindh are sustainability of surface and groundwater resources and their main uses: irrigation and drainage, urban and rural water supply, and wetlands including the Indus Delta, flood management and dryland management. The Strategic Overview in Annex 9 first reviews the history of Sindh from a water management perspective. It then discusses the overall situation in the province and describes each environmental issue. A summary of this overview is presented in Table 5.4. The SWAT will develop a broad Strategic Water Plan to address these challenges and develop mitigation measures. A draft scope of work for the study is given in Annex 9.

Table 5.4: Strategic Water and Environmental Issues in Sindh

Issue	Strategic Overview	Reference to Section in Annex 9
Water resources	From a semi-natural flood-based system, the water resources system of Sindh has become largely engineered, with winners and losers. It sustains a larger rural economy than planned, as made clear by the steeply increased cropping intensity. Climate change is presenting a new set of conditions with erratic rainfall events, increasing evapotranspiration and higher frequency of floods and droughts.	2-3
Surface water	Due to increased water use, reduced storage capacity, larger diversions to flood plains and the canal commands and the change in cropping patterns, scarcity has increased as seen in the increased number of days with zero outflow below Kotri.	4
Groundwater	Groundwater was underused in Sindh until 2000, but its use has increased since then. The resources are precarious, either isolated small aquifers in drylands or freshwater pockets in saline areas. Considerate (conjunctive) management is required.	5
Water logging	Water logging began developed rapidly in the 1960s and still persistently affects 35-45% of the irrigated area on annual basis, with the problem most prevalent in the post-monsoon season. Widespread water logging explains the current massive water loss due to non-beneficial evaporation, but also suppresses crop yields and causes health hazards.	6
Irrigation	Sindh is home to the world's largest irrigation canals. Management has been challenging, with frequent breaches and embankment overtopping and unauthorized diversions. A major problem is the large number of direct outlets that have been sanctioned since the 1970s, creating inequity and complicating the management of the system. Despite many changes to the system (additional storage, conjunctive groundwater use) water allocations/irrigation duties for the canal commands were never updated and are now largely informal and sub-optimal. Crop water productivity, especially in the lower part of the system, is low.	6
Drainage	In response to increased waterlogging and salinity, an extensive drainage network was developed from 1970-2000 to remove seepage water. The drainage network is not equipped to evacuate storm water, which has caused flooding and has foregone opportunities for recharge. Operation and maintenance of the drainage network is problematic. The Left Bank Outfall Drain has aggravated flooding problems around Badin. The Right Bank Outfall Drain is not completed: as a consequence, drainage effluent is now deposited in Manchar Lake causing this huge water body to rapidly deteriorate.	6
Multifunctionality	The canal network was designed to provide for agriculture, but as Sindh's population grew and the economy diversified, the canal and drainage network became increasingly multifunctional. It became the basis for industrial water supply, waste disposal, and domestic services.	2, 6-7

Issue	Strategic Overview	Reference to Section in Annex 9
Water quality	Water quality is a major concern due to the long-term practice of disposing untreated industrial or municipal wastewater in the canal and drainage systems. This has spread high levels of cadmium, lead, and mercury into the surface water system. In several districts of Sindh, arsenic concentrations in ground water exceed the WHO guideline of 10 µg/l. The cause is likely the chemical reduction of iron oxyhydroxides due to poor groundwater management.	7
Drinking water supply	Drinking water supply in rural Sindh is problematic, with 98% of water samples deemed unsafe for drinking. Bacteriological contamination, due to inadequate handling, is the prime problem. Microbiological pollution of shallow groundwater – the main source in rural areas – presents additional health risks. The other challenge is the high non-functionality of improved public systems that stands at 56%; this is high for any country. This is largely compensated for by widespread self-supply systems that use precarious tiny water lenses. The situation is not much better in major cities, where 84% of samples have high coliforms and where there is a shift from taps to reverse osmosis plants and water tankers.	7
Wetlands	Sindh has many wetlands, including ten with Ramsar status. While these wetlands harbour important biodiversity and contain unused potential, they have also been in decline due to reduced water supplies, poaching, pollution, invasive species, and encroachment.	8
Indus Delta	The Indus Delta has witnessed a steady decline since the mid-1950s. The development of hydraulic structures on the Indus (reservoirs, barrages, flood protection bunds) has deprived the Delta of fresh water supplies, flood pulses, and sediments. The failure of the tidal link changed the configuration of the Delta further. The decline of mangrove forests (now reversed) and sea-level rise have further affected the Indus Delta. Until now, no concerted effort has worked on protecting this once buoyant area.	9
Floods	Over the last 15 years, Sindh has been the scene of several severe flooding events. The higher depression over the Indian Ocean makes it likely that floods will occur more frequently. Though equipped with flood protection bunds along the Indus River, the management of the main hydraulic system (irrigation and drainage canals) is not equipped to mitigate the impact of flood events.	10
Drylands	The drylands of Kohistan, Tharparkar, and Nara Desert are among the most densely populated globally. Unlike similar drylands elsewhere in the world, there has been little management of the specific resources of these areas beyond the construction of small dams. Groundwater resources are particularly fragile and under threat.	11

5.6 Addressing Cumulative Impacts of the SWAT Project.

This section gives the preliminary identification of Valued Environmental Components (VECs), and an assessment of potential cumulative impacts contributed by the SWAT project. A detailed Cumulative Impact Assessment (CIA) of the SWAT Project will be carried out as part of the proposed Strategic Water Plan development during the implementation of Component 2.

5.6.1 Valued Environmental Components (VECs)

The key issues discussed in Table 5.4 can be considered as the valued environmental components (VECs) in Sindh Province. The most important ones relevant to the SWAT are i) surface water resources; ii) groundwater resources; iii) Wetlands incl Manchar Lake Iv) the Indus Delta, and v) the dryland areas.

These VECs are briefly described below and the detailed indicators for the VECs will be identified under the proposed CIA study.

(i) Surface water resources

Water resources available in 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 IBIS. 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 (including two serving Balochistan Province) via an intricate system of 117 branch canals, 1,400 distributaries and minors, and 44,000 watercourses. 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 recent economic development following rapid urbanization and industrialization, and the population increase, the pressures from other sectors are also increasing quickly. Effectively, the 12 main canals of Sindh have been transformed into multi-purpose canals serving agriculture, industries, households, and the environment including wetlands, the Indus Delta, and natural habitats.

Flows into Sindh at Guddu averaged 65.19 MAF between 2004 and 2019, with flows concentrated in June and September. According to the Water Apportionment Accord, a total volume of 25 MAF in any 5-year period (an annual equivalent of 5 MAF) be released below Kotri as environmental flows (during Kharif period) to maintain a stable coastline and sustain mangrove vegetation in the Indus delta. However, the actual releases below Kotri were only about 1.76 MAF. It was also estimated that about 19%[52] of irrigation water losses during Kharif season.

Under business-as-usual circumstances, water demand will increase in Sindh as a result of the combined effect of population growth, structural change in the economy, and increased requirements of irrigation water due to climate change. The largest part of the increased demand comes from agriculture, but water demand from municipal and domestic users is expected to more than double, with higher demands on quality and reliability. Given the limited nature of water resources in Sindh, better management of existing resources is imperative to deal with future demand.

(ii) Groundwater

[52] For instance, in 2018-2019 the inflows were 49.80 MAF, of which 35.66 MAF was consumed – most of it in agriculture (33.80 MAF). Water losses where 6.69 MAF, mostly in the kharif season.

For a long time, groundwater in Sindh was less visible, overshadowed by the surface canal system. There are three hydro-geological zones in Sindh: (a) the Eastern (Thar) Desert; (b) the Western Mountain; and (c) the Indus Valley or the Plains of Sindh. The most important groundwater area in Sindh is the Indus Plains, which is recharged by the meandering river and the irrigation network. The Indus River in Sindh Province generally flows on a ridge and is hence mainly influent, meaning that it feeds the aquifer systems alongside it rather than being fed by it. Along the Indus, groundwater quality in Sindh is generally fresh and useable (within 1500 PPM) due to centuries of seepage. In addition, there are scattered lenses of fresh groundwater, varying in depth and size, throughout Sindh close to the irrigation canals. These lenses, fragile as they are, are important for local self-supply drinking water systems.

Overall, however groundwater is saline, and salinity increases at deeper levels. At shallow depth (0-25 m), 65% of the areas are saline, whereas 81% of the deeper (75-100 m) layers are saline. In comparison to other parts of Pakistan, private tube well development has been taken up less in Sindh due to the prevailing groundwater salinity. Moreover, in normal years the relatively generous surface irrigation supplies, especially on the right bank of the Indus, reduce the need for additional groundwater use.

(iii) Wetlands

Important wetlands have formed throughout Sindh. As a result, Sindh is not only endowed with a large number of wetlands, but also with an important variety of wetlands. The main types of wetlands in Sindh are the following:

- marine (coastal wetlands including coastal lagoons)
- estuarine (including deltas, tidal marshes, and mangrove swamps)
- lacustrine (wetlands associated with lakes)
- riverine (wetlands along rivers and streams)
- palustrine (meaning “marshy” - marshes, swamps, and bogs)

Under the Ramsar Convention, 10 Wetlands were recognized in Sindh in 2021, which includes one (Hub Dam) that is shared with Balochistan. In addition to official wetlands there are many other wetlands, including game reserves and irrigated plantations. There are also many other potential wetlands, including Badin and Kadhan Lagoons, Beroon Kirthar Canal, Charwo Lake, Clifton Beach, Ghauspur Jheel & Sindhi Dhoro Lake, Khango (Khowaj) Lake, Hawkes Bay / Sandpit, Khipro Lakes, Korangi and Gharo Creeks, Hamal Katchri Lake, Langh (Lungh) Lake, Mahboob Lake, Shahbunder & Jafri Lake, Phoosna Lakes, Pugri Lake, Sadhori Lake, Nara Canal, Soonhari Lake, Tando Bago Lake, and Sanghriaro Lake

Wetlands are very important for the survival of local biodiversity. The aquatic flora and fauna in each wetland adapt to their bio-geochemistry. With the enormous variety of wetlands in Sindh, the cumulative biodiversity is large.

Among the wetlands in Sindh, Manchar Lake stands out. Manchar Lake is one of the largest natural shallow lakes in Asia. The lake has a mean depth between 0.5 and 3.75 meters and an average area of 233 km^2, which can extend from 200 to 500 km2, but has in the past fallen dry as well. The water in Manchar lake has three sources: overflows of the Indus River, run-off from the Khirthar Mountain range, and since 1932 the Main Nara Valley Drain (MNVD). The importance of these sources has changed over time. As the inflows of the flood runoff from the Khirthar range reduced due to upstream development as have the high waters from the Indus, following the regulation of the river, the

drainage inflows of the MNVD have become the prime source of water for Manchar Lake, only occasionally augmented by floodwater releases either from Khirthar range or the Indus. With this, the quality of the lake water has become problematic, affecting the people living on and close to Lake as well as the environment at large, including the groundwater bordering Manchar Lake. In particular, after 1981 when the MNVD was remodelled to carry the effluent of a large number of smaller drains, disposals from industries and domestic waste as well as excess water from agriculture and saline seeps, started to dominate the inflow. The accumulation of polluted supplies through the Main Nara Valley Drain (MNVD) in combination with the high evaporation from the shallow waters transformed Manchar into a saline lake. As a result, calcium, hardness, chlorine, arsenic, nickel, manganese, zinc, copper and sulphate are above permissible limits.

(iv) 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 also a designated Ramsar wetland site. It contains many different ecosystems: riverine forest, 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 an area of ecological deterioration, endemic poverty, and poor access to basic services such as clean drinking water.

A number of human-made interventions have caused significant environmental transformation, that has undermined the natural production potential and caused the abandonment of many villages:

i. *Severe reduction of water deliveries with the expansion of the irrigation networks and the conversion of the floodplains*. Due to the reduced river flows, the saline barrier has moved upstream of the Indus, affecting the river ecology and freshwater availability in large areas of land in the Thatta, Sijawal, and Badin Districts.
ii. *Severe reduction of 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. Following the estimated 80% reduction in sediment discharge after the construction off Tarbela and Mangla Dams the deltaic shoreline along the central delta coast has receded at average rates of 50 m/year.
iii. *Change of flooding patterns*. Due to construction of embankments, the Indus River has been confined. The flooding area has reduced, further affected by the changes in river releases. This has had several effects, an important one being the reduced recharge of groundwater along the Indus. This has also resulted in saline water ingression.
iv. *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. The scouring of the tidal link – basically creating a new river – moved the tidal effect much further upstream (70 km).
v. *Change of mangrove forest cover*. One-third of the Indus Delta was originally covered by mangrove forests, in particular Avicenna Marina. Over the years, this vegetation has changed: mangrove cover dropped to 10% in 2010 due to the changed hydrology and encroachment. In recent years, with concerted efforts, mangrove cover has increased to 13% with success achieved especially on the Right Bank of the Indus. The mangroves have many economic and

ecological benefits. They are sources of firewood, timber, and bee forage, and they serve as grazing areas for livestock and fish spawning grounds.

vi. *Sea level rise*. There is a gradual rise of the sea level along the coast of Sindh. Data show that the sea level near Karachi has risen from 7,029 to 7,238 mm during the 1916–2016 period, indicating a rise of 209 mm (or 20.9 cm) in the past 100 years. Combined with the reduced inflow of water and sediment from the Indus, this has caused an increase in the area in the Indus Delta that is salt-affected and permanently inundated, at 97,000 and 135,000 ha from 1972 and 2018 respectively due to sea intrusion.

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(v) Dryland areas

There are large and important areas in Sindh where water supply, agriculture, and livestock keeping depend on the effective use of rain runoff or floods. These are the dryland areas outside the Indus Basin Irrigation System, covering 60% of the province. The dryland areas in Sindh have received relatively little attention, yet they are very important, serving as watersheds, grazing areas, wildlife reserves, and sources of special botanical products, charcoal, and timber. These areas house a surprisingly large human population in Sindh due to the intimate integration with the economy of irrigated areas. As they harbour unique flora and fauna, several parts of the dryland zones have been designated as protected areas: Khirthar National Park, Hub Wildlife Sanctuary, Mahal Wildlife Sanctuary, Nara Wildlife Sanctuary, Takkar Wildlife Sanctuary, and Rann of Kutchh Wildlife sanctuary.

5.6.2 Protecting the VECs through SWAT Water Resource Management (Component 1)

The overall objective of the activities under component 1 is to establish the institutional and legal framework for integrated water resources management and to get the process of systematic and pro-active management of water resources going, something that so far in spite of the enormous importance of water resources management in Sindh has been non-existent. All activities under component 1 will contribute to the protection of the VECs (see table below), but the most so from the Sindh Strateicc Water Plan, under activity 1.2. The table below gives the activities' impact under the SWAT Water Service Delivery components. The impacts are expected to be highly positive (blue dots).

	Surface water	Groundwater	Wetlands	Indus Delta	Drylands
1. Water Resources Management					
1.1 Policy and Institutional Reforms	●	●	●	●	●
1.2 Sindh Strategic Water Plan (SSWP)	●	●	●	●	●
1.3 Hydro-Agro Informatics Program	●	●	●	●	●

Component 1.1 Policy and Institutional Reforms will create the new legal basis for integrated water resources management and will restructure current institutions (Irrigation Department and SIDA) into an *Irrigation and Water Resources Department*, thus broadening the remit of these institutions to address water resources management and multifunctionality. This also creates the basis to address the hitherto neglected dimension of water resources management, particularly groundwater management. By bringing water resource management within the canal command areas within the scope of operations, a more profound approach to resolving waterlogging can be developed based on regulating/ curtailing the inflows in the different waterlogged areas. Similarly, flood management is served by a rethink of how the canal system is operated during times of heavy rainfall. The policy reforms – by virtue of having a Sindh Water Resources Commission and designated Area Water Boards not only for the Indus Based Irrigation System but also for the dryland areas of Sindh and importantly for the Indus Delta – can also contribute to better management of wetlands, including the Indus Delta, and the dryland areas.

Component 1.2. Sindh Strategic Water Plan. Building upon the Sindh Water Policy, this SWAT support activity will facilitate the preparation of the Sindh Strategic Water Plan, which is meant to be updated every 5 years and align with the Sindh Water Policy. Annex 9.1 describes the scope of the development of the Sindh Strategic Water Plan. So far, there has been no such effort of bringing all stakeholders together to systematically address integrated challenges - such as combining flood management and groundwater recharge, controlling effluent discharges into the canal system can improve water quality and with this safe drinking water availability, thus mainstreaming multifunctionality, revisiting water allocations to facilitate conjunctive management and control water logging and developing appropriate cropping patterns. The Sindh Strategic Water Plan and the stakeholder process will address priority concerns such as water productivity, (reduced) water logging and salinity, water quality, safe sourcing of urban and rural water supply, effluent control, groundwater management and flood/ drought management.

This Sindh Strategic Water Plan will consist of a main plan for the entire province and subplans for all 12 canal commands, two dryland zones and the Indus Delta. The plan will be developed under the aegis of the Sindh Water Commission and the Water Resource Management Unit in the new Irrigation and Water Resource Management Department. The plan and subplans will be prepared with the help of consultants and recent graduates from the Sindh HEIs. The plan and subplans will discuss current performance and agreed improved operations, taking into account different climate scenarios. The improved performance should be reflected in five-year targets, that refer to the Sindh Water Policy. The targets will be underpinned by planned activities and responsibilities. These should include (1) improved operations, (2) improved regulations (3) investments and capacity building and (4) monitoring and tracking

Component 1.3. Hydro-Agro Informatics (HAI) Program. The HAI is meant to be the backbone of the Sindh Strategic Water Plan for water management in Sindh. For this reason, the HAI will collect and make available data on a permanent basis and deliver i) crop monitoring and productivity reports; ii) canal flow monitoring reports; iii) water balance reports; iv) flood monitoring and mapping; v) drought monitoring; and vi) agro-met communication to farmers. As such the HAI is also meant to feed into direct operations and farmer information. The HAI should also deliver data on topics for which information is now only available in a patchy and one-off manner, such as the status of groundwater, the extent of waterlogging, water quality and the status of the Indus Delta.

5.6.3 Impact on VECs from SWAT Water Service Delivery (Component 2)

The overall objective of the water service delivery component is to improve the delivery of canal water services to enhance the agricultural water productivity and to improve overall water resources management. The remit of this component is in contrast to component 1, more focused on the canal system and makes investments in these. There is no engagement in the dryland areas

The table below gives the activities' impact under the SWAT Water Service Delivery components. The impacts are highly positive (blue dots). Blanks stand for a lesser relevance. There are no negative impacts foreseen on the VECs by any of the SWAT sub-activities under component 2, as explained below.

	Surface water	Groundwater	Wetlands	Indus Delta	Drylands
2. Water Service Delivery					
2.1 Integrated FO Area Development	●	●			
2.2 AWB and SIDA Support	●	●			
2.3 Left Bank Main Canals	●	●		●	
2.4 Right Bank Preparatory Studies	●	●	●		

Component 2.1 Integrated FO Area Development-SIDA. These investments may also serve as examples of how to better manage the surface and groundwater in irrigation and drainage systems, creating more equity and reliability of delivery of surface water and the safe use of groundwater.

Component 2.2: AWB and SIDA Support: This component will strengthen the capacity of the SIDA and AWB to deliver reliable service to the FOs and the capacity of SIDA to support the FOs for improving canal operations and irrigation service delivery, including a focus on behavioral changes. This will involve a mix of institutional support, training, financial support and technical tools to support SIDA, AWBs and FOs. This will address the interlinked long-term impacts, particularly the need for practically improved water resource management within the canal system, tailoring surface irrigation, groundwater use and protection, reducing drainage requirement, multifunctional management, and water quality preservation. It may ingrain a bigger picture of water management beyond the operational requirements of the canal and drainage infrastructure.

Component 2.3: Left Bank Main Canal: The renovation of Akram Wah will improve the integrated water resource management of the canal system, including the secure water supplies to the cities and the fresh groundwater lenses adjacent to the canal (that serve as source of water for rural settlements in this area with predominantly salt groundwater). Part of the renovation may also address the control of the Akram Wah canal for effluent disposal. The study on the regulating canal deliveries and flow distribution that is part of this component may also include operating procedures during floods and

downstream releases for environmental services. It should also address the unauthorized above quota releases to the main canals – that is a cause of waterlogging and reduced releases to the Indus Delta.

Component 2.4: Right Bank Studies and Emergency Works. The component will finance detailed studies for the renovation of three main canals on the Right Bank that are supplied from Sukkur Barrage (Dadu, Rice and Northwest Canals) and the Warah branch canal. The Right Bank command area is characterized by low levels of agricultural productivity, excessive waterlogging and salinity, and widespread poverty. The largest and previously most ecologically important freshwater lake in Pakistan, Manchar Lake, is severely degraded due to the inflow of highly contaminated water from the Main Nara Valley Drain. The studies should develop and lead to a comprehensive plan of action dealing with irrigation, drainage, wetland protection, water resource management and delivery of multifunctional services (including drinking water) on the Right Bank – combining investments with better water management practice and optimized water allocation.

6 Environmental and Social Assessment Framework

This chapter describes the step-by-step methodology to carry 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. Section 6.9 describes the procedures to be followed for managing the E&S risks associated with cash transfers under Component 5. Agricultural Flood Emergency Rehabilitation.

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. For subprojects that do not require any civil works, ensure relevant mitigation measures provided in Tables 5.1 to 5.3 are implemented.	After identification of the proposed subproject	PIUs (EMU of SIDA and ADU Agriculture Department) will conduct 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. For subprojects that do not involve any civil works, stakeholder consultations will be carried out in accordance with the Stakeholder Engagement Plan	During Feasibility and E&S assessment studies	PIUs (with the support of PIC)
3	E&S Studies – Baseline Data Collection, Impact Assessment, preparation of	Primary baseline environmental data of the project influence area (covering physical, chemical, biological and socioeconomic environment) will be collected	During E&S assessment studies	PIUs with the support of PIC and ESIA Consultants

Step	Activity	Description of the Activity	Timing/Status	Responsibility
	ESIA/ESMP and RAP/ARAP	Assessment of impacts and their significance Preparation of site-specific ESIAs/ESMPs and RAPs		
4	Consultations and Disclosure	Consultations with the stakeholders (including affected communities) prior to E&S studies and after completion of draft ESIA/ESMP and RAP/ARAP. Disclosure of the ESIA and RAP (including translated summaries) on PIU's website and pm external website of the WB	During E&S studies After completion of ESIA/ESMP and RAP/ARAP	PIUs with the support of PIC
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	PIUs. 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 PIUs 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 and reporting of compliance by the Construction supervision consultants and EMU of SIDA and PMU of ASPD.	During Construction	E&S staff of all PIUs will review and approve the C-ESMPs and OHS Plans. ESHS Staff of Contractor will implement the plans. E&S staff of PIUs and PIC 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 will help to categorize the subprojects into high, substantial, moderate and low risk category projects following the Bank's ESF guidance and the guidance for this categorization and type of instruments are given in Annex 2. The screening report will be shared with the World Bank. If the screening concludes, the proposed subprojects are of high-risk and substantial risk categories and a detailed ESIA and/or 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/or 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 Risk Classification	Required E&S Documentation (to be confirmed after screening)
2.3. 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 ESIA, SMRP have been prepared for Akram Wah
2.1 integrated FO area Agriculture Development - SIDA	Rehabilitation of minor canals and distributaries	Moderate to substantial	Site-specific ESMP and RAP
	Rehabilitation of water courses	Low to Moderate	Generic ESMP-and ECPs
	Construction of Social infrastructure (canal crossings, water collection points, etc.). Construction of FO Offices	Low to Moderate	Generic ESMP-and ECPs
3.3. Improving Agriculture IT Base	Rehabilitation and modernization of extension and research Offices	Low to Moderate	Generic ESMP-and ECPs
3.1 Integrated FO Development - AWB	Rehabilitation of 300 water courses for improved last-mile delivery and additional lining of 2,640 water courses	Low to Moderate	Generic ESMP-and ECPs
	Construction of Water Storage Tanks and promote high-efficiency irrigation in 1000 acres	Low to Moderate	Generic ESMP-and ECPs

Component	Project Activity	Potential E&S Risk Classification	Required E&S Documentation (to be confirmed after screening)
	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 area, 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 substantial 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)
- ECP 20: Covid 19 Health and Safety Plan

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**.

The stakeholder Engagement Plan is provided in **Annex 11**.

Table 6.3: Sample Mitigation Plan

Impact	Mitigation Measures (Please see Table 5.3 for more detailed mitigation measures)	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
E&S impacts due to Project siting				
1. Elite capture by land owners and/or industrialists to ensure disproportionate water allocation for them and/or infrastructure development for their own benefits	Consult with all relevant stakeholders, as described under the Stakeholder Engagement Plan Ensure representation of all stakeholder groups during subproject identification, design and implementation.		PIUs	PCMU
2. Loss of vegetation and habitats due to land clearing under project footprints	Obtain clearance from tree cutting from relevant authorities if they are located in the government property (for example, trees located with ROW belongs to the Irrigation Department) Compensatory tree plantation at the rate of 5 new trees per tree cut.		PIUs	PCMU
3. Involuntary physical and economic displacement and replacement due to acquisition of land for the construction of project facilities	Prepare RAP for the subprojects Adequate compensation and resettlement assistance for affected households as per the entitlement matrix		EMU of SIDA and ADU/PIU	PCMU
4. Impact on residential structures and wood and fruit trees	Adequate compensation and resettlement assistance for affected households as per the entitlement matrix		PIUs	PCMU
5. Employment generation for the local community	The hiring of local people during construction works	Annex 8	Contractor, PIUs	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	ECP 1 ECP 5 ECP 6	Contractor	EMU/PMU CSC

Impact	Mitigation Measures (Please see Table 5.3 for more detailed mitigation measures)	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
	Proper dumping and adequate compaction to avoid dust and release back to the river Landscaping of the disposal areas after completion of works			
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 camps, sites, and batching plants	Construction of wastewater treatment facilities at the campsite (e.g., septic tank and soak pit) and at the worksites (sedimentation tanks for batching plants and site drainage)	ECP 3 ECP 4 ECP 16	Contractor	EMU/PMU CSC
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 PIUs	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	PIUs PIC
14. Sourcing of aggregates for concrete works	Reuse of excavated material from the construction sites 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	PIUs PIC

Impact	Mitigation Measures (Please see Table 5.3 for more detailed mitigation measures)	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
15. Impact on aquatic habitat due to construction activities	Control of wastewater and sediment releases to the river/canal	ECP 3 ECP 14	Contractor	PIUs PIC
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	PIUs PIC
Social / 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 PIUs	PIUs PIC
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	PIUs PIC
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	PIUs PIC
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 The Contractor will implement measures specified in ECP 20 for Covid-19	ECP 16 ECP 17 ECP 20 Annex 8	Contractor	PIUs PIC
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	ECP 17	Contractor	PIUs PIC

Impact	Mitigation Measures (Please see Table 5.3 for more detailed mitigation measures)	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
	violence and respectful attitude while interacting with the local community			
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 PIC
24. Risk of child labor	No hiring of workers less than 18 years of age	ECP 15 Annex 8	Contractor	EMU/PMU PIC
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 PIC
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		PIUs	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 modules designed for sanctioned discharge		PIUs	AWB
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		Farmer/Owner	PIU

Impact	Mitigation Measures (Please see Table 5.3 for more detailed mitigation measures)	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
	Educating the owners about standard HSE procedures and precautions.			
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		PIUs	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 3 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.		PIUs	PCMU

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. A stakeholder Engagement Plan of the project is given in Annex 11.

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	PIUs with the support of PCMU	Prior to bidding document preparation
2	**Environmental Approval** for the construction of the subprojects	Sindhi EPA	Submission of ESIA/ESMP	PIUs with the support of PCMU	Prior to bidding document preparation
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	PIUs with the support of PCMU	During the construction phase (before the use of quarry and excavated material)

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	PIU
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	PIUs 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	PIUs 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	
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		PIUs will include this condition in the bidding document

Condition	The rationale for the inclusion of this Condition in the Contract	Specifications to be included in the Bidding Documents	Responsibility	
			Bidders	PIU
		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**)		
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 • 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	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	PIU
		The suitability of the Code of Conduct can be assessed and discussed as part of the Bid/Proposal evaluation and negotiations The successful bidder is required to implement the agreed code of conduct upon contract award		
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) the 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 Plan

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**).

6.9 E&S Procedures for Component 5 Activities

Component 5 Agriculture Flood Emergency Response will involve cash transfers to support small farmers to cultivate their rabi crop. The size of the cash transferhas been estimated to help cover the basic inputs required by farmers immediately (seed and fertilizer); however, the farmers will have the flexibility to allocate the money according to their needs. For instance, some farmers may allocate part of their resources for land preparation, including land preparation, seeds, fertilizer, or other chemicals or diversification towards cash crops or livestock. This flexibility is important to be responsive to the different needs farmers face.

The potential environmental and social risks of these activities are low and will mainly result from the of fertilizers, inappropriate utilization and handlining of inputs such as pesticides and treated seeds, and potential conflict between those that receive the benefit and those that don't (particularly landowners and tenants). Detailed procedures to be followed to manage these E&S risks during the implementation of Component 5 are given in **Annex 10**.

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

The Project will be implemented by three existing Project Implementing Units (PIUs), as shown in Table 7.1. The PIU is responsible for all aspects of project management for its respective component, including procurement and contract management, financial management, safeguards, monitoring and evaluation under the overall supervision of the PCMU.

Table 7.1: Project Implementation Units

Component	Parent Department	PIU	Partner Entities
1. Water Resources Management	Planning and Development (PDD)	Project Coordination and Management Unit (PCMU)	Irrigation Department Agriculture Department Environment Department Disaster Management Authority Civil Society and Research Institutes
2. Water Services	Irrigation Department	Sindh Irrigation and Drainage Authority (SIDA)	Agriculture Department Area Water Boards (AWBs) Farmer Organizations Water Course Associations Farmers
3. Agriculture Subsidies and Investments	Agriculture, Prices, and Supply	Agricultural Development Unit (ADU)	SIDA Food Department Agriculture Dept Directorates: Research, Extension, and Water Management Farmers and Agi-Business
4. Project Coordination and Monitoring	Planning and Development (PDD)	Project Coordination and Monitoring Unit (PCMU)	All of the above
5. Agriculture Flood Emergency Response	Agriculture, Prices, and Supply	Agricultural Development Unit (ADU)	Agriculture Dept Extension Directorate.

A brief description of each PIU is given below.

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 responsible for the implementation of the Component 2 and its RAP/ESMP through the Environmental Management Unit (EMU). This includes disbursement of funds for compensation and permanent acquisition of land identified in the RAP/ESMP. 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

The staff from Project Implementation Unit (PIU), already established under SAGP and SIAPP projects, 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 PIU of SAGP and SIAPEP 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 of Component 3. Further, A total of four (4) DPIU/Divisional Field Offices will be established; for Agriculture Hyderabad, Mirpurkhas, Sukkur & Larkana districts.

The overall responsibility of environmental performance, including ESMP implementation, will rest with the PIUs of SIDA and ADU. Existing environmental and social staff of the PCMU, SIDA and PIU of Agricultural Department (under SAGP) are shown in **Table 7.2**. All these staff are experienced in the implementation of World Bank funded projects and will be responsible for implementing ESMF of this project. Additional specialists to be hired under these units are also given in Table 7.2.

Table 7.2: 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		
2. Water Service Delivery	SIDA/EMU	1. Deputy Director 2. Environmental Specialist (vacant) 3. Ecologist (Amin Khushk) 4. Environmental Inspectors (2 positions)	Sociologist		A Social Specialist in each AWB, who is responsible for O&M of canals
3. Agricultural Component 5. Agricultural FERC	PIU/ADU	Environmental and Social Safeguard Specialist		Junior Environmental Specialist	Junior 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 7.3**.

Table 7.3: 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/PIU of Agriculture Department (ADU)	• 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 PIU of Agriculture Department	• 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 subprojects • Prepare bidding documents and ensure all the E&S requirements are reflected in the bidding documents • Supervise civil works, ensuring compliance with all design parameters, including quality requirements and ESMP implementation • Prepare monthly reports and submit to respective PIUs • Implementation of the ESMPs and carry out E&S safeguard Monitoring • 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 7.4**. PIUs 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 7.4** 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 7.4: 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 PIUs and PCMU, including their consultants	E&S specialists of PCMU, PIUs and PIC/CSC	Before the start of the project activities. (To be repeated as needed.)
General environmental and socio-economic awareness; Environmental and social sensitivity of the project influence area; Mitigation measures; Community issues;	PIUs/PCMU personnel who will be in charge of Operation & Maintenance and the Engineers from the local contractor	PIC/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 SIDA/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 SIDA/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 Component One: 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

The grievance committees of SIDA projects and the GRM process is described below

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

SIDA will place complaint boxes on different locations of the site and labor camps. The contractor will hire a community mobilization officer. The community mobilization officer will be responsible for receiving and recording the day-to-day grievances of communities. The camp management officer of the contractor will keep a register along with complaint boxes and document complaints on a daily basis. Initially, the contractor will be responsible for resolving local complaints at the site. If he could not resolve any complaint, then the complaint will be sent to SIDA/AWB.

Any grievance which cannot be resolved at a project level (i.e., by the contractor, Supervision Consultant, SIDA or AWB) shall be referred to the GRC. If the affected person is not satisfied with the decision of GRC, he/she, as a last resort, may submit the complaint to the court of Law. The committee will establish community complaints register at sub-project sites. Committee will register and file any grievance redress cases and will bring these to the notice of the Project Director. The revenue department will be involved in land acquisition and crop compensation.

Grievances may be submitted to the GRC through any of the following means:

- By SMS, WHATSAPP, LETTER, SIDA WEBSITE, PCMU WEBSITE, AWB WEBSITE
- These complaints are submitted directly to the Managing Director of SIDA and the PMC/A Team Leader and will be forwarded to the GRC Chairman.
- By the individual(s) in writing directly to the GRC Chairman
- By the individual(s) in person at the Left Bank AWB office
- Director AWB shall forward grievances to the GRC chairman
- Referred to GRC chairman by the Contractor or PC (for grievances submitted to the Contractor or PIC in the first instance but that can be not resolved by them)

The following standards shall underpin the proposed systems for handling any submitted grievances:

- All grievances received will be formally recorded by the GRC chairman in a Grievance Register to be maintained by the GRC
- A written acknowledgement shall be issued by the GRC chairman to the affected person within three working days of receipt.
- The GRC shall meet to discuss the Grievance within 5 working days of receipt. Attendees, minutes of the meeting and actions arising from the meeting shall be entered into the Grievance Register.
- If required, a second meeting of the GRC shall be held within 20 working days of receipt of the grievance, thus allowing 15 working days for deliberation by the GRC, receipt of legal advice and undertaking of investigations as may be necessary. Attendees, minutes of the meeting and actions arising from the meeting shall be entered into the Grievance Register.
- The final decision of the GRC (arising from the first or second meeting) shall be recorded in the Grievance Register, including any further actions to be taken, and both shall be communicated to the affected person in writing within 30 days of receipt of the grievance.
- If a final decision cannot be reached by the GRC within 30 days, the findings of the GRC to date shall be communicated to the affected person in writing. The GRC shall agree upon a timeframe for resolution of the grievance, which shall be recorded in the Grievance Register and shall also be communicated to the affected person in writing within 30 days of receipt of the grievance.
- Attendees, minutes and actions arising from any subsequent meetings shall continue to be entered into the Grievance Register, and the affected person shall be updated, in writing, on findings at 30-day intervals.

- If at any time, the affected person is not satisfied with the decisions or findings of the GRC, they may register their complaint in a court of law.

All costs incurred by the GRC shall be borne by SIDA.

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 a 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 the Project Coordinator to resolve those complaints which are not or cannot be resolved at the 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
4. To be Nominated

Committee Level-II:

1. Project Director Agriculture Component (Chairman)
2. DG Agriculture Extension
3. 3. Environmental and Social Safeguard Specialist (PMU Agriculture)
4. 4. Director/PIU concerned district
5. 5. To be Nominated by PD

Committee Level-III:

1. Project Coordinator (PCMU)
2. Project Director (Agriculture Component)
3. DG Agriculture Extension
4. Environmental and Social Safeguard Specialists (Agriculture Component)
5. To be Nominated by PD

In addition to these GRM committees, the Agriculture component will establish one separate committee through construction supervision consultants during the implementation of civil works to resolve community or labor-related complaints arising 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 that 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 a PIU official (SIDA for Component 2 and ADU for component 3) 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. PIUs 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.

7.4 Budget for Preparation and Implementation of ESMF

The cost of implementing ESMF has been tentatively estimated at USD 1.5 million for the Project (Table 7.5). The estimated costs for carrying out E&S studies for the preparation of ESIA/ESMP and A/RAP for the subprojects are estimated to be USD 500,000. Detailed cost estimates will be provided in the ESMPs and RAPs of respective subprojects.

Table 7.5: Budget for ESMF Implementation

S.No.	Description	Quantity	Amount	Remarks
1	Hiring of Environmental staff	60 months	120,000	One specialist for ADU
2	Hiring of Social Staff	60 months	480,000	Three for SIDA (for AWBs) and one for ADU

3	Environmental screening of subprojects and Preparation of ESIA/ESMPs	Lump-sum	500,000	
4	Capacity building programs	Lump-sum	200,000	on E&S aspects of the Project
5	Implementation of SEP	Lump sun	300,000	
	TOTAL		1,500,000	

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 Stakeholder Engagement Plan for the future consultations to be carried out during the implementation of subprojects.

8.1 Stakeholder Engagement Activities

Stakeholder consultation for the proposed subprojects will entail informing communities and other relevant stakeholders on the scope of the subproject and the need for the community to own and safeguard the project as beneficiaries and stakeholders. The farmers and rural communities will mostly be the beneficiaries of this project. Therefore, effective and close consultation with them is a prerequisite for the successful implementation of the subprojects. In recognition of this, efforts will be made to carry out the consultations with both beneficiary and affected communities.

The consultation would be an ongoing activity taking place throughout the entire project process. Stakeholders' participation and consultation would take place through meetings, radio programs, requests for written proposals/comments, filling in questionnaires, explanations of the subproject to the locals, making public documents available at the AWB, FO and WCA levels. A summary of the proposed engagement activities is given in **Table 8.1**, and a detailed Stakeholder Engagement Plan (SEP) of the Project is given in **Annex 11**.

Table 8.1: Summary of Stakeholder Engagement Activities

Activity	Stakeholders	Timeline	Engagement Methods	Responsible Parties
A. During Subproject Identification and Design				
Subproject or Beneficiary Identification	Farmers WCA FOs AWBs Local Government SIDA Agriculture Department	Prior to the selection of each subproject or beneficiary	Brochures, posters and flyers Notification in radio and print media Public meetings with AWB, FO and WC levels, based on the subproject scope. Focus Group Meetings for women and vulnerable.	PIU's E&S specialists
Subproject Screening	WCA FOs AWBs Local Government	After identification of each subproject	Surveys Interviews	PIU's E&S specialists
ESIA/ESMP and RAP/ARAP Preparation for subprojects	Affected communities, SIDA, Irrigation Dept. Agriculture Dept., Sindh EPA	During the preparation of ESIA/ESMP and RAP/ARAP	Surveys Interviews	PIUs and PICs

Disclosure of ESIA/ESMP and RAP/ARAP for subprojects	Affected households, Vulnerable groups Community leaders Farmers WCA FOs AWBs Local Government Sindh EPA	After completion of the draft ESIA/ESMP and RAP/ARAP	Public meetings Consultation Workshops Uploading the documents on PIU website Sharing executive summaries with local WCAs and FOs FO-level information centers	PIUs and PICs
Grievance Redress Mechanism	Affected communities, Farmers WCA FOs AWBs	Establish and disseminate the mechanism prior to subproject implementation	Brochures, posters and flyers Notification in radio and print media Focus group Meetings and Public Meetings	PIUs and PICs
Training and Capacity Building on ESMP/RAP	PIUs PCMU SIDA Irrigation Department Agriculture Department Contractors	Quarterly	Training workshops	E&S Specialists of PICs and PIUs
B. During Subproject Implementation				
ESMP/RAP Implementation Progress	PAPs Local communities Vulnerable groups Contractors PCMU	Monthly	Site visits followed by review meetings Focus group discussion	E&S Specialists of PICs and PIUs
Community feedback	Project beneficiaries Project Affected Communities WCA FOs AWBs	Quarterly	One to one interview or Focus group discussions	E&S Specialists of PICs and PIUs
Grievance Redress Mechanism	Project beneficiaries Project Affected Communities Project workers	Monthly	Review grievance records Brochures, posters and flyers	E&S Specialists of PICs and PIUs
Training on OHS and community health and safety	Workers of Contractors and Sub Contractors	Daily Monthly	Tool box talks Training programs	Contractors PICs
Training on Code of Conduct	Workers of Contractors and Sub Contractors	Throughout construction	Posters – displaying conduct in local language	Contractor

8.2 Consultations Summary

8.2.1 Component One: Water Resources Management

Overall, stakeholders (WCA, FOs, AWBs and Local Government) 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

8.2.2 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 (Affected communities, SIDA, Irrigation Dept. Agriculture Dept., Sindh EPA, affected households, Community leaders, Farmers, WCA, FOs, AWBs, and Local Government) 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 the training of FOs should be done by AWBs as they are more aware of farmers' capacity development needs.

8.2.3 Component Three: Agriculture Investments

Overall, the proposed interventions were well received by stakeholders (Farmers, WCA, FOs, AWBs, and Local Government). 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 be tied 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, favouring 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.

8.3 Consultation Meetings

Two rounds of stakeholder consultations were conducted during the preparation of this ESMF, one at the initial stages of preparation and the second after completion of the draft ESMF. Initial consultations were held in April 2021 with AWBs of Ghotki, Nara and Left Bank canals, FOs of these three AWBs, Sindh EPA, Public Health and Engineering Department, Forest and Wildlife Department, Livestock and Fisheries Department, Irrigation Department, Agriculture Departments, and PIUs. In addition to these consultations, a gender-specific consultation workshop was carried out with the AWBs, FOs, UN Women, ILO, and a women's NGO. All these consultations were carried out through video conferences and telephonic interviews.

The second round of consultations was carried out during August 2021 with the AWBs, FOs, and WCAs to disclose the draft ESMF and obtain feedback from all the relevant stakeholders. Further, a workshop was conducted on 24th August 2021 at the SIDA office in Hyderabad, with all the relevant stakeholders, including AWBs, FOs, PIUs, EPA, Public Health and Engineering Department, Forest and Wildlife Department, Livestock and Fisheries Department. The overall feedback from the participants is very positive, and participants recommended continued consultations throughout the project implementation. All these consultations were carried out through public meetings following the COVID-19 protocols. Details of the second round of consultation meetings are shown in Table 8.2.

Table 8.2: Details of Stakeholder Consultation Meetings

S#	Location	Date	Number of Participants	Type of Participants
A	**First Round of Consultations (phone and video conferences**			
1	Phone Calls	May and June 2021	20	Farmers of Water Course Associations and Farmer Organizations from AWBs. Officials from various stakeholders of SWAT. Mainly from Agricultural department, agriculture extension, Sindh Environmental Protection Agency
2	Video conference	30-06-2021	18	Women farmers and FO members, NGO
B.	**Second Round of Consultations (public meetings)**			
1	SIDA committee room, Hyderabad	12-08-2021	18	Farmers of Water Course Associations and Farmer Organizations from Left Bank Canals AWB
2	Sanghar	13-08-2021	14	Farmers of Water Course Associations and Farmer Organizations from Nara Canal AWB
3	SIDA Committee room, Hyderabad	24-08-2021	35	Officials from various stakeholders of SWAT. Mainly from Agricultural department, agriculture extension, Sindh Environmental Protection Agency, Forest department, Academia, Fisheries and Civil Society, livestock, SIDA
4	Pano Aqil	23-8-2021	18	Farmers of Water Course Associations and Farmer Organizations from Left Ghotki Feeder Canal AWB
5	Ghotki	24-8-2021	14	Farmers of Water Course Associations and Farmer Organizations from Ghotki Feeder Canal AWB

Details of the participants and photographs of these meetings are given in **Annex 12**.

8.4 Feedback from the Stakeholder

All the participants of the meetings have largely welcomed the Project interventions. The feedback from the initial consultations is summarized in **Table 8.3,** and the feedback from the second round of consultations is summarized in **Table 8.4.**

Table 8.3: Feedback on First Round of Consultation Meetings

Feedback on Project Components	Response/Actions
Component 1: Water Resource Management	
1.1 Policy and Institutional Reforms All stakeholders agreed on developing a succinct water policy that is truly reflective of water needs of different users, including domestic, industrial, and ecological needs. Overall, majority of the institutional stakeholders agreed on the need to revise *abiana*	The project will develop a strong

rate but advised caution over its strategy. Currently, *abiana* is nominal and its collection very cumbersome. Large and medium farmers, especially in upper and middle riparian regions are unlikely to resist incremental increases, but small and subsistence farmers at tail end and industrial users are likely to resist and challenge it. At present, large to medium farmers have advantage as they receive water based on reported acreage rather than usage. This leads to imparity. Some believed that revised water prices would change user behaviour in upper and middle riparian, help reduce wasteful practices that would in turn make water available for tail enders. Stakeholders felt that institutional reforms are long overdue but expressed skepticism that in the past they were not executed successfully. All agreed on the need to devolve management of water bodies to farmers, but at the same time acknowledged that functions, authorities, and responsibilities need to be clearly delineated to avoid duplication. 1.2 Sindh Strategic Water Plan All stakeholders unanimously supported this intervention and recommended to base this plan on existing and future needs of all water users, that encompass agriculture, industrial, domestic and ecological needs. They suggested to undertake broad level stakeholder consultations 1.3 Hydro-Agro Informatics (HAI) Program This intervention was also well received as many stakeholders felt that there are numerous information gaps in data. Getting right information at the right time would help growers, buyers, and relevant government departments take better stock of situation and make informed decisions that benefit all parties. Departments need to be established that can undertake water accounting, monitor demand and supply etc.	extension program for the high value and water-efficient crops that attract subsidies. The project will conduct extensive training programs on the high-efficiency irrigation Strengthening coordination among AWBs, FOs and WCAs Extensive consultation programs with all the relevant stakeholders on the proposed water pricing system The project supports the restructuring of the water and irrigation institutions of the Sindh
Component 2: Water Resource Management	
2.1 Rehabilitation of Selected distributaries – 15 FO Area Development Subprojects Stakeholders were of the view that currently FOs in Nara are most active whereas in other AWBs they remain dormant. In many districts FOs and area engineers do not always meet eye to eye on every matter, there might be minor to medium level conflict in execution of this component. Some stakeholders reported that engineers feel that FOs are not capable enough to undertake modernization project successfully. However, FOs felt that they understand localize problems better and could better mobilize, if they are given proper assistance and resources in time. For this component some stakeholders stressed on developing a strong communication and mobilization strategy as any water storage or regulation project is eyed with skepticism and seen as a tool of control. Middle and tail end FOs of select distributaries need to be taken in absolute confidence 2.2 Capacity building of AWBs, FOs and SIDA There was mixed feedback on the existing roles of the above three water bodies. Stakeholders highlighted that SIDA's scope is limited to three AWBs. It was reported that in the past development of FOs in Nara was outsourced to a third independent	Environmental and social assessment studies for all subprojects to address all potential environmental and social impacts and risks Strengthening coordination among AWBs, FOs and WCAs

party, because of which AWB Nara is perhaps better and FOs there are more functional compared to Ghotki Feeder and Left Bank AWBs. Lessons can be learnt from AWB Nara. However, it was stressed that roles and responsibilities need to be clearly defined of the three water bodies. It was also recommended that training of FOs should be devolved to AWBs and should be demand driven. As for grievances redress system, the top tiered stakeholders believed that they exist, whereas bottom tiered reported that these systems are not very effective. Most of the grievances are related to water availability, especially in water scarce seasons. Component 2.3 Rehabilitation of Akram Wah Canal All institutional stakeholders acknowledge the need for rehabilitation of Akram Wah and recognized that it would improve water supply in the command area significantly. They welcomed the intervention. (P.S: For this component a Resettlement Action Plan has been developed that contains more extensive consultations) Component 2.4 Feasibility studies for Rehabilitation of 3 Main Canals The studies are overdue and welcome, but stakeholders were of the view that implementation and execution of projects on the Right Bank are much difficult because of the tribal nature of the communities	Strengthen the grievance redress system
Component 3: Agricultural Subsidies and Investments	
3.1 Improve last-mile water service delivery Under FO Subprojects at AWB level Institutional stakeholders reported that in successive meetings farmers have repeatedly demanded land-levelling and water course lining. It was reported that 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, washing areas, drinking and bathing ponds for animals. 3.2 Agricultural Subsidies and Investments Mixed reviews were received on this intervention. It was highlighted that GoS is more in favor of across the board subsidies for farm input supplies like fertilizers rather than selective subsidies. It was mentioned that landless and women farmers are unable to get subsidies as subsidies are extended to farmers with land title. As for E-vouchers it was pointed out that it would only be successful if agro dealers, suppliers, and farmers are properly aligned and e-vouchers are timely distributed. It was reported that 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. FOs felt that they can be supported through subsidies to purchase expensive machines and tools (tools that are required for land levelling, etc.). which they can sublet to other farmers/growers by charging some fee 3.3 Developing Agriculture Value Chains	Environmental and social assessment studies for all subprojects to address all potential environmental and social impacts and risks Strengthening coordination among AWBs, FOs and WCAs Strengthen the grievance redress system

Whereas, many believe that Value Chain development is important and that some progressive farmers are making that shift, but cautioned that farmers are likely to grow crops for which there are established markets. They also pointed out that currently sugar, wheat and cotton are cash crops, and one cannot expect large farmers to make a sudden shift to water thrifty crops. They believed that this shift has to be transitional keeping in mind the food security and market uptake. They also stressed the need to align market strategy with high value crops to ensure that famers reap proper benefits. Some stakeholders suggested that developing value chains can also upgrade and expand the scope of female farmers in the agriculture sector, by designing women inclusive value chain projects	

Table 8.4: Feedback from Second Round of Consultations

Issue/Point/ topic	Details of comments/Feedback from the participants	Responses or proposed Actions
Institutional set up in the Irrigation Sector	• Communication channels between AWBs and FOs are weak. AWBs do not hold regular meetings with FOs • SID underestimates the capacity of FOs. Evaluation of rehabilitation/repairs of distributaries and watercourses is done by SID without involving FOs or WCAs. All repair works of water courses should be determined by FOs • Contractors' contracts and bills are in English. They are approved and cleared without consulting FOs or WCAs. The presence of FOs is mandatory to determine terms and conditions of technical repair or rehabilitation works with contractors. Bills should be cleared with approval from FOs • Abiana collected by AWBs has been unutilized for years. In WSIP, for some time, districts with impressive abiana collections were recognized through an award ceremony • Chairmen of FOs usually use their own money to perform official duties • The police do not register water theft cases if reported by FOs. Police ask them to bring a representative of SID to deal with direct outlet and water theft issues. Giving magisterial powers to FO Chairmen to be considered • Warabandi/rotation should be determined in consultation with farmers, including women farmers • FOS and WCAs demanded training and capacity development in abiana collection, bookkeeping, and other financial management training	• Institutional reforms will clearly define roles, responsibilities, and powers of different institutional tiers in the irrigation sector and their coordination with other relevant agencies • Regular elections in AWBs will allow Chairmen from different districts to be nominated • Digitized GRM/complaint system to be introduced to register complaints/grievances and to make it more accountable • Capacity development of FOs to manage modernized structures • More active representation of women farmers in FOs and WCAs in order to get their concerns related to warabandi heard and addressed

Issue/Point/ topic	Details of comments/Feedback from the participants	Responses or proposed Actions
Changes in Water Pricing	• Mid-size to big farmers have no objections to increase in abiana as the existing rates are very nominal. • Increasing abiana would compel farmers in upper and middle riparian districts to give up wasteful practices, allowing the availability of water for lower riparian • 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 • There is a lack of coordination between abiana collection agencies and Land Revenue Department. It has been observed that the Land Revenue Department gives NOC for the sale of land without getting abiana dues cleared	• Safeguards need to be ensured for small and subsistence farmers as well as for shared croppers as abiana is increased. Efforts need to be made to exempt them from the increase • Abiana needs to be charged for overall land acreage rather than reported yields • Increase in abiana legally backed through the provision of law • Digital apps together with other venues to increase the user base and to reduce the cost of collection
Rehabilitation of Akram Wah Canal	• The rehabilitation is welcomed, but drainage considerations need to be ensured • Centuries-old trees along the Akram Wah Canal should be conserved	• Drainage design requirements to be included in the ToRs of consultants/contractors • Consultants/contractors evaluated for drainage design/s • Tree plantation scheme developed and to be undertaken by consultant/contractor
Modernization of distributaries	• FOs are willing to take charge of O&M of the modernized distributaries, but AWBs are not fully agreed on the proposed design • Any modernization structure also needs to be mindful of drainage requirements	• Modernization design to be decided upon with agreement of all stakeholders through inclusive consultations • Drainage design requirements to be included in the ToRs of consultants/contractors • Consultants/contractors evaluated for drainage design/s
Other Water Uses and Structures for Community Betterment	• Women farmers and users want more hand pumps installed in their villages at safe and close locations • Water ponds for animals and washing ghats should be constructed keeping in mind the drainage design • Water storage tanks for minors should be constructed • The drainage outlets should not lead to any fresh water body	• Drainage aspects of water structures mandatory in the design and construction of all water structures
Subsidies and support required in improving Agricultural productivity	• Subsidies should not be general but should be given as per the needs of farmers, like in SAGP project • Subsidies offered in SAGP encouraged communities to transfer land titles to women to avail opportunities in the project • Subsidies in land levelling are highly demanded by farmers across all districts • Farmers do not use smartphones or digital platforms to find new markets or trading opportunities	• Subsidies in the project target high-value and water-efficient crops and improving their value-chain facilities • The subsidies and beneficiaries will be finalized after the extensive consultation process

Issue/Point/ topic	Details of comments/Feedback from the participants	Responses or proposed Actions
Value chain Development	• Profits and policies steer farmers' choices in agriculture. Ever since the government announced the wheat procurement policy, many rice-growing farmers shifted to wheat • Often times the local agricultural produce faces challenges with exports, which lowers the prices and results in losses for farmers • The focus should be on high value/volume agricultural commodities with high demand or underserved markets	• FEGs developed and supported to extend business services for select value chain projects
Making women in agriculture more visible	• There are many more women engaged in the agriculture sector as against the official figures • Women farmers are eager to develop and expand their small businesses, especially in fodder, home-based flour mills, kitchen gardening, livestock and dairy • Women farmers have limited access to smartphones • Women play an important role in keeping water courses clean and clear, as opposed to male FOs' claims that women do not play any role in O&M of water courses • Agriculture cottage industries need to be developed and supported	• Representative sampling and consultation with women in all components of SWAT • Gender indicators developed for each main activity under each component of SWAT • Women FEGs to be trained and developed

8.4.1 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 (Annex 12) from SWAT implementing agencies, AWBs, ILO, UNWomen, and NGOs working in Sindh. The participants were presented with the gender issues highlighted in the gender analysis phase. Their feedback is summarized in Table 8.5.

Table 8.5: 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 to 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 are 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 the majority do not have "form 7" (land title)

8.5 Access to Information

The draft ESMF has been disclosed on the PIU websites, and the final ESMF will also be disclosed on the PIUs and World Bank external websites. The executive summary of the ESMF will be translated into the Sindhi language and will be published on the PIU websites, and hard copies of these documents will be made available at local AWB offices for public access. The ESIA and A/RAP documents to be prepared for proposed subprojects will also be consulted upon and disclosed on the PIU and World Bank external website and made available to the local communities by placing them at local AWB and FO 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 and 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. • Dispose the waste in the approved municipal waste management sites. • 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 modify groundcover and topography changing the surface water drainage	The Contractor shall • Minimize the amount of exposed soil at any one time (only clear vegetation immediately before construction is about to begin) • Install temporary drainage works (channels and bunds) in areas required for sediment and erosion

	patterns of the area including infiltration and storage of stormwater.	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	The Contractor shall • Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds

	stockpiles may contaminate the soils	

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 is (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 considering the environmental sustainability of the sites. • 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.

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

ECP 10: Air Quality Management

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

		• Service all equipment regularly to minimize emissions • Provide filtering systems, duct collectors or humidification or other techniques (as applicable) to the concrete batching and mixing plant to control the particle emissions in all its stages, including unloading, collection, aggregate handling, cement dumping, circulation of trucks and machinery inside the installations
Construction activities	Dust generation from construction sites, material stockpiles and access roads are a nuisance in the 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,	The Contractor shall • Appropriately site all noise-generating activities to avoid noise pollution to local residents • Use the quietest available plant and equipment

	livestock and the natural environment.	• 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 the 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 equipment, materials and human resources. • Do not dump wastes, be it hazardous or non-hazardous into the nearby water bodies or in the river.
Construction activities on the land	The main potential impacts to aquatic flora and fauna River are increased suspended solids from earthworks erosion, sanitary discharge from work camps, and hydrocarbon spills	The Contractor shall • follow mitigation measures proposed in ECP 3: Water Resources Management and EC4: Drainage Management.

ECP 15: Road Transport and Road Traffic Management

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction vehicular traffic	Increased traffic use of the road by construction vehicles	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 Pre-approved regulatory or guidance framework can also be used. Establishment of permit to work systems and provide associated training to the workers • 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 and COVID related aspects as mentioned in ECP 20 • 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 19: 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.

ECP 20: COVID 19 Health and Safety Plan

Item	Good Practices/ Management Guidelines (to be implemented by Contractor/Promoter)
Awareness materials	• Preparation of awareness materials on COVID-19, e.g., signs, posters • Installation of awareness signs at work sites for visibility to workers and the general public
Detection Measures	• Control and document the entry/exit to the work site for both workers and other parties. • Prevent sick workers from entering the site by checking the temperatures of workers and other people entering the site. Require self-reporting prior to entering the site. • All workers to self-monitor their health, possibly with the use of questionnaires, and take their body temperature regularly. • Thermal screening at the workplace to be considered only in the context of a combination of measures for prevention and control of COVID-19 at the workplace and along with risk communication.
Physical Distancing measures	• Keep a distance of at least 1 meter between workers and minimize physical contact, ensure strict control over external access and queue management (marking on the floor, barriers). • Reduce the density of people in the building (no more than 1 person per every 10 square metres), physical spacing at least 1 meter apart for work stations and common spaces, such as entrances/exits, lifts, pantries/canteens, stairs, where congregation or queuing of employees or visitors/clients might occur. • Avoid crowding by staggering working hours to reduce the congregation of employees at common spaces such as entrances or exits. • Implement or enhance shift or split-team arrangements or teleworking. • Minimise the movement of local workers in and out of the site (e.g., avoid workers returning home to affected areas or returning to site from affected areas). • Minimise the workers' contact with the local community.
Respiratory measures	• All workers should wear a face mask. • If a worker is sick, they should not come to work if a member of staff or a worker feels unwell while at work, provide a medical mask so that they may get home safely. • Where masks are used, whether in line with government policy or by personal choice, it is very important to ensure safe and proper use, care and disposal
Hand Hygiene measures:	• Regular and thorough handwashing with soap and water or hand hygiene with alcohol-based hand-rub (a) before starting work, before eating, frequently during the work shift, especially after contact with co-workers or customers, (b) after going to the bathroom, after contact with secretions, excretions and body fluids, after contact with potentially contaminated objects (gloves, clothing, masks, used tissues, waste), and immediately after removing gloves and other protective equipment but before touching eyes, nose, or mouth.

	• Hand hygiene stations, such as hand washing and hand rub dispensers, should be put in prominent places around the workplace and be made accessible to all staff, contractors, clients or customers, and visitors, along with communication materials to promote hand hygiene
Cleaning and Disinfection	• Cleaning and Disinfection off all site facilities, including offices, accommodation, canteens and common spaces: • Cleaning (soap, water, and mechanical action) to remove dirt, debris, and other materials from surfaces. Disinfection of dirty surfaces and objects only after cleaning. • Most common disinfectants – sodium hypochlorite (bleach) of surface at concentration 0.1% or alcohol at least 70% concentration for surfaces which can be damaged by sodium hypochlorite. • Priority disinfection of high-touch surfaces - commonly used areas, door and window handles, light switches, kitchen and food preparation areas, bathroom surfaces, toilets and taps, touchscreen personal devices, personal computer keyboards, and work surfaces. • Disinfectant solutions must always be prepared and used according to the manufacturer's instructions, including instructions to protect the safety and health of disinfection workers, use of personal protective equipment, and avoiding mixing different chemical disinfectants. • Provide appropriate PPEs to the cleaners. • Manage the waste as medical waste, and dispose of it in accordance with local regulations.
Response measures if workers found with COVID-19 symptoms	• Workers who are unwell or who develop symptoms consistent with COVID-19 to stay at home, self-isolate, and contact a medical professional or the local COVID-19 information line for advice on testing and referral (consider telemedicine and flexible sick leave policy). • Standard operating procedures to be prepared to manage a person who becomes sick at the workplace and is suspected of having COVID-19, including isolation, contact tracing and disinfection. • People who were in close contact at the workplace with persons with laboratory-confirmed COVID-19 should be quarantined for 14 days from the last time of the contact in accordance with WHO recommendations. • Set out differentiated procedures for the treatment of sick persons based on the case severity. Pay workers throughout periods of illness, isolation or quarantine. • Set aside a part of worker accommodation for precautionary self-quarantine. • Establish communications with local medical services and refer sick workers to there.
Adjusting Work Practices and Manage Work Related Travels	• Consider changes to work processes and timings to minimize contact between workers (e.g., decreasing the size of work team, changing to a 24-hour work rotation). • Cancel or postpone non-essential travel to areas with community transmission of COVID-19. • Provide hand sanitizer to workers who must travel, advise workers to comply with instructions from local authorities where they are travelling, as well as information on whom to contact if they feel ill while travelling. • Workers returning from an area where COVID-19 transmission is occurring should monitor themselves for symptoms for 14 days and take their temperature twice a day; if they are feeling unwell, they should stay at home, self-isolate, and contact a medical professional.

Communication and Contact With the Community	• Carefully manage the relations with the community with clear and regular communication. • Made aware of the procedures put in place at the site to address issues related to COVID-19. • Practice social distancing with the local community.
Risk communication, training, and education	• Provide posters, videos, and electronic message boards to increase awareness of COVID-19 among workers and promote safe individual practices at the workplace, engage workers in providing feedback on the preventive measures and their effectiveness. • Provide regular information about the risk of COVID-19 using official sources, such as government agencies and WHO, and emphasize the effectiveness of adopting protective measures and counteracting rumors and misinformation. • Special attention should be given to reaching out to and engaging vulnerable and marginalized groups of workers, such as those in the informal economy and migrant workers, domestic workers, subcontracted and self-employed workers, and those working under digital labour platforms. • Train the workers on procedures in place by the project, and their own responsibilities in implementing them.

Annex 2: Environmental Screening Checklist[53]

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

[53] 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):	The guidance for risk-categorisation High-risk: Subprojects that involve complex and large scale civil works. The anticipated impacts are high in magnitude and/or spatial extent, and high probability of serious adverse impacts on sensitive ecosystems and public health. Substantial Risk. Subprojects that involve large-scale civil works. The anticipated impacts are medium in magnitude and/or spatial extent in time. Medium to low probability of impacts on sensitive ecoystems and public health Moderate Risk. Subprojects that involve medium scale civil works, and the impacts are temporary in nature and low in magnitude. The impacts will not be felt beyond the actual footprints of the subprojects

	Low Risk. Subprojects that involve minor civil works and its potential impacts on public health and the environment are likely to minimal and negligible.
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

Type of Proposed Works or Subprojects	**Generic ESMPs**
Earth works for rehabilitation of water courses and drainages and water storages	Table 1 and All ECPs
Construction and rehabilitation of buildings	Table 2 and All ECPs
Construction of any other small-scale civil works	Table 3 and All ACEPs
FO subprojects and High-efficiency irrigation systems, including use of pesticides	Table 4 and All ECPs

Table 1. Generic ESMP for Earth Works

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
Environmental Social Health and Safety (EHS) Staff of the Contractor	• The contractor shall designate an ESHS staff, who will be responsible for coordination with the E&S staff of the PU and CSC and reporting on ESHS aspects • Monthly reporting on the ESHS aspects • Training of workers on the ESHS aspects	ECP 18	Contractor/	PIU CSC
Development of land for the subprojects will lead to soil erosion and sedimentation, and risk of soil pollution	• The development will be carried out within the footprints of the subproject sites without affecting the nearby areas and altering the natural drainages • The drainage from the construction sites will be collected to the sedimentation ponds, and then the clear water will be released. • Install temporary silt fences during construction to slow down and catch any suspended sediments. • Hazardous material should be stored in bunded areas to hold any spills	ECP 2 ECP 5 ECP 6 ECP 7 ECP 8	Contractor/	PIU CSC

Excavation and desilting works may generate spoils.	• The excess earth and spoils should be reused for strengthening existing embankments
	• The excess earth and spoils should be disposed of at the government lands, which are barren and not in any agricultural use.
	• The spoil disposal sites should be selected away from the agriculture and canal areas
	  • Transport and disposal of spoils and designated spoil disposal sites
	  • Proper dumping and adequate compaction to avoid dust and release back to the river
		ECP 1
		ECP 5
		ECP 6
			Contractor/	PIU
				CSC

Tree cutting from construction sites	• Compensatory tree plantation at the rate of 5 new trees for each tree cut		Contractor/	PIU CSC
Generation of waste from the construction sites	• Transport and disposal of waste generated from the work sites and from the workers' camps should be disposed of at the places approved by local union councils or municipalities	ECP 1 and 16	Contractor/	PIU CSC
Wastewater discharges from the construction sites	• Construction of wastewater treatment facilities at the campsite (e.g., septic tank and soak pit) and at the worksites (sedimentation tanks for batching plants and site drainage)	ECP 3 ECP 4 ECP 16	Contractor/	PIU CSC
The potential risk of soil pollution by construction works	• Storage of fuels and chemicals in contained facilities • Cleaning of spilled material immediately	ECP 5 ECP 6 ECP 7	Contractor/	PIU CSC
Increased traffic on the local roads	• Hiring of licensed drivers and operators • Follow speed limits	ECP 15	Contractor/	PIU CSC
Air and noise pollution from construction and traffic	• Avoid night time construction works near the residential areas • Regular maintenance of vehicles	ECP 10 ECP 11	Contractor/	PIU CSC

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
Risk of Infection from Covid-19	• Awareness of workers on the risk of Covid-19 infection • Prevent sick workers from entering the site by checking the temperatures of workers and other people entering the site. Require self-reporting prior to entering the site. • All workers to self-monitor their health, possibly with the use of questionnaires, and take their body temperature regularly.	ECP 20	Contractor/	PIU CSC
Impact on lakes and aquatic habitat due to construction activities	• Control of wastewater and sediment releases to the lakes and canals • No construction sites will be implemented in the lakes that are currently dry	ECP 3 ECP 14	Contractor/	PIU CSC
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/	PIU CSC
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/	PIU CSC
Impacts from the influx of labor from the outside areas	• The hiring of local labour to the extent feasible • A construction camp will be built with all adequate facilities (safe drinking water and sanitation, kitchen, rest areas, recreation) for all outstation workers • 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	Contractor/	PIU CSC
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/	PIU CSC
Workers Health and Safety due to hazards associated with the construction activities	• 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 first aid facilities at the construction sties	ECP 18 ECP 19	Contractor/	PIU CSC
Risk of child labor	• No hiring of workers less than 18 years of age	ECP 15 Annex 8	Contractor/	PIU CSC

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
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/	PIU CSC

Table 2. Generic ESMP for Construction of Buildings

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
Environmental Social Health and Safety (EHS) Staff of the Contractor	• The contractor shall designate an ESHS staff, who will be responsible for coordination with the E&S staff of the PU and CSC and reporting on ESHS aspects • Monthly reporting on the ESHS aspects • Training of workers on the ESHS aspects	ECP 18	Contractor/	PIU CSC
Development of land for the subprojects will lead to soil erosion and sedimentation, and risk of soil pollution	• The development will be carried out within the footprints of the subproject sites without affecting the nearby areas and altering the natural drainages • The drainage from the construction sites will be collected to the sedimentation ponds, and then the clear water will be released. • Install temporary silt fences during construction to slow down and catch any suspended sediments. • Hazardous material should be stored in bunded areas to hold any spills	ECP 2 ECP 5 ECP 6 ECP 7 ECP 8	Contractor/	PIU CSC
Lack of adequate facilities in the proposed building facilities	• The proposed buildings should be designed with an adequate water supply and sanitation facilities • All the facilities should be designed with special attention to disabled and elderly people.	ECP 16	Contractor/	PIU CSC
	• Water efficiency is promoted by sustainable building siting, design, and construction. It could include the collection of rainwater, re-use of water for gardening, etc. • Water-saving equipment, including ultra-low-flush toilets, spray nozzles, urinals, faucet aerators, and low-flow showerheads, infrared and ultrasonic sensors, water spigots, and pressure-control valves.	ECP 3	Contractor/	PIU CSC
Energy Conservation the form of heat and power. Building siting, design, construction	• Installation of a renewable energy system where local conditions permit (e.g. solar water heating, photovoltaic cells) • Reduction of energy consumption associated with heating, ventilation, and air conditioning (HVAC) systems through:		Contractor/	PIU CSC
Wastewater discharges from toilet flushing,	• Construction of septic tanks for the treatment of toilet flushing	ECP 16	Contractor/	PIU CSC

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
Waste Management	• Transport and disposal of waste generated from the work sites and from the workers' camps should be disposed of at the places approved by local union councils or municipalities	ECP 1 ECP 2	Contractor/	PIU CSC
Tree cutting from construction sites	• Compensatory tree plantation at the rate of 5 new trees for each tree cut		Contractor/	PIU CSC
Generation of waste from the construction sites	• Transport and disposal of waste generated from the work sites and from the construction workers should be disposed of at the places approved by the FOs	ECP 1 and 16	Contractor/	PIU CSC
Wastewater discharges from the construction sites,	• Construction of wastewater treatment facilities at the campsite (e.g., septic tank and soak pit) and at the worksites (sedimentation tanks for batching plants and site drainage)	ECP 3 ECP 4 ECP 16	Contractor/	PIU CSC
The potential risk of soil pollution by construction works	• Storage of fuels and chemicals in contained facilities • Cleaning of spilled material immediately	ECP 5 ECP 6 ECP 7	Contractor/	PIU CSC
Increased traffic on the local roads	• The hiring of licensed drivers and operators • Follow speed limits	ECP 15	Contractor/	PIU CSC
Air and noise pollution from construction and traffic	• Avoid night time construction works near the residential areas • Regular maintenance of vehicles	ECP 10 ECP 11	Contractor/	PIU CSC
Sourcing of aggregates for concrete works	• Reuse of excavated material from the construction site to the extent feasible • Source the material from the licensed quarry and borrow sites.	ECP 9	Contractor/	PIU CSC
Impact on aquatic habitat due to construction activities	• Control of wastewater and sediment releases to the lakes and canals • No construction sites will be implemented in the lakes that are currently dry	ECP 3 ECP 14	Contractor/	PIU CSC
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/	PIU CSC
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/	PIU CSC
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/	PIU CSC
Impacts from the influx of labor from the outside areas	• Hiring of local labour to the extent feasible	ECP 16 ECP 17	Contractor/	PIU CSC

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
	• A construction camp will be built with all adequate facilities (safe drinking water and sanitation, kitchen, rest areas, recreation) for all outstation workers • The Contractor will establish a mechanism to collect the complaints from the workers and address those complaints by the approved GRM plan			
Risk of Infection from Covid-19	• Awareness of workers on the risk of Covid-19 infection • Prevent sick workers from entering the site through checking temperatures of workers and other people entering the site. Require self-reporting prior to entering the site. • All workers to self-monitor their health, possibly with the use of questionnaires, and take their body temperature regularly.	ECP 20	Contractor/	PIU CSC
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/	PIU CSC
Workers Health and Safety due to hazards associated with the construction activities	• 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 first aid facilities at the construction sties	ECP 18 ECP 19	Contractor/	PIU CSC
Risk of child labor	• No hiring of workers less than 18 years of age	ECP 15 Annex 8	Contractor/	PIU CSC
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/	PIU CSC

Table 3. Generic ESMP for Small-Scale Civil Works

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
Environmental Social Health and Safety (EHS) Staff of the Contractor	• The contractor shall designate an ESHS staff, who will be responsible for coordination with the E&S staff of the PU and CSC and reporting on ESHS aspects • Monthly reporting on the ESHS aspects	ECP 18	Contractor/	PIU CSC

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
	• Training of workers on the ESHS aspects			
Development of land for the subprojects will lead to soil erosion and sedimentation, and risk of soil pollution	• The development will be carried out within the footprints of the subproject sites without affecting the nearby areas and altering the natural drainages • The drainage from the construction sites will be collected to the sedimentation ponds, and then the clear water will be released. • Install temporary silt fences during construction to slow down and catch any suspended sediments. • Hazardous material should be stored in bunded areas to hold any spills	ECP 2 ECP 5 ECP 6 ECP 7 ECP 8	Contractor/	PIU CSC
Tree cutting from construction sites	• Compensatory tree plantation at the rate of 5 new trees for each tree cut		Contractor/	PIU CSC
Generation of waste from the construction sites	• Transport and disposal of waste generated from the work sites and from the construction workers should be disposed of at the places approved by the FOs	ECP 1 and 16	Contractor/	PIU CSC
Wastewater discharges from the construction sites	• Construction of wastewater treatment facilities at the campsite (e.g., septic tank and soak pit) and at the worksites (sedimentation tanks for batching plants and site drainage)	ECP 3 ECP 4 ECP 16	Contractor/	PIU CSC
The potential risk of soil pollution by construction works	• Storage of fuels and chemicals in contained facilities • Cleaning of spilled material immediately	ECP 5 ECP 6 ECP 7	Contractor/	PIU CSC
Increased traffic on the local roads	• The hiring of licensed drivers and operators • Follow speed limits	ECP 15	Contractor/	PIU CSC
Air and noise pollution from construction and traffic	• Compliance with NEQS on vehicle and machinery emissions and ambient noise	ECP 10 ECP 11	Contractor/	PIU CSC
Risk of Infection from Covid-19	• Awareness of workers on the risk of Covid-19 infection • Prevent sick workers from entering the site by checking the temperatures of workers and other people entering the site. Require self-reporting prior to entering the site. • All workers to self-monitor their health, possibly with the use of questionnaires, and take their body temperature regularly.	ECP 20	Contractor/	PIU CSC
Sourcing of aggregates for concrete works	• Reuse of excavated material from the construction site to the extent feasible • Source the material from the licensed quarry and borrow sites.	ECP 9	Contractor/	PIU CSC
Impact on aquatic habitat due to construction activities	• Control of wastewater and sediment releases to the river/canal/lakes •	ECP 3 ECP 14	Contractor/	PIU CSC

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
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/	PIU CSC
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/	PIU CSC
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/	PIU CSC
Impacts from the influx of labor from the outside areas	• The hiring of local labour to the extent feasible • A construction camp will be built with all adequate facilities (safe drinking water and sanitation, kitchen, rest areas, recreation) for all outstation workers • 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/	PIU CSC
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/	PIU CSC
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/	PIU CSC
Risk of child labor	• No hiring of workers less than 18 years of age	ECP 15 Annex 8	Contractor/	PIU CSC
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/	PIU CSC

Table 4. FO Subprojects on Agriculture and High-efficiency irrigation Systems

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
Soil erosion may result from poor crop cover after land preparation and lack of soil conservation structures on sloping land planted with annual crops	Soil loss prevention practices include appropriate use of the following techniques: • Practice reduced and zero tillage, as well as direct seeding and planting, to minimize damage to soil structure, conserve soil organic matter, and reduce soil erosion. Consider contour and strip planting, terracing, intercropping with trees, and grass barriers in sloping areas. • Minimize soil compaction, damage, or disturbance by using appropriate land preparation machinery at the right time of year. • Consider a crop rotation program to maintain the soil coverage during the year. • Manage soil organic matter by returning crop residues or adding compost and manures whenever available and economically viable. • Plan soil preparation when weather conditions pose the lowest risk of causing environmental damage. • Consider erosion management practices (e.g., contour and strip planting, terracing, discontinuous trenching, intercropping with trees, and grass barriers) in sloping areas. The following approaches are recommended to maintain soil productivity over the long term: • Cultivate crops that are suited or adapted to the local climate and soil conditions and adopt good agronomic practices3 to optimize crop productivity. • Develop and implement a soil monitoring and management plan that includes soil and terrain mapping and erosion risk identification. • Conduct regular surveys to monitor soil structure and chemistry in order to identify areas where remedial action is required. • Recycle and/or incorporate organic materials (e.g., crop residues, compost, and manures) to replenish soil organic matter and improve soil water-holding capacity whenever available and economically viable. • Minimize the use of pesticides by implementing a pest and disease early-warning system, by using biological pest and disease control methods, and by implementing control measures before outbreaks require large-scale control. • Follow good practice irrigation guidance to avoid negative impacts on soil productivity.	ECP 5 ECP 6 ECP 7	Contractor/	PIU CSC
Nutrient management strategies should aim to maintain and/or improve soil fertility and optimize crop yield while minimizing	• Consider the use of green manures, cover crops, or mulching techniques to maintain soil cover, reduce the loss of nutrients, replenish soil organic matter, and capture and/or conserve moisture. • Plan a crop rotation program to incorporate nitrogen-fixing legume crop plants and cover crops in the cropping cycle.	ECP 5 ECP 18	Contractor/	PIU CSC

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision

off-site environmental impact (e.g., contamination of groundwater resources and eutrophication of surface water resources from surface runoff and leaching of nutrients).	• Draw up balanced fertilizer programs for each soil management unit based on mapped fertility results, history of crop performance, soil and leaf analysis, and crop assessment.
	• Time the application of crop nutrients to maximize uptake and minimize nutrient runoff or volatilization.
	• Assess soil pH periodically and apply soil amendments (e.g., agricultural lime) to correct changes in soil pH, as required, to ensure that nutrients are available for plant uptake.
	• Conduct periodic soil analysis to detect changes in soil fertility, inform decisions on fertilizer application rates, and avoid unsustainable nutrient depletion and over-fertilization.
	• Establish and respect setbacks from watercourses—including appropriate buffer zones, strips, or other "no-treatment" areas along with water sources, rivers, streams, ponds, lakes, and ditches—to act as a filter for potential nutrients runoff from the land.
	• Select and maintain fertilizer application equipment to ensure desired application rates are used and over broadcasting of solid fertilizers as well as over spraying of liquid fertilizers are minimized.
	• Implement nutrient planning, monitoring, and documentation, which includes the use of a fertilizer logbook to record the following information:
	  • Dates of purchase, dates of use, amount of fertilizer and nutrient used (kg/ha), purpose of use, and crop growth stage.
	  • Weather conditions before, during, and after application.
	  • Methods used to minimize nutrient loss (e.g., incorporation into the soil, split applications, irrigation after application).
	• Ensure that all personnel are trained in and use appropriate management procedures for the storage, handling, and application of all types of fertilizers, including organic wastes.
	• Personal Protective Equipment (PPE) should be used according to the Safety Data Sheets (SDS) of the product or according to a risk assessment of the fertilizer product. SDS should be available at each management unit.			

Crop Residue and Solid Waste Management	• In all annual cropping systems, residues (leaf material, roots, and other plant parts) can be recycled beneficially to improve soil organic matter and soil structure, as well as to reduce soil loss. These residues are valuable sources of organic matter and carbon and can lead to the extended release of nutrients during the development (growth) phase of the next crop cycle. • Recycle residues and other organic materials by leaving the materials on site or through composting (and spreading). • Consider using crop residues for other beneficial purposes—such as animal feed, bedding, or thatching—when leaving residues in the field is neither practical nor appropriate.		Contractor/	PIU CSC
Water Management	• Determine rain or water irrigation requirements of the crop, based on internationally recognized guidelines, while recognizing seasonal variations and regional norms. When irrigation is practiced,	ECP 5 ECP 7	Contractor/	PIU CSC

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision

Water management for annual crop production should aim to conserve the quantity and quality of water resources while optimizing crop yield	• develop an appropriate irrigation plan and schedule, and monitor consumption and regularly compare with these targets, which should be based on available supplies of water
	• Maintain soil structure and soil organic matter. The use of crop residues and mulches will assist in maintaining soil organic matter levels, retaining soil humidity, and reducing surface evaporation.
	• Where applicable, maximize the retention of rainwater through appropriate "rain harvesting" techniques, which may include:
	  • Diverting water flow from roads and paths toward crops, thus storing water in the soil and reducing the effect of short dry spells.
	  • Storing runoff from rainy periods for use during dry spells by using tanks, ponds, cisterns, and earth dams.
	  • Maintaining protective vegetation in canals and drainage systems to reduce canal bank scouring and slow runoff.
	• When irrigation is used, implement irrigation water conservation techniques, such as:
	  • Whenever feasible, adopt water-efficient irrigation systems, such as micro-sparing, drippers, and fertigation.
	  • Consider the soil infiltration capacity to select the best irrigation system and avoid the runoff of water.
	  • Ensure regular maintenance of the irrigation system, as well as that of its associated channels and infrastructure.
	  • Maintain a water management logbook that records the time and quantity of rainfall evaporation, as well as the amount of irrigation applied and soil moisture levels (%), in order to verify both that irrigation is being used according to crop need and to develop an understanding of long-term trends in water use.
	  • Reduce evaporation by avoiding irrigation during periods when evaporation is elevated (e.g., in periods of higher temperatures, reduced humidity, or high winds). Use trickle or drip irrigation techniques, if practical.
	  • Reduce evapotranspiration by using shelterbelts and windbreaks.
	  • Reduce seepage losses in supply channels by lining them or using closed pipes.
	  • If herbicides are used, ensure they are applied at the appropriate time of year to most effectively control undesirable vegetation and reduce its water consumption.
	• The following measures are recommended to prevent and control the contamination of water sources:
	  • Avoid over-irrigation, which may result in the leaching of nutrients and contaminants.
	  • Ensure appropriate soil moisture by active monitoring of soil humidity.
	  • Establish and respect setbacks and buffer zones in riparian areas. Buffer widths should be based on the specific risk, land management regime, and slope of the area.			

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
Pest Management The primary aim of pest management should not be to eradicate all organisms but to manage "pests," including insect pests, diseases, and weeds that may negatively affect plantation crops so that they remain at levels beneath an economically and environmentally damaging threshold.	• Identify the main pests affecting crops in the region, assess the risks to the operation, and determine whether a strategy and capacity is in place. • Where possible, apply early-warning mechanisms for pests and diseases (i.e., pest and disease forecasting techniques). • Select resistant varieties and use the cultural and biological control of pests, diseases, and weeds to minimize dependence on pesticide (chemical) control options. Favour manual, mechanical weed control and/or selective weeding. • Employ mechanical controls—such as traps, barriers, light, and sound—to kill, relocate, or repel pests. Use pesticides to complement these approaches, not replace them. Pesticide Use • Ensure that any pesticides used are manufactured, formulated, packaged, labelled, handled, stored, disposed of, and applied according to the FAO's International Code of Conduct on Pesticide Management • Do not purchase, store, use, or trade pesticides that fall under the World Health Organization's (WHO) Recommended Classification of Pesticides16 by Hazard Classes 1a (extremely hazardous) and 1b (highly hazardous), or Annexes A and B of the Stockholm Convention. • Do not use pesticides listed in WHO Hazard Class II (moderately hazardous), unless the project has appropriate controls established with respect to the manufacture, procurement, or distribution and/or use of these chemicals. These chemicals should not be accessible to personnel without proper training, equipment, and facilities in which to handle, store, apply, and dispose of these products properly. • Preferentially, use selective pesticides, where appropriate, rather than broad-spectrum products to minimize impacts on non-target species. Pesticide Storage • Store all pesticides in a lockable, bunded container or store that has sufficient space in which to capture any spills without contaminating the environment. Stores should be set away from water sources, residential and built-up areas, as well as livestock and food storage areas. • Procure spill kits and institute suitable control measures in case of accidental spillage. • Store all pesticides in their original, labeled containers and ensure that storage instructions are followed. • Keep a register of all pesticides procured, recording when they were received, the amount used, the amount remaining in store, and their location. • Warehouses must have appropriate ventilation, secondary containment, and emergency showers and kits.	ECP 2 ECP 18	Contractor/	PIU CSC

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision

	Handling
	• Operators must read, understand, and follow product label directions for mixing, safety, application, and disposal; use trained personnel for critical operations (e.g., mixing, transfers, filling tanks, and application).
	• Insist that correct PPE (e.g., gloves, overalls, eye protection) for each exposure route18 listed in the Safety Data Sheets (SDS) be worn at all times when handling and applying pesticides.
	• Mandate that any mixing and filling of pesticide tanks occur in a designated filling area.
	• This should be set away from watercourses and drains.
	  • If on concrete, water should be collected in a separate sump and disposed of as a hazardous waste.
	  • Ensure that spills are cleaned up immediately using appropriate spill kits; spills should not be washed away into watercourses or drains.
	
	Application
	• Give preference to the application method with the lowest EHS risk and ensure non target organisms are not affected.
	• Select pesticide application technologies and practices designed to minimize off-site movement or runoff (e.g., low-drift nozzles, using the largest droplet size and lowest pressure that are suitable for the product).
	• Establish buffer zones around watercourses, residential and built-up neighborhoods, as well as livestock and food storage areas.
	• Ensure that all equipment is in good condition and properly calibrated to apply the correct dosage.
	• Insist that applications occur under suitable weather conditions; avoid wet weather and windy conditions.
	
	Disposal
	• Any unused dilute pesticide that cannot be applied to the crop, along with rinse water, and out-of-date or no-longer approved pesticides, should be disposed of as a hazardous waste, as per FAO guidelines.
	• Empty pesticide containers, foil seals, and lids should be triple rinsed, and washings used in the pesticide tank should be sprayed back onto the field or disposed of as hazardous waste in a manner consistent with FAO guidelines and according to the manufacturer's directions. Containers should be stored safely and securely under cover prior to their safe disposal; they should not be used for other purposes.			

Fertilizers	• Store fertilizers in their original packaging and in a dedicated location that can be locked and properly identified with signs, access to which is limited to authorized persons.	ECP 2 ECP 18	Contractor/	PIU CSC

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
	• Ensure that SDS and inventories are available at fertilizer storage facilities and available to first responders when necessary. • Only purchase and store minimal fertilizer requirements, and use older fertilizers first. • Keep fertilizer stores separate from pesticides and machinery (e.g., fuels, ignition, or heat sources). • Know and understand each crop's fertilizer requirements and only apply what is required, when it is required, to minimize losses to the environment. • Implement a suitable training program for personnel that are transporting, handling, loading, storing, and applying fertilizers			
Energy Use Energy is used in annual crop production for site preparation, cultivation, management, irrigation, harvesting, transport, lighting, heating, cooling, and ventilation	• Select energy-efficient machinery and equipment (e.g., tractors, ventilation systems, drying and storage systems, cooling devices) and consider on-board fuel-use monitors. • Consider implementing training programs to make operators aware of energy-efficient practices when using machinery (e.g., switching off engines when waiting to load) and when driving. • Irrigation energy use can be significant: the following techniques are recommended for efficient use of energy in irrigation systems: • Develop an irrigation plan that is appropriate for climate, season, soil conditions, plant materials, and grading. This plan should include optimum scheduling, monitoring, and recording systems so that energy usage and efficiencies can be examined. An irrigation logbook or database should be maintained so that quantitative measures are recorded (e.g., kWh electricity per cubic meter applied, fuel usage as liter per cubic meter applied). • Regularly maintain the irrigation system and associated infrastructure, such as supply channels and water storage. • Select efficient pumps. •Ensure properly matched pumps, systems, and power sources by keeping a good record of the amount of water pumped and the energy used to ensure suitability.		Contractor/	PIU CSC
Air quality impacts	• Avoid open burning for land preparation, weed control, and post-harvest treatments. Evaluate controlled burning in energy production facilities to extract thermal energy for beneficial use. Where burning is unavoidable, potential impacts should be identified and weather conditions monitored to schedule burning in an effort to minimize impacts. • Prohibit burning of pesticide-treated agricultural wastes and by-products (e.g., pesticide containers) to avoid unintended emissions of persistent organic pollutants (POPs). • Reduce the risk of fire by reducing the build-up of potential groundcover fuel sources and controlling weeds and invasive species. Where controlled burns of residues are necessary, ensure optimal conditions for the low risk of spread and low impact on existing air quality. • Modify field operations where possible (e.g., reducing the number of in-field passes with machinery, reduced tillage operations, or improved logistics to minimize travel distances). • Modify timing of operations, where possible, to coincide with favorable atmospheric conditions and reduced risk of air pollution.	ECP 10 ECP 15	Contractor/	PIU CSC

Impact	Mitigation Measures	Relevant ECPs	Responsible for Implementation	Responsible for Supervision
	• Establish cover crops where possible; retain residues, and reduce tillage intensity to avoid dust and soil degradation due to wind erosion. Where water supplies are ample, water application to cropped areas and access roads may reduce the risk of airborne dust. • Establish natural wind barriers—such as vegetative field borders, hedgerows, herbaceous wind barriers, and tree/shrub establishment—to intercept airborne particulate matter and droplets, which may also include contaminants.			
GHG Emissions	• Where feasible, consider using renewable energy (e.g., solar, wind, biofuel) for crop drying or to power irrigation pumps. • Drain water from wetland rice soils during the growing season to reduce methane emissions		Contractor	PIU CSC
Pesticide treated seeds	• Use agricultural inputs (seeds) purchased for the project will not be treated with pesticides to prevent and ingestion and related human health impacts		FOs	PIU CSC

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 will be assessed during the screening exercise, and it is estimated that these studies will be carried out with in 2 months for each subprojects. 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

The key staff and their qualification requirements for carrying out the studies 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 and B 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 and B 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	Location	Frequency	Responsibility Implementation
Irrigation Flows	Visual observations to ensure canal flows are not blocked	At cross-regulators	Monthly	Contractor
Erosion	Visual inspection of erosion prevention measures and the occurrence of erosion	All sites	Monthly	Contractor
Wastewater discharges from batching plants, and campsites	Spot measurement for pH Visual inspection to ensure clear water leaving the site	batching plant discharges	Weekly	Contractor
	Sampling and analysis of wastewater discharges for the parameters given in SEQS	3 sites (including batching, camp discharges)	Quarterly	Contractor
Surface water quality	Visual inspection of the presence of petroleum products.	All sites	Monthly	Contractor
Air Quality (dust)	Visual inspection to ensure good standard equipment is in use and dust suppression measures (spraying of waters) are in place.	All sites	Daily	Contractor
	Visual inspection to ensure dust suppression work plan is being implemented	All sites	Daily	Contractor
Ambient Air Quality	Air quality monitoring for 24 hours for the parameters specified in SEQS	At 3 sites	Quarterly	Contractor
Noise and vibration	24-hour noise monitoring (at/near construction sites, campsites, offices, colony, communities, quarry area, transportation routes)	At 6 sites	Quarterly	Contractor
Emissions from plant and equipment	Visual Inspection	All vehicles	Monthly	Contractor
Waste Management	Visual inspection on spoil disposal	At disposal sites	Monthly	Contractor
	Availability of dust bins at worksites and camp	At camp and work sites	Monthly	Contractor
	Collection and treatment of organic waste	At campsite	Monthly	Contractor
	Collection and treatment of recyclable and hazardous	At camp and work sites	Monthly	Contractor

Parameter	Means of Monitoring	Location	Frequency	Responsibility Implementation
	waste by the waste management contractor			
Operation of borrow sites	Visual inspection of borrow sites	At borrow sites	Monthly	Contractor
Spoil disposal sites	Visual inspection of spoil disposal sites	At spoil disposal sites	Monthly	Contractor
Tree plantation	Visual inspection to ensure plantations are growing well (5 trees to be planted for each tree uprooted)			
Spills from hydrocarbon and chemical storage	Fuels are stored in contained facilities Availability of spill kits at the site Visual Inspection for leaks and spills	At fuel storage sites	Monthly	Contractor
Traffic Safety	Placement of traffic signs and traffic control personnel	Near the construction sites	Monthly	Contractor
Local Roads	Visual inspection to ensure local roads are not damaged	Local roads	Monthly	Contractor
Cultural and Sites	Visual observation for cultural sites	Along the local roads	Monthly	Contractor
Drinking water and sanitation	Water quality analysis for drinking water parameters specified in SEQS	At the campsite	Quarterly	Contractor
Safety of workers	Usage of Personal Protective equipment Safety audits	All worksites	Daily	Contractor
Labour engagement and GBV risks	Interaction with labours and review of GRM Record of training	All work sites	Monthly	Contractor
Workers Camps	Visual observation of the camp facilities and their maintenance	At campsite	Monthly	Contractor
Reinstatement of Work Sites	Visual Inspection	All worksites	After completion of all works	Contractor
Pesticide Use	Changes in Pesticide Use	In project districts	After completion of works	Agriculture Department
Seed Purchase	Use agricultural inputs (seeds) purchased for the project will not be treated with pesticides to prevent and ingestion and related human health impacts	In project districts	After completion of works	Agriculture Department

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: 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		
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
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 2.4: Right Bank Studies and Emergency Works		
- 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 2.3: Left Bank Main Canals Infrastructure		
– 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 2.1: Integrated FO Area Agriculture Development -SIDA		
– 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	- # of women trained in different aspects (including preventive) O&M requirements of new structures - # of women directly engaged in O&M of water structures

Project Activities	Gender Action Outputs	Indicators and Targets
	women in water resource management	
Component 2.2: 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 - Gender mobilization strategy developed	- # of suggestions/complaints made by women (record maintained) - # of suggestions/complaints made by women addressed - # of women in AWBs, FOs, WUAs
Component 3: Agriculture Investments		
Component 3.3: Improving Agriculture Information and Technology		
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 3.4: 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
Component 3.1: Integrated Farmer Organization Area Development - AWB		
Improving On-Farm Water Management	- Women consulted for their views on proposed component and their potential role	- # of women engaged in on-farm water management - # of women trained in O&M of on-farm water management investments

Project Activities	Gender Action Outputs	Indicators and Targets
	- Women's capacity developed in on-farm HEIS management - Improved health with increased capacity to manage water storage ponds	- 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 Monitoring		
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 Procedures

1. Introduction

This Labor Management Procedure (LMP) describes the requirements of Implementing Agencies (IAs) with regard to labor and working conditions, as applicable to each of the IAs, during the implementation phase of the proposed Project. It aims to guide the management and control of activities that may pose labor-related risks. This LMP sets out potential impacts and consequences related to labor terms and conditions and describes how they will be mitigated. The IAs will use commercially reasonable efforts to require contractors, or other intermediaries procuring labor, to apply these procedures provided in this document.

The objectives of this LMP are to:

- Publicize labor policies as a frame of reference for the personnel who will participate in the Project;
- Guarantee compliance with labor regulations for all Project participants, whether they are direct workers or not, generating the appropriate working conditions in compliance with applicable regulations;
- Guide the participating IAs staff who will participate in the Project in implementing Labor Management Procedures;
- Promote fair and equitable labor practices for the fair treatment, non-discrimination and equal opportunity of male and female workers;
- Establish, promote and manage a healthy management -worker relationship;
- Protect project workers, including vulnerable workers such as women, persons with disabilities, children (of working age, in accordance with this ESS2) and migrant workers, contracted workers, community workers and primary supply workers, as appropriate;
- Provide project workers with accessible means to raise workplace concerns.

The LMP has been developed by the IAs to manage risks under SWAT funded by World Bank. The LMP sets out the project's approach consistent with national requirements as well as the objectives of the relevant World Bank's Environmental and Social Standards on Labor and Working Conditions (ESS2).

The LMP describes the main labor requirements and risks associated with the Project, and helps the IAs of SWAT to determine the resources necessary to address labor issues. The LMP is a living document, which has been initiated early in project preparation, and will be reviewed and updated throughout development and implementation of the Project. Accordingly, this document lays out the type of workers likely to be deployed by the Project and how the workers will be managed. Key aspects of the LMP will be incorporated into contractual obligations of contractors and sub- contractors. All contractors and sub-contractors will be required to prepare and implement labor management plans consistent with the LMP.

2. Overview of Labour Use in the Project

According to ESS2, the categories of labors relevant to the project are

- Direct Workers: People employed or engaged directly by the IAs to work specifically in relation to the Project;
- Contracted Workers: People employed or engaged through third parties to perform work related to core functions of the project, regardless of location;
- Primary Supply Workers. People employed or engaged by the borrower's primary suppliers.

Direct workers

The Project's direct workers are those employed directly by IAs to work specifically in relation to the Project. Direct workers will include the project-based staff and the permanent staff of the PCMU and Project Management Units (PMUs) for implementing a wide range of the project's activities. The staff of the Units will be composed, among others, of a Project Director (PD), Environment and Social Specialists, a Social and Gender specialist, a Financial Management Specialist and a Procurement Specialist. The IAs will employ consultants and support staff who will be working on contractual bases as part of the PCMU and PMUs. Terms and conditions of these consultants will be guided by the national and provincial labor Laws. The consultants will be engaged by the Project to undertake short period assignments as necessary. The health and safety requirements provided in this LMP will also apply to civil servants who will be seconded in to support the project implementation.

Contracted Workers

IAs will involve different contractors for carrying out preparation of documents and implementation of different civil works under the Project. SWAT's contracted workers include the consultants preparing the project/sub-project's feasibility study and detail design; consultant for preparation of ESIA/ESMP/RAP, Construction Supervision Consultant (CSC), Independent Environmental and Social Monitoring Consultant (IEMC), construction contractors and subcontractors and their workers. Civil work contractors and workers include skilled and non-skilled workers. The different categories of anticipated contracted workers are presented below.

Skilled permanent staff of the contractors (engineering firm): The permanent technical staff of the contractors will be engaged in the Project, including project managers, site engineers, construction foreman, environmental social health and safety (ESHS) officer, administrative and finance officers for the project/subprojects.

Skilled workers engaged by sub-contractors/subcontractors: Depending on the requirements of expertise for each type of sub-project and activities, contractors will mobilize their relevant workers to meet Project requirements. The works requiring skilled workers may include drivers, operators of heavy machines for dredging or excavation, piling, hauling, road roller/soil compaction, sand/quarry loading, and grader/excavation, and structural houses. The workers will be expected to have expertise relevant to the required works. The skilled workers may include both local and migrant workers.

Unskilled community members engaged by the contractor/subcontractors: It is expected to reduce large number of migrant workers at sites. The subprojects will be designed to maximize the employment generation through engaging local labors as unskilled workers especially in simple works such as construction of ancillary works, walls, excavation/leveling, loading/unloading materials, supporting for builders, site cleaners, watering working sites. To ensure equal opportunities in employment, the contractor will be contractually required to coordinate with IAs to prioritize the affected communities and vulnerable groups, including female workers and labors with disabilities at their desire.

Design Consultant. Consultants will be engaged by IAs to provide services of preparation of feasibility study (FS) and detailed design for the civil works under the Project. The procurement process for the consultant team will start during sub-project preparation, but the consultant will be on board in the early stage of project implementation. The FS and detailed design consultant will support IAs until the approval of the FS and detailed design for each sub-project.

Construction Supervision Consultant: A construction and supervising consultant will be engaged by IAs to provide day-to-day construction oversight for the civil works. The procurement process for the

consultant team will start during subproject preparation, but the consultant will be on board in the early stage of project implementation. The construction and supervision consultant will support IAs until the completion of the civil works.

Independent Monitoring Consultants: Independent Monitoring Consultants for environment and for social issues are planned to be engaged by IAs. Independent monitoring consultants are responsible to ensure compliance with approved plans and programs related to environmental and social issues. The independent monitoring consultants will be engaged at the beginning of the implementation period and will complete their works from 6 months to 1 year after all resettlement/environmental activities have been satisfactorily completed.

Primary Supply Workers

The project, on an ongoing basis, will source directly goods or materials essential for the core functions of the sub-projects.

Number of Project Workers

Direct Workers. The estimated number of direct workers is not yet defined, but there are likely to be 20-25 people employed by each IA. The staff of the PCMU as described in sub-section 2.1 will be composed, among others, a PD, technical engineering staff, safeguard specialists, gender specialist, a financial management specialist and a procurement specialist. Direct workers will carry out key functions such as coordination, fiduciary, environmental and social management, monitoring and evaluation, and reporting.

Contracted Workers. The precise number of Project workers to be employed are not known as of now. This will become known as and when implementation begins.

Civil Works Contractors/ Community Workers/Supply Workers. The project will support subproject investments. The number of workers expected to be associated with each of the subprojects will be dependent upon the nature of subproject. Thus, the total number of civil works contract workers is yet to be established.

Workforce Characteristics

Direct Workers for most positions will be qualified professionals. Contractors will include firms with qualified and semi-skilled labor. Third party contracts will be awarded to hire semi-skilled and un-skilled labor in rehabilitation of Akram Wah Canal and would mostly require on-site engagement. Modernization of distributaries and lining of water canals will engage community workers too.

Timing of Labor Requirements

Direct Workers: The direct workers under the project will generally be required full time for all components and around the year during the project implementation.

Contract Workers: Based on the scope of works involved in the Project, the PCMU and PMUs will employ contractors who will hire contracted workers based on their level of skills and sub-project needs. The LMP is developed at this stage of the project although the scale and exact locations of Project activities to be implemented under this component have not yet determined. Details of the timing of the number of labor requirement, frequency, types of job and time of the requirement will be determined when the relevant feasibility studies as well as environmental and social studies are conducted during the detail design phase and results will be updated in this LMP. Similarly, it will also be incorporated in the contractor's LMP which will be prepared as the requirement of Construction Phase Environmental and Social Management Plan (C-ESMP).

Primary Supply Workers. The number of primary supply workers will be known at the time of procurement

3. Assessment of Key Potential Labour Risks

The main labor risks associated with the SWAT are assessed to be related to the potentially hazardous work environment, the associated risk of accidents and incidents at the work place, child labor and forced labor, labor influx and associated community health and safety risks, including Sexual Exploitation and Abuse (SEA)/Sexual Harassment (SH) risks and the capacity of the implementing agencies to manage and mitigate the E&S risks and the context under which the Project is being implemented.

Occupational Health & Safety Risks

The health and safety risks which could impact the project staff including PMUs, consultants and contractor workers are associated with the civil works and operation activities of the project. In particular, the various risks of injuries and accidents for workers, related to the rehabilitation and modernization works is associated with the risk of, physical hazards of using the equipment, the risk of tripping and falling, electric shock, burns, falling objects, exposure to hazardous materials and dust inhalation.

Hence, it is very important to identify hazards, manage identified risks to offset workers' health and safety risks. It is also anticipated that such a proactive approach to risk management will result in massive cost savings, and a reduction in compensation claims as well as noncompliance with health and safety legislation.

Labor related risks will be minimized by following the mitigation hierarchy which included (i) hazard elimination (ii) substitution of process, substance or tool (iii) prevent contact with the risky object i.e., create barrier, install guards (iv) implementation of safe system of work such as permit to work system, putting time limits on performing a hazardous activity and (v) use of appropriate personal protective equipment. To ensure a safe and healthy workplace, PMUs will take reasonable care to identify all the foreseeable health and safety hazards, which could harm their employees or other persons in the workplace. Hazards may arise from the work process, the equipment and materials in use, the work environment, or other people involved.

The Project will ensure compliance with occupational health and safety provisions. All contractors will be required to provide detailed information on their occupational health and safety management plan as part of their offers. The relevance of these safety provisions will be part of the criteria used by the Procurement Committee to select the contractors. All contractors will be required to ensure workers will use safety gears (personal protective equipment or PPE), receive safety training and other preventive actions as provided in the WB OHS Guidelines and environment as per requirements of ESS2. Safety is the responsibility of both the employer and employee.

Child labor

When construction activities involve hazardous work, people under the age of 18 will not be employed on the project, except possibly in offices or jobs other than construction. To confirm that workers below the age of 18 years are not hired to work on the project, workers will need to provide legally recognized documents such as Computerized National Identity Card (CNIC). However, if other labor-related risks arise during project implementation, the PMU will develop procedures to prevent other impacts. This will

include awareness raising sessions which will be conducted regularly to the communities to sensitize on prohibition and negative impacts of child and forced Labor.
The above social impact is assessed to be low as: (i) local labor will prioritized to use for construction activities, at the same time measures to control the age of hired workers will be taken; (ii) the contractor/subcontractors shall not hire child labor for the project-related jobs as commitment not to use child labor is one of the required conditions in the bidding documents; (iii) workers will be trained on labor safety, traffic safety, sanitation before starting any civil works; (iv) PMU staff in charge of contractor supervision will monitor and report the absence of forced labor.

Labor Influx

The focus of the Project will be to localize the economic benefits with minimal opportunities for outside labor to service work that require specialized/skilled labor that is not present in project localities. A large scale of labor influx is not expected due to the availability of local labor supply in the province and scale of works anticipated under the Project. However, according to the initial consultation with key staff of project provinces, except for a number of skilled workers will be mobilized for rehabilitation at Akram Wah. Majority of workers may will be sourced locally or from nearby districts within the province. The priority for local labor (dependent on skill, experience capacity) is expected to minimize the risk of influx, where there is a requirement for special skills. Specific requirements to manage risks associated with labor influx, related to the interaction between project workers and local communities will be managed through contractual requirements, code of conduct and training set out in this document.

Labor disputes over terms and conditions of employment

Labor disputes in a new construction environment are inevitable. Likely causes for labor disputes include demand for limited employment opportunities; labor wages rates and delays of payment; disagreement over working conditions; and health and safety concerns in work environment. In addition, employers such as contractors/subcontractors may retaliate against workers for demanding legitimate working conditions, or raising concerns regarding unsafe or unhealthy work situations, or any grievances raised, and such situations could lead to labor unrest. However, implementing the project policy on sound labor treatment in accordance with ESS2, project contractors/subcontractors will be required to provide their labor with information on the employment, while negotiating to reach a consensus on terms and conditions of employment with the laborers before signing labor contract for implementation. Monitoring the compliance with implementation of the terms of work conditions that have been signed labor contract of both sides and implementing the GRM for laborers will be the effective mitigation measures to address the labor disputes during the project implementation.

Sexual Exploitation and Abuse (SEA)/Sexual Harassment (SH)

Although, the influx of workers will be minimal, however, new workers (outside of their social spheres) may form close social relationships with local communities. This can lead to unacceptable and / or illegal behavior, ranging from unwanted aggressive advances, SEA/SH against women and children. All contractors will be required to have a written contract with their workers materially consistent with objective of ESS2, following procedures as specified in the World Bank's Procurement Regulations. The workers will be required to sign a Code of Conduct (CoC) prepared by the Contractors and reviewed and approved by PMU.

Table 1 presents a summary of the potential risks and impacts related to labor and working conditions, together with mitigation measures to avoid, eliminate or reduce associated impacts.

Table 1: Risks and Impact Mitigation

Category	Worker Impacts/Risks	Subproject Impacts/Risks	Mitigation Measures	Responsibility
Recruitment and selection of Workers	Perception of unfair recruitment and selection practices.	Community tensions –stop work practices that affect implementation.	• Human Resources policy including at least: • Selection criteria of each position • Equal opportunities for men, women and transgender • Method and place of recruitment • Maximize work opportunities for local citizens • Enhance local employees' skills base through training	IAs, contractors and consultants
Terms and Conditions of employment (earnings/ benefits).	Perceptions that Wages/salaries and benefits are less for locals relative to outsiders.	Work stoppages/ protest, absenteeism, sit-ins, sabotage.	• IAs' policy needs 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.	IAs, contractors and consultants
Labor relations (Conflict Handling)	Workers feel aggrieved and don't know how	Workers embark on various forms of actions.	• IAs' policy needs to include the following: • Effective grievance redress process which	IAs, contractors and consultants
	to vent their grievances.	Workers take matters into their own hands, which results in violence and conflict that affects workplace harmony.	should be gender sensitive • Disciplinary procedure • Workplace rules and regulations • Demobilization procedure • Effective Information dissemination to workers	
Labor communi-cation mechanis ms.	• Workers are not informed about activities/ or events that affect them • Workers are unable to communicat e collective	• IAs' action due to rumors or incorrect perceptions • Poor morale and unproductiv e workforce	• Effective communication mechanisms including: • Regular written communication for all workers about the project operations/activities • Worker committees/organization/ unions • Use of notice	IAs, contractors and consultants

Category	Worker Impacts/Risks	Subproject Impacts/Risks	Mitigation Measures	Responsibility
	issues that bother them • Rumors/ misinformation spreads		boards/toolbox 	
Child Labor	Recruitment of individuals who, by virtue of age, would be exposed to hazardous situations and be subject to impaired social development	Increased health and safety risk to workforce, potential non-compliance with national labor laws, and reputational risk to the project.	• Human Resources and contracting policies that cover recruitment and selection processes that specifically address issues associated with child labor.	IAs, contractors and consultants
Employment conditions - wages and benefits	Perceptions that wages, salaries and benefits are not fair according to market.	Worker's action - work stoppages, absenteeism, sit-ins, sabotage	• Human Resources policy with respect to equal pay for equal work according to local conditions and industry averages • An effective employee • complaints/grievance process	IAs, contractors and consultants
Workers relations/ interaction with community	Disturbing the nearby communities due to the workers' routine activities such as recreation, and travelling etc. Communities are negatively impacted by some camp activities as well (i.e., lighting, traffic movement).	All negative actions on 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 community.	Contractors
Worker Accommodation/camp Specificati	Accommodation is considered sub-standard which leads to discontent	Workers have low morale Perception that project is unable to	• Build camps to the minimum camp specifications. The following plans will be	Contractors

Category	Worker Impacts/Risks	Subproject Impacts/Risks	Mitigation Measures	Responsibility
ons.	amongst the residents and concerns about perceived health risks	care about their welfare, which in turn affects motivation and productivity .	applied as necessary: • Minimum Health Requirements • Minimum Camp Specifications for • Operations Accommodation • Emergency Response Plan • Security Management Plan.	
Camp manageme nt	Residents do not live-in		• Implement an induction program to be attended	Contractors
practices	harmony and the potential for conflict rises. Residents do not know how to complain or make a grievance		by all residents that covers at least the following: • Camp rules and regulations • Code of conduct • Camp grievance mechanism • Camp disciplinary procedure • Cultural awareness • Health, safety and security. • First aid kits are adequately stocked	
House-keeping	The general appearance of the camp deteriorates making camp life unpleasant .	The overall camp experience is compromised which in turn leaves workers demoralized and unproductive	• Ensure that camp grounds and common areas are routinely cleaned and organized with appropriate signage in place. • Establish easily accessible, designated smoking areas which are clearly highlighted and regularly cleaned. • Ensure that equipment and facilities are kept clean and well maintained.	Contractors
Labor communi-cation mechanis ms.	• Workers are not informed about activities/ or events that affect them • Workers are	• IAs' action due to rumors or incorrect perceptions Poor morale and unproductive e	• Effective communication mechanisms including: • Regular written communication for all workers about the project operations/activities • Worker	IAs, contractors and consultants

Category	Worker Impacts/Risks	Subproject Impacts/Risks	Mitigation Measures	Responsibility
	unable to communicate collective issues that bother them • Rumors/ misinformation spreads	workforce	committees/organization/ unions • Use of notice boards/toolbox •	
Child Labor	Recruitment of individuals who, by virtue of age, would be exposed to hazardous situations and be subject to impaired social • development	Increased health and safety risk to workforce, potential non-compliance with national labor laws, and reputational risk • to the project.	• Human Resources and contracting policies that cover recruitment and selection processes that specifically address issues associated with child labor.	IAs, contractors and consultants
Employment conditions - wages and benefits	Perceptions that wages, salaries and benefits are not fair according to market.	Worker's action - work stoppages, absenteeism, sit-ins, sabotage	• Human Resources policy with respect to equal pay for equal work according to local conditions and industry averages	IAs, contractors and consultants
Workers relations/ interaction with community	Disturbing the nearby communities due to the workers' routine activities such as recreation, and travelling etc. Communities are negatively impacted by some camp activities as well (i.e., lighting, traffic movement).	All negative actions on 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 • community.	Contractors
Worker Accommodation/camp	Accommodation is considered sub-standard which leads to	Workers have low morale Perception that project is unable	• Build camps to the minimum camp specifications. The following plans will be	Contractors

Category	Worker Impacts/Risks	Subproject Impacts/Risks	Mitigation Measures	Responsibility
Specifications.	discontent amongst the residents and concerns about perceived health risks	to care about their welfare, which in turn affects motivation and productivity .	applied as necessary: • Minimum Health Requirements • Minimum Camp Specifications for • Operations Accommodation • Emergency Response Plan • Security Management • Plan.	
Camp management	Residents do not live-in		• Implement an induction • program to be attended	Contractors
practices	harmony and the potential for conflict rises. Residents do not know how to complain or make a grievance		by all residents that covers at least the following: • Camp rules and regulations • Code of conduct • Camp grievance mechanism • Camp disciplinary procedure • Cultural awareness • Health, safety and security. • First aid kits are • adequately stocked	
House-keeping	The general appearance of the camp deteriorates making camp life unpleasant .	The overall camp experience is compromised which in turn leaves workers demoralized and unproductive	• Ensure that camp grounds and common areas are routinely cleaned and organized with appropriate signage in place. • Establish easily accessible, designated smoking areas which are clearly highlighted and regularly cleaned. Ensure that equipment and facilities are kept clean and well maintained.	Contractors

4. Brief Overview of Labour Legislation – Terms and Conditions

There are a number of labor laws in Pakistan. These Labor laws are broad and contain several ordinances, acts, rules and regulations and other statutes relating to industrial, commercial and labor establishments. These laws compliment in smooth running of the business with regard to matters relating to employers and employees in order to achieve the target of higher productivity, reasonable profits, better wages and reduction in unjust practices or discrimination. Many of these laws pertain to the implementation of the international labor conventions that Pakistan has ratified.

Federal Laws

Federal laws related to labor rights and welfare are listed below.

- Factories act, 1934
- Industrial Relation Act
- Workman Compensation Act 1923
- Minimum Wages ordinance, 1961
- Payment of Wages Act 1936
- Industrial & Commercial Employment Standing Orders ordinance 1968
- Shops & Establishment Act 1969
- Maternity Benefit Ordinance 1958
- The Mines Maternity Benefit Act, 1941
- Apprenticeship Ordinance 1962
- Employees Old Age Benefit Act 1976
- Prohibition of Employment of Children Act 1938
- Employments of Children Act 1991
- Bonded Labor Abolition Act 1992
- Employees Cost of Living (relief) Act 1973
- Companies' Profits (Workers participation) Act 1968
- Workers Welfare Fund Act 1971
- Minimum Wages (Unskilled Workers), (Amendment) 2015
- The Disabled Persons (Employment and Rehabilitation) Act 2015
- The Protection Against Harassment of Women at the Workplace Act, 2010
- Transgender Persons (Protection of Rights) Act, 2018
- The Maternity and Paternity Leave Act, 2020

The most relevant laws for the purpose of LMP of SWAT are discussed below.

The Industrial Relations Act 2012

The Industrial Relations Act 2012, aimed at regulating the labor-management relations in the country, and allows to bring workers grievance to the attention of his or her employer, in writing, either him or herself, through the shop steward or through his or her trade union within three months of the occurrence of the cause of action. Forms of termination have been described as removed, retrenched, discharged or dismissed from service. To safeguard against abuse of power, victimization or unfair labor practices, the Labor Courts have been given powers to examine and intervene to find out whether there has been a violation of the principles of natural justice and whether any action by the employer was real or unjust.

West Pakistan Maternity Benefits Ordinance, 1958 (The West Pakistan Maternity Benefit Rules, 1961)

The law is applicable to female workers across the board within all establishments. Female worker is entitled to 12 weeks of maternity leave. Every employer is liable for payment of maternity benefits at the rate of her wages last paid during the period of six weeks immediately preceding and including the day on which the female worker delivers a child, and for each day of six weeks succeeding the day.

The Industrial and Commercial Employment ACT, 2013

It governs the Industrial relationship between the employer and the workers to maintain industrial peace and settle disputes between them by negotiations, reconciliations, arbitration and adjudication. This Act establishes and provides procedures for settling grievances and resolving disputes between workers and employers. It also specifies the procedure for lock-outs and strikes and confers upon the right to establish or join trade unions of their own choices.

The Employees Old-Age Benefits Act 1976

The Employees Old-Age Benefits Act 1976 (the "EOAB") provides for certain old age benefits for the persons who are employed in industrial, commercial and other organizations.

Minimum Wages (Unskilled Workers) Act, 2013

The Government has announced that "the minimum wages would be increased from Rs. 12,000 to 13,000 per month (w.e.f. 1" July, 2015). Since then, the minimum wages have been reviewed annually. The current minimum wages for the year 2021-22 was announced to be Rs. 20,000 per month.

The Disabled Persons (Employment and Rehabilitation) Act 2015

The Disabled Persons (Employment and Rehabilitation) Act 2015 provides for the employment, rehabilitation and welfare of disabled persons and for matter connected their well-being.

Employment of Child Act (ECA), (1991)

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

The Protection Against Harassment of Women at the Workplace Act, 2010

In 2010, Pakistan Government passed a Law called 'Protection Against Harassment of Women at Workplace, Act 2010. The Protection against Harassment of Women at the Workplace Act 2010 provides legal protection to women against harassment at the workplace, and reforms the existing legislation regarding women's right to work in Pakistan. It focuses on sexual harassment experienced at the workplace by employees and facilitates the transformation of the work environment, so that it is free of sexual harassment, intimidation and abuse. The law (Section 354 IPC) makes it a special crime to use force against a woman, or even threaten to use force, if the intention is to "outrage her modesty" It is an offence only when the accused intended or knew it to be likely that the acts in question would outrage the victim's modesty

Provincial Labor Laws

In 2010, subjects of labor and employment devolved to provinces under the 18th Amendment to the Constitution of Pakistan, as a result of which the federal labor laws made applicable on provinces under Article 270 AA (6) of the Constitution of Pakistan. The 18th Constitutional Amendment in Pakistan has

altered the landscape of the labor administration system in the country. Provinces now have greater responsibility and resources in terms of legislation and implementation. Sindh drafted Sindh Labor Policy 2018 to protect workers' rights are as follows:

- The Sindh Industrial Relations Act, 2013
- The Sindh Workers Welfare Fund Act, 2014
- The Sindh Employees Old-Age Benefits Act, 2014
- The Sindh Companies Profits (Workers Participation) Act, 2015
- The Sindh Workers Compensation Act, 2015
- The Sindh Minimum Wages Act, 2015
- The Sindh Terms of Employment (Standing Orders), Act, 2015
- The Sindh Bonded Labor System (Abolition) Act, 2015
- The Sindh Factories Act, 2015
- The Sindh Shops & Commercial Establishment Act, 2015
- The Sindh Payment of Wages Act, 2015
- The Sindh Prohibition of Employment of Children Act, 2017.

Summing up, Pakistan has more than 70 laws relating to labor issues. The government of Pakistan is currently in the process of consolidation and rationalization of labor laws and all these laws are being consolidated in five broad categories of Industrial Relations, Employment and Service Conditions, Occupational Safety & Health, Human Resource Development and Labor Welfare & Social Safety Net. However, the problem with laws is the weak enforcement mechanisms at the provincial level.

5. Overview of Labor Legislation: Occupational Health And Safety

There was no independent legislation on occupational safety and health issues in Pakistan before 2017. The main law, which governs these issues, is the Chapter 3 of Factories Act, 1934. All the provinces, under this act, have devised Factories Rules. The Hazardous Occupations Rules, 1963 under the authority of Factories Act is another relevant legislation. These rules not only specify hazardous but also authorize the Chief Inspector of Factories to declare any other process as hazardous.

Apart from the Constitution which also covers OHS, some other regulations include: The OHS clauses are covered in the following laws.

- Pakistan Penal Code, 1860
- Fatal Accidents Act, 1855
- Factories Act 1934
- Punjab Factories Rules 1978
- Sindh Factories Rules 1975
- West Pakistan Hazardous Occupations Rules 1963
- Mines Act 1923
- Provincial Employees Social Security (Occupational Diseases) Regulations 1967
- Workmen's Compensation Act 1923 and Rules 1961
- Workmen Compensation Act, 1923
- The Provincial Employees Social Security Ordinance, 1965
- West Pakistan Shops and Establishments Ordinance, 1969
- Pakistan Environmental Protection Act, 1997 (Hazardous Substance Rules, 2003)
- The Agricultural Pesticides Ordinance, 1971 (The Agricultural Pesticide Rules, 1973)
- West Pakistan Labor Camps Rules, 1960

- National Highway Safety Ordinance 2000
- Hazardous Substances Rules, 2003
- Sindh Workers Compensation Act, 2016
- Pakistan Occupational Health and Safety Act 2018

International Conventions

ILO conventions

ILO has formulated more than forty regulations, particularly concerning with the Occupational Health and Safety (OHS) issues. It has three major regulations; ILO Technical Convention: C187

Promotional Framework for Occupational Safety and Health Convention. This convention stresses a (i) safe and healthy working environment by formulating a national policy; (ii) Each Member shall promote and advance, at all relevant levels, the right of workers to a safe and healthy working environment; (iii) in formulating its national policy, each Member, in light of national conditions and practice and in consultation with the most representative organizations of employers and workers, shall promote basic principles such as assessing occupational risks or hazards; combating occupational risks or hazards at source; and developing a national preventative safety and health culture that includes information, consultation and training. In addition, the following conventions and regulations are summarized below.

Prevention of Major Industrial Accidents Convention, 1993 (No. 174): The purpose of this Convention is the prevention of major accidents involving hazardous substances and the limitation of the consequences of such accidents. The convention protects workers, the public and the environment by preventing major accidents from occurring at these installations, minimizing the consequences of a major accident either on- or off-site and provides guidance on appropriate emergency planning.

Safety and Health in Construction (1992): The objective of this code is to provide practical guidance on a legal, administrative, technical and educational framework for safety and health in construction with a view to: preventing accidents and diseases and harmful effects on the health of workers arising from employment in construction; ensuring appropriate design and implementation of construction projects; providing means of analysing from the point of view of safety, health and working conditions, construction processes, activities, technologies and operations, and of taking appropriate measures of planning, control and enforcement.

Safety and Health in Building and Civil engineering Works (1972: Code of practice relating to occupational safety and occupational health in civil engineering and the construction industry -

includes provisions concerning the work environment and equipment, fire protection, noise, machinery (incl. Building machinery and electrical machinery, ionising radiations, explosives, handling, occupational health, welfare, health services, etc.)

This Code of practice covers 42 topics related to safety and health in building and civil engineering. Main topics: workplaces and equipment; scaffolds, ladders and stairs; lifting appliances; railways, road and similar transport; construction equipment; electricity; blasting; concrete work; other building operations; excavations; underground construction; work in compressed atmosphere; work clothes and personal protective equipment; hygiene and welfare; medical supervision.

6. Responsible Staff

The PMU of each IA has the overall responsibility for project management to oversee all aspects of the implementation of the LMP, in particular to ensure contractor compliance. PMU will address all LMP aspects as part of procurement for works as well as during contractor induction. The contractor is subsequently responsible for management in accordance with contract-specific LMPs, implementation of

which will be supervised by PMU a monthly basis or at shorter intervals as defined by specific Plans. The detailed approach is described in the following sections. The E&S team in PMU will implement and monitor the provision of this LMP as follows.

- Ensure compliance with the safeguard requirements, including the LMP and OHS provisions for the workers;
- Undertake the implementation of the Project within their respective regions/districts;
- Guarantee that the obligations are met towards the direct workers as included in this LMP, the ESMF and other applicable procurement documents;
- Monitor the training of the project workers;
- Monitor for potential risks of serious safety issues in the conduct of activities;
- Develop and implement the grievance mechanism for direct workers, including ensuring that grievances received from the workers are addressed promptly, and reporting the status of grievances and resolutions.
- Ensure that the project workers are informed of the grievance mechanism;
- Maintain records of recruitment and employment of hired workers, with age and gender verification.
- Provide induction and regular training to direct workers on environmental, social and occupational health and safety issues.
- Report to the World Bank on labor and occupational health and safety performance and any incident or accident related to the Project involving project workers.

Occupational Health and Safety: Once the sub-projects are approved by the PMU, contractors must engage one OHS Specialist and OHS inspectors keeping in view the number of sites. The contractor's OHS staff will be supervised by supervision consultants and PMU of each IA with the help of their safety directorates. Smaller contracts may permit for the safety representative to carry out other assignments as well. The safety representative ensures the day-to-day compliance with specified safety measures and records of any incidents. Minor incidents are reported to IAs on a monthly basis, serious incidents are reported immediately. Minor incidents are reflected in the quarterly reports to the World Bank, major issues are flagged to the World Bank immediately.

Labor and Working Conditions: Contractors will keep records in accordance with specifications set out in this LMP. IAs may at any time require records to ensure that labor conditions are met. The PMU will review records against actuals at a minimum on a monthly basis and can require immediate remedial actions if warranted. A summary of issues and remedial actions will be included in quarterly reports to the World Bank.

Worker Grievances: IAs' procedures currently in place will remain for Project staff. Contractors will be required to present a worker grievance redress mechanism which responds to the minimum requirements in this LMP. The Social Development Specialist will review records on a monthly basis. Where worker concerns are not resolved, the national system will be used as set out in the section, but the PMU will keep abreast of resolutions and reflect in quarterly reports to the World Bank.

Additional Training: Contractors are required to, at all times, have a qualified safety officer on board. If training is required, this will be the contractor's responsibility. The safety officer will provide instructions to contractor staff. IAs will arrange training to address risks associated with labor influx and will provide a schedule for trainings required. The contractor will be obligated to make staff available for this training, as well as any additional mandatory trainings required by PMU, as specified by the contract.

To minimize gender disparity in their work with communities, staff will receive training on the prevention of SEA/SH, codes of conduct, as well as on gender and GBV in general. The PMU will also be responsible for (i) training, (ii) implementation and (ii) supervision of occupational health and safety (OHS) aspects.

Various government agencies like National Institute of Labor Administration and Training, Directorate of Workers Education provide training to workers on these issues. The Centre for Improvement of Working Conditions and Environment (CIWCE) is a pioneering institution in Pakistan (working under the Directorate of Labor Welfare, Punjab) which provides training, information and research facilities for promotion of safety, health and better work environment in the industries and businesses. Training materials, safety posters and different safety signs are available from this Centre.

7. Policies And Procedures

This section describes the main policies and procedures to be followed during the implementation phase of the Project as well as accidents, occupational diseases and prevention of SEA/SH. These policies and procedures will be updated and modified if necessary, after the allocation of the contracts of the different positions of the PMU. As specified in the national labor laws, the employment of project workers will be based on the principles of non-discrimination and equal opportunities. There will be no discrimination with respect to any aspects of the employment relationship, including recruitment, compensation, working conditions and terms of employment, access to training, promotion or termination of employment. The following measures will be followed by contractors and monitored by the PMU with support from HR to ensure fair treatment of all employees:

- Recruitment procedures will be transparent, public and non-discriminatory, and open with respect to ethnicity, religion, sexuality, disability or gender.
- Applications for employment will only be considered if submitted via the official application procedures established by the contractors.
- Clear job descriptions will be provided in advance of recruitment and will explain the skills required for each post.
- All workers will have written contracts describing terms and conditions of work and will have the contents explained to them. Workers will sign the employment contract.
- Unskilled labor will be preferentially recruited from the surrounding communities, settlements and adjacent villages.
- Employees will be informed at least two months before their expected release date of the coming termination.
- The contracted workers will not be required to pay any hiring fees. If any hiring fees are to be incurred, these will be paid by the Employer.
- Depending on the origin of the employer and employee, employment terms and conditions will be communicated in two languages, in the national language and the language that is understandable to both parties.
- In addition to written documentation, an oral explanation of conditions and terms of employment will be provided to workers who may have difficulty understanding the documentation.
- It is noted that language-related problems are not expected, but if they are, interpretation will be provided for workers as necessary.
- All workers will be 18 years old or above for civil works. This will be a requirement in IAs contracts with civil works contractors.
- Normal working time should not exceed 40 hours per week. With a five-day working week, the duration of daily work is determined by the internal work regulations approved by the

employer after prior consultation with the representatives of the workers, in compliance with the established working week duration.

The IAs will inform the World Bank of any significant event (social issues) as soon as possible, but no later than five working days after the occurrence of the event. Such events include strikes or other workers' demonstrations. The PMU will prepare a report on the event and the corrective measures and submit it to the Bank within 30 working days of the event.

Occupational Health and Safety: IAs under SWAT are committed to: a) Comply with legislation which relates to the occupational health and safety requirements as stipulated in the main law governing OHS is and Factories Act 1934 Chapter 3. The Hazardous Occupation Rules of 1978 regulate certain occupations as hazardous, and contain special provisions to regulate the working conditions in those occupations. In addition, there are other laws to be complied with dealing with OHS including The Mines Act 1923; Social Security Ordinance 1965; Workmen's Compensation Act 1923; Shop and Establishment Ordinance 1969 and Dock Laborer Act 1934 as well as WB ESS2 and ESS 4. These laws and standards will enable OH&S hazards identification and risk elimination through promotion of appropriate skills, knowledge and attitudes towards hazards.

The PMU will have a designated Occupational and Community Health and Safety Specialist and an Environmental Representative for each project site for an agreed period. This specialist must have a minimum Bachelor's degree in civil/environmental engineering/environmental sciences and Certificate course in OHS (e.g., The National Examination Board in Occupational Safety and Health (NEBOSH) with a minimum with at least 5 years of experience as OHS professional in construction of infrastructure projects. Extensive knowledge of all OHS Legislation, OHS guidelines and standards are required. The qualifications required for the specialist will be Master's in Science, Engineering or equivalent, with a minimum of five years of practical working experience.

It is important that all staff must be given induction training so that they are aware of the hazards. This is in addition to toolbox talks and other training needs identified during project implementation.

The PMU will ensure that all workers irrespective of any category should be provided with appropriate type of protective masks, helmet, overall and safety shoes, and safety goggles, protective clothing as well as other appropriate PPEs as per work job hazard analysis and method statements (such as working on live wires); demarcation of workplace and noticed for hazardous area where applicable; accident reporting, notification and investigation practices at each workplace required; safety sign and symbols displayed at workplace and ensure availability of first aid box; also identify and service agreement done with specialized hospitals for complicated accidental and health problems as well as specific details will be included in the emergency management plan.

Occupational Health and Safety Management Plans of Contractors (OHSMP): The Contractor will be required to prepare OHSMP in accordance with OHS standards mentioned in the bidding documents, OHS provisions of ESMP provisions and compliance with local regulatory requirements. All OHSMP's shall have as a minimum requirement to include information on:

- Each person on the site who has a specific occupational safety and health responsibility in relation to the site and describes how those responsibilities are coordinated
- Occupational health and safety induction training that will take place in respect to construction work on the site
- Arrangements for managing occupational safety and health incidents on the site
- Site safety rules and describes the arrangements for ensuring that all persons on or visiting the site are informed of the rules
- Hazards to which a person at the construction site is likely to be exposed

- Risk of injury or harm to a person resulting from those hazards
- Means by which the risk may be reduced
- Safe work method statements (if any) for the site

Child labor: To prevent engagement of underage workers, the age employment scheme should be strictly observed by the hiring authority. Proper procedure in the screening, with age verification, shall be undertaken in the selection of direct workers to ensure that no child shall be employed in the implementation of the Project. Likewise, all contracts must have a provision as to the minimum age requirement and the hiring authority shall keep a labor registry of all hired workers.

Labor influx/ SEA/SH/project workers: All project workers will undergo relevant seminars and training to prevent risks of labor influx or SEA/SH issues. Project workers particularly those coming from other communities will be provided a lecture on the culture and history of the area to enable them to adapt to the community values and avoid any conflicts due to the dissimilarities of their cultural backgrounds.

Discrimination and exclusion of vulnerable groups: The employment of project workers under project will be based on the principle of equal opportunity and fair treatment, and there will be no discrimination with respect to any aspects of the employment relationship, such as recruitment and hiring, terms of employment (including wages and benefits), termination and access to training. The project shall comply with the national Labor laws on gender equality in the work place, which will include provision of maternity leave and nursing breaks and sufficient and suitable toilet and washing facilities, separate from men and women workers.

Development of a SEA/SH Action Plan and Mitigation Measures for Risks Related to Gender:

According to the Note on Good Practices to Combat SEA/SH in the Framework of Financing Investment Projects Involving major civil engineering works, all projects, whatever their risk level, should guarantee the minimum actions recommendations for addressing the risks of SEA/SH related issues.

A SEA/SH Action Plan will be developed during the design phase of the project activities in the target areas. Based on the SEA/SH risk assessment related to the planned activities of the project, this action plan may consider the following elements:

- Formulate a responsibility and response framework within the framework of the project's ESMPs.
- The integration of SEA/SH risk in E&S instruments
- The hiring of a SEA/SH specialist in the PIU and in the team of the supervision consultant.
- Mitigation measures for risks related to gender aspects may include:
- Community engagement / consultations with women throughout the project to guide the planning of project activities,
- The roles reserved for women in the planning and management of project activities,
- Economic activities that include women should incorporate gender messages or discussion groups that address topics such as decision-making dynamics, household power relations and nonviolent resolution of conflicts.
- The definition of SEA/SH requirements in the tender documents (including the requirement of a code of conduct for all workers), indicate how the costs linked to SEA/SH will be paid in the contract,
- Ensure that codes of conduct are signed and understood by all staff and workers including local workers and supervisors,
- Ensure the physical security of workplaces (such as separate facilities for women and men, signage in areas without SEA/SH).

IAs will incorporate standardized environmental and social clauses including the requirement of SEA Mitigation Action plan and worker Code of Conduct in the tender documentation and contract documents, in order for potential bidders to be aware of environmental and social performance requirements that shall expected from them, are able to reflect that in their bids, and required to implement the clauses for the duration of the contract. PMU will enforce compliance by contractors with these clauses. As a core contractual requirement, the contractor, sub-contractors and the third-party labor suppliers are required to ensure all documentation related to environmental and social management, including the LMP, is available for inspection at any time by the PMU or its appointed representatives.

The contractual arrangements with each project worker must be clearly defined in accordance with national law. A full set of contractual requirements related to environmental and social risk and impact management will be provided in the SWAT ESMP to be prepared by IAs. All environmental and social requirements will be included in the bidding documents and contracts in addition to any additional clauses, which are contained, in the Project environmental and social instruments. Under no circumstances will PMU, Contractors, Primary suppliers or sub-contractors engage in forced labor nor child labor. Forced labor includes bonded labor (working against an impossible debt), excessive limitations of freedom of movement, excessive notice periods, retaining the worker's identity or other government-issued documents or personal belonging, imposition of recruitment or employment fees payable at the commencement of employment, loss or delay of wages that impede the workers' right to end employment within their legal rights, substantial or inappropriate fines, physical punishment, use of security or other personnel to force or extract work from project workers, or other restrictions that compel a project worker to work in a non-voluntary basis.

Labor disputes over terms and conditions of employment: Fair, reasonable and lawful terms and conditions shall be applied in the contractual provisions of all project workers to prevent labor disputes. Moreover, there will be an efficient grievance mechanism to address any issues that may arise during existence of the contract. The guidelines provided under Section 9 thereof shall be strictly observed to avoid disputes over terms and conditions of employment.

All the contractors who will be engaged for the project will be required to produce their grievance procedure as a requirement for tender which at a minimum comply with these requirements. In addition, good international practice recommends that the procedures be transparent, is confidential, adheres to non-retribution practices and includes right to representation. After they are engaged, they will be required to produce proof that each worker has been inducted and signed that they have been inducted on the procedure.

Monitoring and reporting: The PMUs will report on the status of implementation of the above policies and procedures on a monthly basis. The PMU will closely monitor labor and occupational health and safety performance of the project and report to the World Bank on a quarterly basis.

Fatality and serious incidents: In the event of an occupational fatality or serious injury, the PMU shall report to the Bank as soon as becoming aware of such incidents and inform the government authorities (where available) in accordance with national reporting requirements. Corrective actions shall be implemented in response to project-related incidents or accidents. The PMU or, where relevant the consultant, may conduct a root cause analysis for designing and implementing further corrective actions.

8. Age of Employment

Minimum age for employment in the Project: Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mines or any other hazardous employment. The Sindh Prohibition of Employment of Children Act 2017, establishes age 14 as the minimum age for employment and age 18 as the minimum age for employment in hazardous work.

IAs and its contractors will be bound by the Sindh Prohibition of Employment Act to disallow any child labor at the project sites or campsites. Employer will ensure that no construction workers or labor under 18 years are employed.

Contractors will be required to verify and identify the age of all workers. This will require workers to provide official documentation, which could include a birth certificate, CNIC, passport, or medical or school record. If a minor under the minimum labor eligible age is discovered working on the project, measures will be taken to immediately terminate the employment or engagement of the minor in a responsible manner, taking into account the best interest of the minor.

The process of age verification: Verification of the age shall be undertaken prior to the engagement of labor and be documented. Check the birthday on official documents such as birth certificate, national ID Card or other credible records, where available6.

9. Terms And Conditions of Employment

The employment terms and conditions applying to SWAT employees are set out in the labor rules and will apply to all project employees who are assigned to work on the Project (direct workers). Terms and conditions of part-time direct workers are determined by their individual contracts.

This section will be updated and modified if necessary, after the allocation of the contracts of the different posts of the PMU. The terms and conditions applicable to the employees of the PMU are defined in the contracts, which provide for the rights of the employees in accordance with the Code of work. These internal work rules and regulations will apply to PMU employees who are assigned to specific work related to the Project (direct workers). The conditions of employment of direct part-time workers are determined by their individual contract.

All the recruiting procedures are documented and filed in the folders in accordance to the requirements of labor legislation of the GoP and Sindh. Monthly timesheets are also filed and kept accurately. Forty hour per week employment is practiced and recorded on paper. The work hours for IAs' workers are 40 hours per week, eight hours per workday. It is noted the Labor Code provides for a work week of 40 hours but allows six-day weeks and this may be required for some project workers. Duration of workday during a six-day week should not exceed 7 hours to meet the 40-hour weekly legal provisions. All project workers will receive at least one rest day (24 hours) after six consecutive days of work.

The contractors' labor management procedure will set out terms and conditions for the contracted and subcontracted workers. These terms and conditions will be in line, at a minimum, with this labor management procedure, the Factories Act 1934, and Sindh Terms of Employment (Standing Orders) Act 2015, and specified in the standard contracts to be used by the IAs under the Project, which will be provided in Project Operations Manual and follow this LMP and the project ESMF.

- A contract of employment, written in a language known to the parties, shall be executed between the IAs and the direct worker that specify the following:
- Parties to the contract, including the name of worker, age, citizenship, civil status, gender, and address;
- Premises with regard to the needed services, acceptance of the parties, qualifications of the worker, and attestation that the worker is not related within the third degree of consanguinity or affinity to the hiring authority and/or its representative, and that the worker has not been previously dismissed from government service by reason of administrative offense;
- Terms and conditions of the contract, including the hours and place of work, remuneration payable to the worker, job description, summary of deliverables, duration of contract,

procedure for suspension or termination of contract, statement that there is no employer and employee relationship between the contracting parties.

As provided in the Factories Act, 1934, every worker who has completed a period of twelve months continuous service in a factory shall be allowed, during the subsequent period of twelve months, holidays for a period of fourteen consecutive days. If a worker fails in any one such period of twelve months to take the whole of the holidays allowed to him or her any holidays not taken by him or her shall be added to the holidays allotted to him or her in the succeeding period of twelve months.

A worker shall be deemed to have completed a period of twelve months continuous service in a factory notwithstanding any interruption in service during those twelve months brought about by sickness, accident or authorized leave not exceeding ninety days in the aggregate for all three, or by a lock-out, or by a strike which is not an illegal strike, or by intermittent periods of involuntary unemployment not exceeding thirty days in the aggregate; and authorized leave shall be deemed not to include any weekly holiday allowed under section 35 which occurs at beginning or end of an interruption brought about by the leave.

Non-discrimination and equal work opportunities:

Article 19-A of the Constitution imparts the State's obligations aimed at achieving equality in the form of securing the well-being of the people, irrespective of sex, caste, creed or race, by raising their standard of living, by preventing the concentration of wealth and means of production and distribution in the hands of a few to the detriment of general interest and by ensuring equitable adjustment of rights between employers and employees.

IAs are committed to equal opportunities for all its employees and potential employees where everyone is treated with respect and dignity and where there is equal opportunity for all. All employees, whether part-time, full time or temporary, will be treated fairly and with respect. Selection for employment, promotion, training or any other benefits will be on a basis of aptitude and ability. Decisions about pay and benefits, terms and conditions of employment, appraisals, dismissal or redundancy will be made objectively and without unlawful discrimination. All employees will be helped and encouraged to develop their full potential, and the talents and resources of the workforce will be fully utilized to maximize the efficiency of the organization.

Project Management will ensure that:

- Equality and non-discrimination policy is adhered to within their own area of responsibility;
- Bring the details of the equality in employment policy to the attention of their team members;
- Ensure that information on equality of opportunity is included in all induction processes; and
- Ensure that their team members are available to attend relevant equality training programs (if any).

The Project Team is responsible for ensuring that equality on employment is effectively communicated to all employees and all those involved with the organization at whatever level or position and for providing advice and guidance where appropriate. It will, in particular, provide full text and induction on equal opportunities to all new employees; translate this policy into Urdu and send to all relevant involved parties. In addition, upon any significant update, the policy will be presented to all members of staff or at department/office meetings and re-translated to all relevant involved parties.

Each member of staff has a responsibility to:

- Follow any measures introduced to ensure equality of opportunity and prevent discrimination, harassment or bullying;

- Report any discriminatory acts;
- Treat others fairly without prejudice; and
- Promote a work environment where an individual can feel valued and realise his/her potential and encourage others to do so.

Failure to comply with the policy, procedures and practices outlined below will be considered within the framework of IAs disciplinary procedure. The IAs equal opportunity policy also covers bullying and harassment issues at the workplace and in any work-related setting outside the workplace, for example, during business trips and at work-related social events.

Hours of work: The Factories Act, 1934 (Section-34), Shops and Establishment Ordinance, 1969 (Section 8) and Road Transport Ordinance, 1961 (Section-4) are used to determine working hours and rest time in different industries. Section 34 of the Factories Act provides that "no adult worker shall be allowed or required) to work in a factory for more than 48 hours in a week; if the factory is seasonal, 50 hours a week and if the work is of continuous nature, he may work for 56 hours in a week. As for the daily hours, these may not be more than 9 hours a day (in case of seasonal; 10 hours). The working hours of a child/adolescent (15-18) are 5 hours in a day. The factories Act is applicable to all the precincts employing 10 or more workers. The law makes provisions for one weekly holiday and if that is not given, a compensatory holiday must be given as soon as possible. Shops and Establishments Ordinance 1969 and Mines Act 1923 also limit the weekly hours to 48 hours. The above ordinance covers shops and commercial establishments not regulated by Factories Act and Mines Act. Any adult worker is required to work overtime, if asked, and the rate of overtime payment is double the usual pay (Section 47). Overtime is not payable to the contract workers, employed on piece rate basis. The normal hours of work of Project workers shall not exceed 8 hours a day for 5 days or 40-hour work week, exclusive of time for meals. Where exigencies of the service require such personnel to work for 6 days or 48 hours, the project worker shall be entitled to a compensatory time-off (CTO) to off-set the overtime rendered. No worker shall be allowed to render services beyond the 48-hour overtime.

Rest per week and Leave: Every project worker is entitled to a 2-day rest period during weekends (Saturday and Sunday). Workers shall also be entitled to a rest day on regular holidays recognized by the State. Every worker is entitled to 10 days casual leave with full pay during a year. Workers are also entitled to 16 days sick leave with half pay (8 days with full pay) in a year. Festival holidays as notified by the provincial government with full pay (usually 10-13) are also allowed. If a worker is required to work on a festival holiday, he will be given one day additional compensatory holiday with full pay and a substitute holiday (300% of usual wages).

Maternity leave: Under the Maternity Benefits Ordinance, every employed woman is entitled to a maximum of 12 weeks of fully paid maternity leave. This leave can be taken 6 weeks before the expected birth date and 6 weeks after the delivery and entitles the employee to 100 percent of pay. The employee must be employed for at least 4 months preceding the date of delivery. It is unlawful for an employer to dismiss a women worker who is on maternity leave. The qualifying period for getting this leave is four months of preceding employment with the employer. Maternity benefit and maternity leave of 16 weeks is also provided under the Mines Maternity Benefits Act, 1941(section 5).

Wages: The laws relating to fixation and payment of wages are Payment of Wages Act 1936, Coal Mines (Fixation of Rate of Wages) Ordinance 1960, Minimum Wages Ordinance, 1961 and Minimum Wages for Unskilled Workers Ordinance 1969. Civil Servants Act, 1973 (article 17) is the relevant legislation governing remuneration in the public sector and wages are recommended by the Pay and Pension Commission constituted by government. Under the payment of Wages Act, no wage period should exceed one month (section 4) and wages are to be paid within seven days after the end of wage period (except for establishments employing more than 1000 workers, they can pay within 10 days). The Provincial

Governments constitute Minimum Wages Boards under Section (3) of Minimum Wages Ordinance, 1961 to decide the wage rates. Minimum Wages Board is a tripartite body comprising the representative of Government, Employers and Employees. The Board, upon reference to it by the Provincial Government, recommends to such government, the minimum rate of wages for workers as specified in the reference. The Provincial Government on the recommendation of the board fixes the Minimum Rate of Wages for all classes of workmen as provided in Section (6) of the Minimum Wages Ordinance, 1961.

Workers' Welfare: The workers welfare legislation includes Employees Old Age Benefits Act 1976 (with provisions for old age pension, old age grant, invalidity and widow(er) pension). This act is applicable to establishments employing 5 or more workers. Contribution has to be made both by the employer (5% of minimum wages) and employee (1% of minimum wages). Employees Social Security Ordinance 1965 (applicable like EOAB Act) provides benefit to the employees in cases of sickness, maternity, employment injury or death. The amount in this scheme is contributed only by the employer. The Workmen's Compensation Act, 1923 provides for the compensation to be paid by employer to workers or their legal heirs in cases of death, permanent total disablement, permanent partial disablement and temporary disablement during working in an establishment. The Standing Orders 1968 also provides for compulsory group insurance against natural death and injury for all the permanent employees in a workplace.

Termination of contract: The contract of employment shall cease at the end of the period stated in the contract. However, the contract may be pre-terminated by the hiring authority due to breach of any provision thereof, breach of trust, loss of confidence, and for reasons detrimental to the interest of the agency, provided that the project worker is informed in writing at least 30 days prior to the effectivity of such termination. Likewise, the project worker may pre-terminate the contract provided that a written notice is submitted to the hiring authority, stating therein the reasons for the pre-termination, at least 30 days prior to the proposed date of effectivity thereof, and the same has been received, accepted, and approved in writing by the hiring authority.

Industrial and Commercial Employment (Standing Industrial and Commercial Employment (Standing Orders) Ordinance 1968 was enacted in 1968 to address to the contractual relationship between employer and employee. The ordinance is applicable to establishments employing 20 or more workers. The ordinance classifies workmen in six classes: permanent, probationers, badlis, temporary, apprentices and contract workers (last was added in 2006). The legislation requires that workmen should be provided the contract in writing, showing the terms and conditions of his service, at the time of hiring, promotion and transfer. It also requires that the wage rates paid to different categories of workers/work should be posted on the notice boards.

Termination of an employment contract may be either termination simpliciter, which is termination on grounds other than misconduct after a notice (section 12) or termination on account of misconduct (section 15). Notice of termination, for termination simpliciter, is mandatory for permanent employees. A notice of one month must be served before severing the employment relationship or payment of one month's wages in lieu of notice may be provided (Section 12.1). The law also obliges the employer to provide the termination certificate in writing stating the reason behind it. Although there is no specific provision for just cause dismissal, the requirement of written termination letter and section 41 of IRA 2008 which allow the labor court to inquire into the legitimacy of termination provide that there should be bona fide and valid reason for dismissal.

Termination on account of trade union membership and activity is an invalid reason for termination (ILO, 2000). While termination is being done on account of misconduct, worker has still the right of fair hearing. Of the many types of misconduct is "go slow", for which a worker can be fired. Termination on economic reasons/retrenchment has not been focused in law; however, law does provide the procedure of retrenchment (last come, first go) and preference for rehiring of retrenched workmen. In case of laying

off the workers, they must also be given due notice or payment in lieu of notice. If the employer wants to close down the whole business or is terminating the employment of 50 or more workers, it must get the prior approval of labor court. An individual whose employment is terminated has first to use internal mechanisms for dispute resolution (shop stewards, CBA through grievance procedure), however if he is not satisfied with the decision, may appeal to the labor court. In that case, labor court is authorized to go into all the facts of the case and determine whether the termination was valid and bona fide or not. The above-mentioned ordinance also provides for severance pay/gratuity to be paid (when an employee resigns or his services are terminated other than misconduct) equivalent to 30 days wages for every completed year of service or any part thereof in excess of 6 months (For 20 years of service, this means 90 weeks of severance pay).

Deductions from remuneration: No deductions other than those agreed upon in the contract or those prescribed by law or regulations shall be made from a worker's remuneration. The hiring authority is prohibited to demand or accept from the worker any cash payment or gifts in return for admitting such worker to employment or for any other reasons connected with the terms and conditions of employment.

Medical treatment of injured and sick workers: Any injury, illness or accident sustained by the worker during the work period shall be conveyed to the nearest clinic or hospital by the hiring authority or its representative.

Collective Agreements: The duty to collectively bargain arises only between the "employer" and "employee". Where neither party is an "employer" nor "employee" of the other, no such duty would exist. Considering that the terms and conditions provide that no employer-employee relationship shall exist between the contracting parties, there is no duty to bargain collectively.

Collective Bargaining was first introduced in Pakistan with the promulgation of IRO 1969. Collective bargaining has also been called a fundamental right which emanates from article 17(1) of the Constitution. A trade union can move application for determination of CBA if it has its members not less than one-third of those employed as workmen. However, if more than one union exists in the premises, the registrar of trade unions will conduct a secret ballot election/referendum and will issue the CBA certificate to union securing votes not less than one third of total votes. If none of the union is able to get one third of total votes, a run-off election between the top two unions will be held and the union getting majority votes will be certified as collective bargaining agent. Not every workman employed in the premises is eligible for voting (Section 24.5). When a union is certified as a CBA, no application for (re)determination of CBA can be made for a period of two years except where the registration of trade union/CBA is cancelled. The CBA is entitled to undertake collective bargaining with the employer or employers on matters connected with employment, non-employment, the term of employment or the conditions of work other than matters which relate to the enforcement of any right guaranteed or secured to it or any workman by or under any law, other than this Act , or any award or settlement; represent all or any of the workmen in any proceedings; give notice of, and declare, a strike and nominate representatives of workmen on the Board of Trustees of any welfare institutions or Provident Funds (IRA 2008: Section 24.13).

10. Grievance Mechanism

Each IA will establish a GRM (or make provisions in the overall GRM) for the project workers to address labor or workplace-related concerns consistent with the applicable national and provincial laws and ESS2 before the Project Effectiveness and describe them in the Project Operations Manual (POM).

Typical work place grievances include demand for employment opportunities; labor wage rates; delays of payment; disagreement over working conditions; and health and safety concerns in the work environment. A grievance structure will be established for project workers (direct workers and

contracted/supply workers), as required in ESS2. Handling of grievances should be objective, prompt and responsive to the needs and concerns of the aggrieved workers. The worker Grievance Redress Mechanism (GRM) will also allow for anonymous complaints to be raised and addressed. Individuals who submit their complaints or grievances may request that their names be kept confidential and this should be respected. Under ESS2, a worker GRM will be provided for all project, including, direct workers and contracted/supply workers, to raise workplace concerns, including SEA/SH relating to the workplace. A direct worker, or a contractors'/primary suppliers' worker, who has any complaint or grievance has the right to present it and eventually get a proper response on it.

According to ESS2 paras. 21-23, different types of workers (including all direct workers and contracted workers, and were relevant, their organizations) may approach the workers' GRM for the following key reasons, among many others:

- Demand for employment opportunities;
- Labor wages rates and delays in payment of wages;
- Disagreements over working conditions;
- SEA/SH in the workplace; and
- Health and safety concerns in work environment.

The worker GRM, which is different from the public GRM, will leverage existing procedures and systems, and will be established in early stages of the project and will serve throughout the project implementation. The worker GRM will be based on the requirements of the WB's ESS2 – Labor and Working Conditions. Specifically, the worker GRM will operate according to the following key principles:

- It will be made available for all direct and contracted workers (and were relevant their organizations);
- It will be proportionate to the nature and scale and the potential risks and impacts foreseen from the project;
- It will be designed to promptly address concerns using an understandable and transparent process that provides timely feedback to those concerned in a language that they understand, without any retribution;
- It will operate in an independent and objective manner;
- It will be a free system. Complaining workers will not pay fees to use the worker GRM;
- It will utilize existing grievance systems and experiences. In this context, the worker GRM will leverage HR complaining procedures for direct workers that are available at their respective health ministries and departments, and will ensure HR procedures at contractors' organizations are consistent with the official worker GRM system characterized in this document, which will be further referenced in their working agreements, and monitored accordingly;
- Anonymous grievances are also allowed and facilitated, and will be treated equally as other grievances, whose origin is known, however, a suitable contact information is a must to be able to communicate responses back;
- There will be no discrimination against those who express grievances, and any grievances will be treated confidentially;
- It does not replace or override the requirements to provide workplace processes to report work situations that a project worker believes are not safe or unhealthy;
- Workers will be able to raise concerns regarding unsafe or unhealthy work situations through this system; and

- It will not impede access to other judicial or administrative remedies that might be available under the law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.

The worker GRM will have the following design and procedural:

Information about the existence of the grievance mechanism will be readily available to all project workers (direct and contracted) through notice boards, the presence of "suggestion/complaint boxes", and all pertinent information, such as: the designated call centres, hotline numbers, email addresses, office work hours, comment/complaint forms, suggestion display boxes, stipulated timeframes to respond to grievances; info on a register to record and track the timely resolution of grievances; the responsible department to receive, record and track resolution of grievances, and other means as needed.

- The complainant will be able to use mobile-phone based applications, and in-person centres for complaint registration and resolution, and a free hotline linked with a call centre;
- The grievance will be addressed through each area of feedback value chain: (i) uptake, (ii) sort and process, (iii) acknowledge and follow up, (iv) verify, investigate and act, (v) monitor and evaluate, and (vi) provide feedback to the complainant to ensure
- Grievance handling will be transparent and aggrieved workers will be informed within 10 days of their grievance application, either with a respective solution or with a request of extension;
- The aggrieved worker will have the option to refer to a grievance log with key information that will be established by the IAs and quarterly reported upon;
- If not satisfied with the outcome of the contractor level, the aggrieved party will be able to access Grievance Redress Committee (GRC), PMU level as well as PCMU level within the IA. The GRC will responsible for the redress mechanism in the areas labor, environmental and social safeguard (ESS) and project management.
- The mechanism for resolving workers' grievances will be described in the context of staff induction training, which will be given to all project workers. The mechanism will be based on the following principles:
- The process will be transparent and will allow workers to voice their concerns and file grievances.
- At the time of recruitment and prior to actual work engagement, these workers will be informed of the grievance mechanism as described below and the measures to be put in place to protect them against any reprisal, discrimination or biased action on their grievances. Grievance mechanism shall be made easily accessible to all project workers.
- There will be no discrimination against those who express grievances and all grievances will be treated confidentially.
- Anonymous complaints will be treated in the same way as other complaints, the origin of which is known.
- Management will deal with grievances seriously and take appropriate action in a timely manner and deadlines for responding to complaints;
- Information on the existence of the grievance mechanism will be readily available to all project workers (direct and contractual) through bulletin boards, suggestion and complaint boxes and other means as required.
- This mechanism for project workers will not prevent them from using the conciliation procedure provided for by the Labor Code.

The E&S Specialists will monitor the recording and settlement of grievances by workers and report to the PMU in its monthly progress reports. The process will be followed by the GRM focal point, the **environment and social development specialists who will be responsible for the GRM of the project.**

Collective Grievances and Disputes Resulting from the Negotiations of Collective Agreements: Where a trade union is recognized, it is entitled to negotiate on a regular basis with the employer over terms and conditions existing at the workplace and the employer is obliged to negotiate with it. The procedures followed in such instances is usually contained in the agreement, which state how the issues are raised, the procedure for negotiations, the composition of the parties involved in the negotiation and the procedure to deal issues that are not resolved through consensus. In the type of disputes, if the dispute is not resolved at the workplace, the parties to the dispute can utilize the dispute resolutions mechanisms provided for in the labor legislation.

Sexual Exploitation and Workplace Sexual Harassment: A GRM will be established specifically for the purpose of confidentially receiving grievances related to SEA/SH. Further details of the GRM are provided in the SEA/SH Risk Mitigation Action Plan to be developed for SWAT. All SEA/SH related complaints, with the survivor's consent, will be referenced to the project identified service provider who will further manage the case in a survivor centric approach and will report back to the project GBV GRM once the case is solved. In addition, the ESIA/ESMP will identify additional mitigation measures through a SEA mitigation action plan that will be reflected in site specific ESMPs, including the contractors ESMP or contractors specific LMP, where required. This will include engagement with communities on gender related risks, grievance and response measures available, as identified in the manual.

The PMU will, with support from consultants, identify institutions and services provides who are actively engaged in prevention of gender-based violence, sexual exploitation and workplace sexual harassment in order to establish a manual for referencing any potential survivors. The PMU, the project unit and the contractor are not equipped to handle complaints or provide relevant services to survivors, but will reference any person to relevant service providers, including health facilities, law enforcement's gender unit or others, as relevant using the information on available services.

All concerned responsible staff shall hold regular meetings with the project workers to discuss any work-related issues and concerns. Every grievance raised by a worker will be documented with the actions undertaken by the PMU and contractors to address such grievance. The aggrieved worker may raise any issue anonymously through a letter which shall be submitted to his/her immediate supervisor's office. Any grievance which are left unattended by the contractor can be submitted by the worker to the PMU, in which case actions shall be taken to resolve the issue. Any labor dispute shall be first resolved through mediation, conciliation and arbitration, in order to provide an efficient procedure in the settlement of disputes and to promote autonomy and freedom of the parties to make their own arrangements to resolve their grievance.

In addition to the GRM described in the SEP and ESMF where a GRM for project workers will be integrated. A detailed grievance redress mechanism for this LMP shall be further developed and finalized proportional with the magnitude of the workers to be employed, along with the project- level GRM prior to project implementation to guide project management and workers in addressing labor and/or work-related concerns in a transparent and timely manner.

11. Contractor Management

IAs will ensure that the contractors, are legitimate and reliable entities and that they have procedures established for management of labor in compliance with this LMP. Contracts with contractors will include a provision on the obligation to comply with current legislation on labor and protection at work. During selection of contractors, IAs can ask to be provided with an insight into additional documentation, including, without limitations, the following:

- Information in public records, for example, corporate registers and public documents relating to violations of applicable labor law, including reports from labor inspectorates and other enforcement bodies;
- Business licenses, registrations, permits, and approvals;
- Documents relating to a labor management system, including OHS issues, for example, labor management procedures;
- Identification of labor management, safety, and health personnel, their qualifications, and certifications;
- Workers' certifications/permits/training to perform required work;
- Records of safety and health violations, and responses;
- Incident, accident and fatality records and notifications to authorities;
- Records of legally required worker benefits and proof of workers' enrolment in the related programs;
- Worker payroll records, including hours worked and pay received;
- Identification of occupational health and safety committee members and records of meetings; and
- Copies of previous contracts with contractors and suppliers, showing inclusion of provisions and terms reflecting ESS2.

IAs will monitor the performance of contractors in relation to contracted workers, focusing on compliance by contractors with their contractual agreements (obligations, representations, and warranties). This may include periodic audits, inspections, and/or spot checks of project locations or work sites and/or of labor management records and reports compiled by contractors. Contractors' labor management records and reports may include: (a) a representative sample of employment contracts or arrangements between third parties and contracted workers; (b) records relating to grievances received and their resolution; (c) reports relating to safety inspections, including fatalities and incidents and implementation of corrective actions; (d) records relating to incidents of non-compliance with national law; and (e) records of training provided for contracted workers to explain labor and working conditions and OHS for the project.

Primary Supply Workers

The number and type of primary suppliers will be defined once the contractor defines his work plan and makes the corresponding adjustments to the designs to optimize them. The construction work under the Project will require primary supplies including construction materials essential for the functions of the proposed infrastructure, such as aggregates, bitumen and precast concrete interlocking blocks. Some contractors may be able to produce such construction materials by their workforce. However, where the contractor will source (a) essential materials (b) directly from primary suppliers (c) on an ongoing basis, the workers engaged by such primary suppliers (that meet all three criteria are deemed "primary supply workers", as defined in ESS2. As discussed in Section 3 (Key Labor Risks), the OHS risks are also deemed to be generally significant in the construction sector including quarry sites. To address these potential risks, the following measures will be taken:

Selection of primary suppliers: When souring for primary suppliers, the project will require such suppliers to identify the risk of child labor/force labor and serious safety risks. The PMU and the consultants will review and approve the purchase of primary supplies from the suppliers following such risk identification/assessment. Where appropriate, the Project will be required to include specific requirements on child labor/forced labor and work safety issues in all purchase orders and contracts with primary suppliers.

Remedial process: If child labor/forced labor and/or serious safety risks are identified, the PMU and the consultants will require the primary supplier to take appropriate steps to remedy them. Such mitigation

measures will be monitored periodically to ascertain their effectiveness. Where the mitigation measures are found to be ineffective, the PMU and the consultants will, within reasonable period, shift the project's primary suppliers to suppliers that can demonstrate that they are meeting the relevant requirements.

IAs will oversee the procurements of goods and materials requirements under the civil works. Project Contractors will be responsible for procurement and supply of materials and equipment under the same conditions and specifications on ESHS aspects in its contracting agreements

12. Template for Workers Code of Conduct

All workers will sign the following code of conduct

I,_____, acknowledge that preventing any misconduct as stipulated in this code of conduct, including sexual exploitation and abuse (SEA), sexual harassment (SH), and child abuse/exploitation are important. Any activity, which constitute acts of gross misconduct are therefore grounds for sanctions, penalties or even termination of employment. All forms of misconduct are unacceptable be it on the work site, the work site surroundings, or at worker's camps. Prosecution of those who commit any such misconduct will be pursued as appropriate. I agree that while working on this project, I will:

1. Consent to security background check;
2. Treat women, children (persons under the age of 18) and persons with disability with respect regardless of race, color, language, religion, political or other opinion, national, ethnic or social origin, property, birth or other status;
3. Not use language or behavior towards men, women or children/learners that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate;
4. carry out his/her duties competently and diligently;
5. comply with this Code of Conduct and all applicable laws, regulations and other requirements, including requirements to protect the health, safety and well-being of other Contractor's Personnel and any other person;
6. maintain a safe working environment including by:
    a. ensuring that workplaces, machinery, equipment and processes under each person's control are safe and without risk to health;
    b. wearing required personal protective equipment;
    c. using appropriate measures relating to chemical, physical and biological substances and agents; and
    d. following applicable emergency operating procedures.
7. report work situations that he/she believes are not safe or healthy and remove himself/herself from a work situation which he/she reasonably believes presents an imminent and danger to his/her life or health;
8. treat other people with respect, and not discriminate against specific

groups such as women, people with disabilities, migrant workers or children;

9. not engage in any form of sexual harassment including unwelcome sexual advances, requests for sexual favours, and other unwanted verbal or physical conduct of a sexual nature with other Contractor's or Employer's Personnel;
10. Not participate in sexual activity with children/learners—including grooming or through digital media. Mistaken belief regarding the age of a child and consent from the child is not a defence;
11. Not exchange money, employment, goods, or services for sex, with community members including sexual favours or other forms of humiliating, degrading or exploitative behaviour;
12. Attend trainings related to HIV and AIDS, SAE/SH, occupational health and any other relevant courses on safety as requested by my employer;
13. Report to the relevant committee any situation where I may have concerns or suspicions regarding acts of misconduct by a fellow worker, whether in my company or not, or any breaches of this code of conduct provided it is done in good faith;
14. Regarding children (under the age of 18):
    a) Refrain from hiring children for domestic or other labor, which is inappropriate given their age, or developmental stage, which interferes with their time available for education and recreational activities, or which places them at significant riskof injury.
    b) Comply with all relevant local legislation, including labor laws in relation to child labor.
15. Refrain from any form of theft for assets and facilities including from surrounding communities.
16. Remain in designated working area during working hours;
17. Refrain from possession of alcohol and illegal drugs and other controlled substances in the workplace and being under influence of these substances on the job and during workings hours;
18. Follow prescribed environmental occupation health and safety standards;
19. Channel grievances through the established grievance redress mechanism.

I understand that the onus is on me to use common sense and avoid actions or behaviours that could be construed as misconduct or breach this code of conduct.

I acknowledge that I have read and understand this Code of Conduct, and the implications have been explained with regard to sanctions on-going employment should I not comply.

Signed by:_____

Signature:_____ Date:

_____

For the Employer/Contractor

Signed by:_____ Signature:

_____

Date:_____

Annex 9: Sindh Strategic Overview of Water and Environmental Issues

SECTION 1. INTRODUCTION

This is the Strategic Overview of Water and Environmental Issues.[54] It takes stock of the water issues within Sindh Province and the cumulative environmental challenges. It points to opportunities to improve performance: to deliver better water services; to sustain, strengthen, and improve the use of resources; and to create more equity and prosperity. As such, it is meant to contribute to the implementation of the Sindh Water Policy as well as the different water management programs, including the Sindh Water and Agriculture Transformation Project (SWAT). Terms of references for the proposed Sindh Strategic Plan to assess and address the water and environmental and water given issues is given Annexure 1.

This overview draws on a number of data sets, reports, and publications and also direct fact finding. These sources are gratefully acknowledged. However, there are also gaps in the availability, reliability, and continuity of essential information, which we have recorded these. Improving on these shortcomings will help to create a better basis for water management in Sindh, for instance through a Hydro-Agro Information Centre.

This Strategic Overview first reviews the history of Sindh from a water management perspective (section 2). It then discusses the overall situation in the province (section 3) and describes surface and groundwater resources (section 4-5) and their main uses: irrigation and drainage (section 6), urban and rural water supply (section 7), and wetlands including the Indus Delta (section 8-9). The last two sections discuss flood management (section 10) and dryland management (section 11). Each section describes challenges and opportunities, so as to inform strategies for Water Policy and concerned programs.

Below we summarize the cumulative challenges that describe the current situation in water and environmental management with reference to the section of this strategic overview where they are discussed in more detail:

Table 1: Cumulative challenges in water and environment in Sindh

	Cumulative challenge	Outlook section
Water resources	From a semi-natural flood based system, the water resources system of Sindh has become largely engineered, with winners and losers. It sustains a larger rural economy than planned, as made clear by the steeply increased cropping intensity. Climate change is presenting a new set of conditions with erratic rainfall events, increasing evapotranspiration and higher frequency of floods and drougths.	2-3
Surface water	Due to increased water use, reduced storage capacity, larger diversions to flood plains and the canal commands and the change in cropping patterns, scarcity has increased as seen in the increased number of days with zero outflow below Kotri.	4
Groundwater	Groundwater was underused in Sindh until 2000, but its use has increased since then. The resources are precarious, either isolated small aquifers in drylands or freshwater pockets in saline areas. Considerate (conjunctive) management is required.	5

[54] *This document has been prepared by a team from MetaMeta Research, consisting of Frank van Steenbergen, Abdul Ghani Pirzado, Esmee Mulder, and Inger Spierenburg with inputs from Heman Das Lohano.*

	Cumulative challenge	Outlook section
Water logging	Water logging began developed rapidly in the 1960s and still persistently affects 35-45% of the irrigated area on annual basis, with the problem most prevalent in the post-monsoon season. Widespread water logging explains the current massive water loss due to non-beneficial evaporation, but also suppresses crop yields and causes health hazards.	6
Irrigation	Sindh is home to the world's largest irrigation canals. Management has been challenging, with frequent breaches and embankment overtopping and unauthorized diversions. A major problem is the large number of direct outlets that have been sanctioned since the 1970s, creating inequity and complicating the management of the system. Despite many changes to the system (additional storage, conjunctive groundwater use) water allocations/irrigation duties for the canal commands were never updated and are now largely informal and sub-optimal. Crop water productivity, especially in the lower part of the system, is low.	6
Drainage	In response to increased waterlogging and salinity, an extensive drainage network was developed from 1970-2000 to remove seepage water. The drainage network is not equipped to evacuate storm water, which has caused flooding and has foregone opportunities for recharge. Operation and maintenance of the drainage network is problematic. The Left Bank Outfall Drain has aggravated flooding problems around Badin. The Right Bank Outfall Drain is not completed: as a consequence drainage effluent is now deposited in Manchar Lake causing this huge water body to rapidly deteriorate.	6
Multifunctionality	The canal network was designed to provide for agriculture, but as Sindh's population grew and the economy diversified, the canal and drainage network became increasingly multifunctional. It became the basis for industrial water supply, waste disposal, and domestic services.	2, 6-7
Water quality	Water quality is a major concern due to the long term practice of disposing untreated industrial or municipal wastewater in the canal and drainage systems. This has spread high levels of cadmium, lead, and mercury into the surface water system. In several districts of Sindh, arsenic concentrations in ground water exceed the WHO guideline of 10 µg/l. The cause is likely the chemical reduction of iron oxyhydroxides due to poor groundwater management.	7
Drinking water supply	Drinking water supply in rural Sindh is problematic, with 98% of water samples deemed unsafe for drinking. Bacteriological contamination, due to inadequate handling, is the prime problem. Microbiological pollution of shallow groundwater – the main source in rural areas – presents additional health risks. The other challenge is the high non-functionality of improved public systems that stands at 56%; this is high for any country. This is largely compensated for by widespread self-supply systems that use precarious tiny water lenses. The situation is not much better in major cities, where 84% of samples have high coliforms and where there is a shift from taps to reverse osmosis plants and water tankers.	7

	Cumulative challenge	Outlook section
Wetlands	Sindh has a many wetlands, including ten with Ramsar status. While these wetlands harbour important biodiversity and contain unused potential, they have also been in decline due to reduced water supplies, poaching, pollution, invasive species, and encroachment.	8
Indus Delta	The Indus Delta has witnessed a steady decline since the mid-1950s. The development of hydraulic structures on the Indus (reservoirs, barrages, flood protection bunds) has deprived the Delta of fresh water supplies, flood pulses, and sediments. The failure of the tidal link changed the configuration of the Delta further. The decline of mangrove forests (now reversed) and sea-level rise have further affected the Indus Delta. Until now, no concerted effort has worked on protecting this once buoyant area.	9
Floods	Over the last 15 years, Sindh has been the scene of several severe flooding events. The higher depression over the Indian Ocean makes it likely that floods will occur more frequently. Though equipped with flood protection bunds along the Indus River, the management of the main hydraulic system (irrigation and drainage canals) is not equipped to mitigate the impact of flood events.	10
Drylands	The drylands of Kohistan, Tharparkar, and Nara Desert are among the most densely populated globally. Unlike similar drylands elsewhere in the world, there has been little management of the specific resources of these areas beyond the construction of small dams. Ground water resources are particularly fragile and under threat.	11

SECTION 2. HISTORICAL PERSPECTIVE

Water has always been the defining element of Sindh. Sindh is the largely desert territory. Over millennia, the Indus shaped the landscape of Sindh. The Indus would carry silt (0.6% of its volume) during the flood season. These silts were deposited on the riverbanks, forcing the river level to rise, eventually breaking to a lower-lying area and forming a new course, creating periods of insecurity until a new balance was found.

In the past, irrigation was done through direct flooding or inundation canals. Inundation canals would carry water during high flows in the Indus, often following old riverbeds or ridges, sometimes guided by excavations. The other main source of water in agriculture was the flooding of low-lying areas. During the flooding season, the Indus Delta was transformed into an archipelago of stretches of emerged land. On the land, rice cultivation was predominant. In the areas that fell dry after the flooding season livestock keeping was common, feeding on the grasses and shrubs. These lands were drained out either naturally or artificially in October, once the river levels dropped. In between, water bodies throughout Sindh yielded fish and other produce. Sindh was, in many periods, an area of surplus production. This attracted the higher ruling classes, who were often overthrown during periods of uncertainty when the Indus was changing its course.

The water system in Sindh has changed dramatically in the last two centuries, as part of a larger transition of society and economy. Transformations of the water systems came in the 'era of engineering,' starting in the mid-19th century. In this period, the intakes of several of the inundation canals in Sindh were improved by moving them further upstream – the Western Nara, the Fuleli canal, and the Mithrao canal.

A cut was made in the Indus to feed the Eastern Nara canal, following the old Hakra riverbed. The major transformations, however, came with the construction of the Lloyds Barrage, now Sukkur Barrage, commissioned in 1932. To date, this barrage remains the largest irrigation structure globally. Its construction involved entirely new techniques and equipment and deployed 70,000 workers. Developed at the end of the colonial era, there was considerable debate over whether the large investment in the barrage was justified, yet a large part of the investment was recouped from sales to new landowners. The area irrigated by Sukkur Barrage amounts to 3,212 M ha.

The dynamic transformation continued further into 20th century. In Sindh, two more barrages were constructed—the Kotri Barrage (1955) and the Guddu Barrage (1962) – bringing another 1,219 M ha resp 1,226 M ha under irrigation through a network of canals and distributaries. Lower down in the system, at the level of minors and water courses, there was dynamic change as well. In the flat terrain, minor and water courses shifted very frequently. Water courses were reconnected to other minors, and minors and distributaries were shortened or extended – all for landowners to be supplied more reliably. In the flat terrain of Sindh, siltation of canals was also a challenge. For this reason, several areas were largely unusable.

From the 1970s onwards there has also been a steep increase in new offtakes, condoned but at the same time unregulated. For instance, in a desert reach of the Upper Nara canal a large number of irrigation lift systems were constructed that were neither planned nor regulated. Another area that was not part of the original command but that was rapidly converted were the riverine tracts where the original forest plantation was removed to make way for new farmland. The third development was the rapid increase in direct outlets from main canals, branch canals, distributaries, and minors – some authorized at the highest political level in the province as a drought measure, and some illegal but not necessarily removed. Measurements were taken in Nasir Division in Rohri. These indicate that, on average, direct outlets take five times their sanctioned discharge, whereas non-direct outlets only receive half their discharge. Apart from the inequity that this represents, it also promotes water waste and severely reduces water productivity; the water productivity from direct outlets has been measured at only one-third of those of normal gated outlets. In other areas (Johi Branch in Dadu), where the impact of direct outlets has been measured, the inequity appears to be even greater. The ungated direct outlets also make the hydraulic control of canal flows very challenging, as the direct outlets receive water at any level.

Another major transformation affecting the water system of Sindh is the construction of the upstream Tarbela Dam and Mangla Dam, which stores flood water and makes more water effectively available for downstream use, particularly in the dry season. The commissioning of the dams also had other effects. They reduced the flooding regime along the Indus, affecting the flood plains, and they caused sedimentation to come to a halt, affecting the buoyancy of the Indus Delta by depriving it of the inflow of sediment that compensated for incessant coastal erosion.

Gradually, crop intensity increased. Compared to the design intensity at the construction of the systems, actual crop intensity is far higher: 90% against 150%. With the increased demands, water scarcity has become ever more manifest in Sindh, forming an important driver for improved water management to which this Strategic Overview aspires to contribute.

Karim (2021)[55] has highlighted a number of factors that explain the increased scarcity, apart from the ever rising demands and water quality concerns. First is the reduced storage capacity in the main reservoirs in Pakistan. Since its commissioning in 1972 the Tarbela dam has silted up, losing 41% of its capacity (from 14.3 BCM to 8.4 BCM). A comparison of hydrographic surveys of Tarbela Reservoir in different years reveals that the delta pivot point has advanced towards the main dam, from 23.5 km in 1979 to 6.46 km

[55] *Karim, Mohammed Umar (2021), You wanted to know why Sindh doesn't have enough water, Samaa 19.5.2021.*

in 2017. The storage capacity of the reservoir is reduced every year by the deposition of a huge amount of sediment. Moreover, the progressing sediment delta makes it increasingly risky to discharge water beyond live storage levels[56]. The result is a reduced capacity to store flood water and to release it into the canal system in Pakistan, with the effect coming down hardest on the downstream water users.

A second factor that is driving water scarcity in Sindh is the changed water consumption in the Indus Flood Plains related to the conversion of riverine tracts. All along the Indus and its tributaries, large tracts of land were transformed into permanently irrigated land with the development of shallow tube wells. This has reduced water availability. Whereas the seepage to the riverbed and water loss to flood plain agriculture was estimated to be 16% of the Indus flow from 1936-1946, this figure has now probably doubled[57], making less water available for the canal system or for environmental flows. Until three decades ago, cultivation of the flood plains was limited, if only because the riverine forests were actively policed. Over time, however, these areas have been transformed into farmland. In the 1970s, the riverine forests were spread over an area of 241,000 ha, varying in width from 3 to 6 km. These were main productive forests in Sindh and formed a protective barrier against floods. From 1977 to 1996 an estimated 21,590 ha of riverine forest was lost. The trend rapidly accelerated in the last 25 years in Sindh and in all provinces. Abasi et al. (2011)[58] estimate that from 1979 to 2009 forest cover in the riverine tract between Guddu and Sukkur decreased from to 23% to 6%.

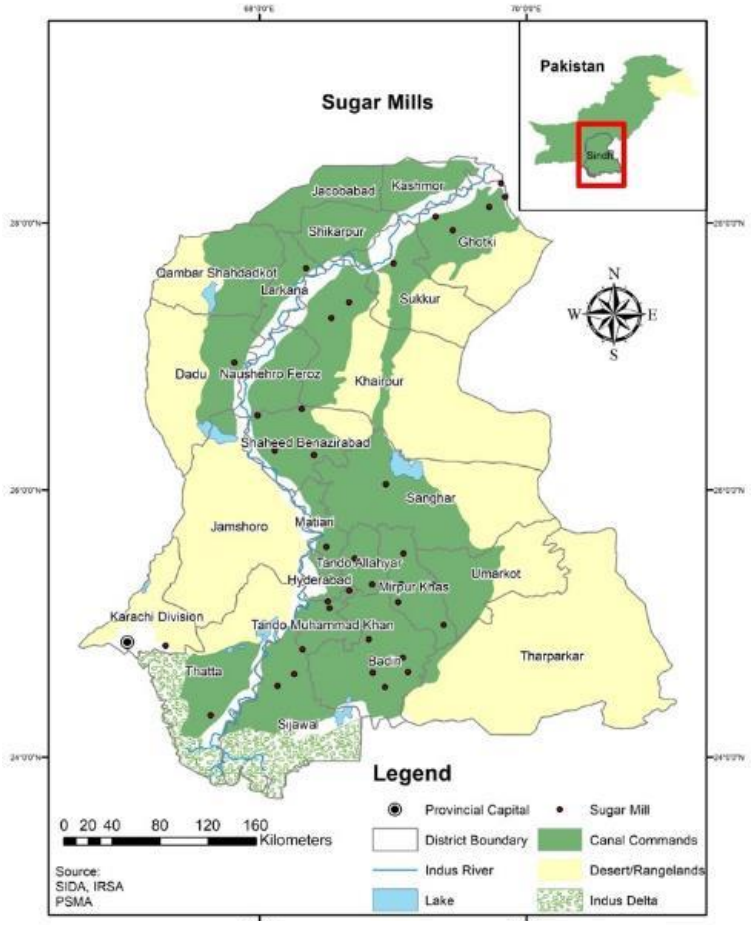

Figure 1: Distribution of sugar mills in Sindh Province

A third factor affecting Sindh's water scarcity is the change in cropping patterns that has taken place over the years. One side of this is the increase in cropping intensity throughout the province. The second

[56] *Rashid, M. U., Miqdad, H., ul Hassan, M. S., & Haseeb, A. (2021). Evaluation Of Sediment Management Strategies For Large Reservoirs.*

[57] *Karim, Mohammed Umar (2021), How a proposed Sindh barrage will choke the Indus Delta, Samaa, 7.5.2021.*

[58] *Abbasi, Habibullah U., Mushtaq Ahmed Baloch, and Abdul Ghafoor Memon (2011), Deforestation Analysis of Riverine Forest of Sindh Using Remote Sensing Techniques. MEHRAN UNIVERSITY RESEARCH JOURNAL OF ENGINEERING & TECHNOLOGY, VOLUME 30, NO. 3, JULY, 2011*

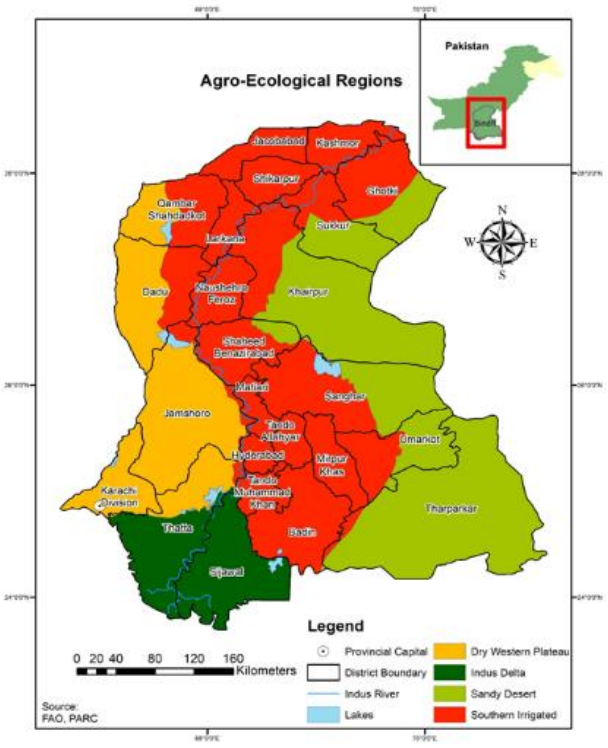

Figure 2: Agro-ecological zones in Sindh Province

phenomenon is the change in cropping patterns. Rice used to be the most common crop in the tail end of the irrigation system. The advantage of rice was that the timing of planting can be adjusted to water availability, even postponing it to May or June. In many of these areas, sugarcane, wheat, cotton, and vegetables have been introduced, which are more stringent in terms of growing season. Ideally, these crops have to start in March, but due to the loss of capacity of the main reservoirs this early availability of water is more and more precarious. This has gone hand-in-hand with the increase in sugar mills in Sindh, many of these in Lower Sindh—a process that went largely unplanned, see figure 1. This means that entire systems are now less flexible, and water scarcity poses a much higher risk than it did two or three decades ago.

Apart from the changes to the Indus, there have also been changes in water resources availability outside the Indus system. A main change has been the reduced inflow of flood flows from the western side. Over time, the spate irrigation systems in Balochistan developed and less flood water escaped to Sindh. This particularly affected the inflows into Manchar Lake, at one time Asia's largest shallow freshwater lake. The surface area of Manchar Lake reduced, and the origin of its inflow changed (see also section 8).

SECTION 3. GENERAL OVERVIEW

Sindh is the third largest province of Pakistan in terms of area (140914 Km^2) and second in terms of population[59]. According to the Pakistan Census in 2017, the population of Sindh was 47,886,051 of which about 23 million live in rural areas and about 25 million live in urban areas [59]. The population is increasing at a rate of 2.41% annually, increasing from about 30.4 million in 1998. The ratio between urban and rural population has stayed relatively constant [59]. Geographically, Sindh has a strategic position along the Arabian Sea. The biggest city of Pakistan, Karachi (16 million inhabitants), lies along this coast and is the economic hub of the country, endowed with the biggest port. Resource-rich Sindh is also the most industrialized province of Pakistan. Its contribution to the national GDP is about 28% despite having only 24% of the population. In Sindh, a wide variety of products are manufactured such as textiles, sugar, paper products, pharmaceuticals, and leather [59]. However, the province's economic growth rate has decreased in recent years and is now below the national average[60].

Additionally, the province has a strong agriculture sector whose provisions include livestock, fisheries, wheat, cotton, sugarcane, rice, fruits, and vegetables [59]. The crops are cultivated in two cropping seasons, rabi and kharif. The rabi season is the winter season and runs from mid-October through mid-April. The main crops in this season are wheat, rape, mustard, vegetables and fodder[61]. The kharif season is the

[59] *Sindh Bureau of Statistics [SBoS]. (2018). Development Statistics of Sindh. Government of Sindh.*
[60] *World Bank Group. (2017). Sindh Public Expenditure Review. World Bank.*
[61] *WSIP. (2012). Preparation of Regional Plan for the Left Bank of Indus, Delta and Coastal Zone. Sindh Water Sector Improvement Project (WSIP-1), Sindh Irrigation and Drainage Authority (SIDA).*

summer season and runs from mid-April through mid-October. In this season cotton, sugarcane, paddy, millets, cluster-bean, pulses, kharif vegetables, and non-traditional oilseeds are cultivated [61]. Furthermore, a variety of fruits are produced, particularly on the left bank of the Indus, including mango, banana, dates, papaya, and guava [61]. The climate of Sindh is arid and hot with an average rainfall of 170-200 mm [61]. Due to this limited rainfall, most of the agriculture in Sindh is irrigated using the Indus as a water source.

A classification of Agro-Ecological Zones (AEZs) of Sindh was prepared by the Agriculture Extension Wings of Agriculture Departments under the guidance of PARC (1980)[62]. Figure 2 shows AEZs at the provincial level.

Irrigated: This is the most prominent zone for irrigated agriculture and includes the canal commands. The Southern Irrigated Zone follows the banks of the Indus.

Indus Delta: As the name suggests, this zone covers the delta area of the Indus. It is sometimes included in the Southern Irrigated Zone and comprises the coastal region of Thatta and the Sijawal district.

Dry Western Plateau: This geo-climatic zone includes the Khirthar Ranges and covers the western part of Sindh.

Sandy Desert: This final zone covers the eastern part of Sindh and is part of the Great Thar Desert.

The irrigated areas of the province are divided into three major agro-ecological zones:

- Zone A: Rice/wheat zone of the right bank of the Indus River in upper Sindh, further divided into sub-zones A1 (Main area) and A2 (Piedmont soil region)
- Zone B: Cotton/wheat zone of the left bank of the Indus River, further divided into aB1 (Guddu Barrage command area) and B2 (Sukkur Barrage command area)
- Zone C: Rice/wheat/sugarcane zone of lower Sindh

With these AEZs defined more than 40 years ago, there is now a general understanding that they need to be updated. Much has changed: the economic conditions, the domestic and international markets, and even the climate have gone through a profound change. There is degradation of resources, such as soil fertility status and quality and quantity of water. There is also a larger diversity of crops. For an improved agricultural outlook, new AEZs are being defined with support of the FAO, with redefined and updated variables such as elevation, climate, land use, land cover, vegetation, soil conditions, fertility, crop area, crop yields, cost-benefit ratio, water duties, and availability. The definition of new AEZs will also be done at a finer scale.

As may be expected with the high economic and population density, the water system is multifunctional. This applies particularly to the canal and drainage system. The canal system not only provides water to the crops, but also to livestock and aquaculture. Directly or indirectly, it is the source of drinking water for cities and rural areas. It supplies industries with water and with the means of effluent disposal – creating

[62] *PARC. (n.d.). Pakistan Agricultural Research Council. Retrieved 2021, from http://old.parc.gov.pk/agroeco.html*

massive water quality problems, because hardly any wastewater is treated and pollutants enter downstream drinking water systems. The way the canal system is managed determines whether droughts and floods in Sindh are mitigated or amplified (see also section 11). The canal system is the defining element in the landscape in Sindh and the driving factor in public health. As the population of Sindh increases and the economy develops, the pressure on canal system services only intensifies.

SECTION 4. SURFACE WATER RESOURCES

Water resources available in 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). 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 (including two serving Balochistan Province) via an intricate system of 117 branch canals, 1,400 distributaries and minors, and 44,000 watercourses[63]. 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 recent economic development following rapid urbanization and industrialization, and the population increase, the pressures from other sectors are also increasingly quickly. Effectively, the 12 main canals of Sindh have been transformed into multi-purpose canals serving agriculture, industries, households, and environment including wetlands, the Indus Delta, and natural habitats.

Flows into Sindh at Guddu averaged 65.19 MAF between 2004 and 2019, with flows concentrated in June and September. These average flows are subject to significant interannual variability; the flow was 43.63 MAF and the peak flow was 103.27 MAF during the same period. For instance, in 2018-2019 the inflows were 49.80 MAF, of which 35.66 MAF was consumed – most of it in agriculture (33.80 MAF). Water losses where 6.69 MAF, mostly in the kharif season. The releases after the last barrage, i.e., Kotri, on the Indus were 1.76 MAF annually (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. Here in the Indus Delta, the water scarcity is most painfully manifest. Figure 3 presents the number of days with zero water flow below Kotri Barrage as developed by Sayal (2015)[64]. Apart from the clear peak during the drought period between 1998 and 2002, there has been a steady rise in the number of dry days, at more than 120 in any given year.

[63] *GoSindh, 2018. Sindh Agriculture Policy: 2018-2030. Planning and Development Department. Karachi*

[64] *Sayal, E. A. (2015). Water Management Issues of Pakistan (Doctoral dissertation, UNIVERSITY OF THE PUNJAB LAHORE, PAKISTAN).*

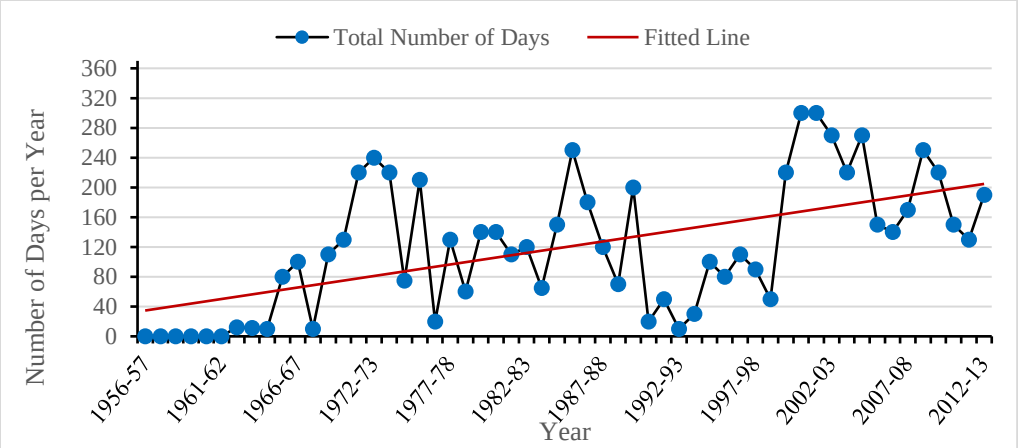

Figure 3: Number of days annually with zero outflow of Indus River

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. Though smaller, but surface water resources are the important to the population of the province. 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.

By far the largest use of water in Sindh is agriculture. Crop consumption is around 95% of total consumption, with 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 is 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 annually and have often been inadequate to meet environmental flow requirements.

Climate change is already manifesting its impacts and will be a strong risk multiplier. It is estimated that without appropriate investments into adaptation, climate change may reduce agricultural value-added to GDP in Pakistan by around 5%. Projected impacts are multifold and include (a) changes to Indus River flows and precipitation patterns affecting canal and dryland areas alike; (b) increased requirements of irrigation water and water demand more generally; (c) reduced productivity of crops and livestock due to heat stress and other adverse impacts, especially for P4 crops; (d) increased frequency and intensity of extreme weather events (droughts, floods); (e) sea water intrusion affecting coastal agriculture, forestry, and biodiversity; (f) higher incidence of typhoons over the Indian Ocean affecting the coastal area of Sindh and its drainage system; and (g) sea level rise (3 mm a year) in the coastal areas.

Under business as usual circumstances, **water demand** will increase in Sindh as a result of the combined effect of population growth, structural change in the economy, and climate change. It has been estimated that total municipal, industrial, and agricultural water demand may increase by up to 15.2 MAF if modest climate change (+1 degrees) is assumed: from 46.8 MAF in 2018 to 62.0 MAF in 2050, or a 30% increase. The largest part of the increased demand comes from agriculture (12.9 MAF), but water demand from municipal and domestic users is expected to more than double, with higher demands on quality and reliability. Given the limited nature of water resources in Sindh, better management of existing resources is imperative to deal with future demand.

As discussed, water resources in Sindh are affected by the effects of climate change and population growth. The coastal areas are facing sea intrusion, which is attributed to sea level rise (3 mm a year) and erratic water flows from the Indus River into the sea. They are also experiencing growing water demand from agriculture, industries, and households due to population growth.

SECTION 5. GROUNDWATER

For a long time, groundwater in Sindh was less visible, overshadowed by the surface canal system. There are three hydro-geological zones in Sindh: (a) the Eastern (Thar) Desert; (b) the Western Mountain; and (c) the Indus Valley or the Plains of Sindh. The most important groundwater area in Sindh is the Indus Plains, which is recharged by the meandering river and the irrigation network. The Indus River in Sindh Province generally flows on a ridge and is hence mainly influent, meaning that it feeds the aquifer systems alongside it rather than being fed by it. Some of the flow drains towards the desert in the east. Another part flows towards the Khirthar Hills. In the Rabi season, when the flow in the river below Sukkur Barrage is almost zero, the river receives groundwater, especially the left bank. Along the Indus, groundwater quality in Sindh is generally fresh and useable (within 1500 PPM), but it deteriorates away from the river. Centuries of seepage and recharge have created such fresh water areas. The native groundwater of the Lower Indus Plain is highly saline. The entire deltaic area south of Hyderabad is a saline groundwater area, except in some shallow pockets in the abandoned riverbeds of the Gaj area. What is important is that salinity also varies with depth in Sindh, increasing in most areas at lower depths. Figure 4 is a record of this: there are several areas where at shallow depth groundwater is fresh and hence useable, but saline and unusable at larger depths.

Overall, groundwater is saline, and salinity increases at deeper levels. Among the shallow wells (0-25 m), 65% are saline, and 81% of the deeper (75-100 m) layers are saline [65]. In comparison to other parts of Pakistan, private tube well development has been taken up less in Sindh due to the prevailing groundwater salinity. Moreover, in normal years the relatively generous surface irrigation supplies, especially on the right bank of the Indus, reduce the need for additional groundwater use[66]. Some have argued that in many areas, particularly in Northern Sindh, a layer of fresh water floats on the more saline layers that could be exploited more extensively and systematically by skimming wells[67]. Some small tube wells already use these thin lenses along canals and distributaries in several parts of Sindh. A careful approach is required in general, as the fresh water pockets vary in depth. In some areas (for instance Badin and Thatta), the layer of fresh groundwater is so thin that it does even not suffice to provide for domestic water needs throughout the entire *rabi* period, particularly in the areas served by non-perennial canals. In those areas, drinking water problems are the most severe. In fact, the lower Left Bank areas of the Indus are a premier problem spot and a "water management disaster" area by international standards. The highly saline groundwater in this area is very much in the root zone, and waterlogging and salinity are widespread. The salinity is caused by the high irrigation supplies (often in the *kharif* when there is less demand elsewhere) and the flat topography of this area plus the worsened natural drainage due to the tidal effect having moved upstream after the scouring out of the Tidal Link. The impact not only concerns agricultural productivity, but also basic drinking water supplies. With groundwater levels being as high as they are, there is little space for fresh/brackish water lenses that would at least provide some relief. The main source of drinking water is

[65] *Iqbal, N., Ashraf, M., Imran, M., Salam, H. A., Hassan, F. U., & Khan, A. D. (2020). Groundwater Investigations and Mapping in the Lower Indus Plain. Pakistan Council of Research in Water Resources (PCRWR).*

[66] *Ahmad, Masood and Gary P. Kutcher, 1992. Irrigation planning with environmental considerations: a case study of Pakistan's Indus Basin, Technical Paper 166. Washington: World Bank.*

[67] *Nazir Ahmad 1993. Water Resources of Pakistan and Their Utilization. Shahzad Nazir, Lahore*

the highly polluted surface water in the three main irrigation canals running in the area. The situation in Badin and Thatta was worsened by the 2010 floods, which further spread the high water tables.

Private tube well densities in Sindh were low but they are catching up. The estimated number of tube wells in Sindh in 2000 was slightly over 28,000 [68] but have now increased. There is no more recent count – but tube well numbers are believed to have grown in Sindh to over 100,000, providing for just below 20% of irrigation needs[69].

A groundwater balance for the Province in broad terms, and considering average rainfall and canal flows, is given in table 2. The figures indicate the order of magnitude in groundwater recharge and discharge. Major components of groundwater recharge in Sindh Province are the seepage from the irrigation system and rainfall. Groundwater discharge is mainly through non-beneficial evapo-transpiration, whereas groundwater use is relatively limited. The budget shows a colossal amount of non-beneficial evapotranspiration, at around 17 BCM, as may be expected with widespread waterlogging (see also section 6). How can gains be made here? Options may include lowering the water table or reducing seepage from the canal system, using even brackish groundwater, by changing to bio-saline cropping patterns.

Table 2: Groundwater balance for Sindh

Recharge/Discharge Components in BCM	**Normal Year**
Recharge Components	
Recharge from Rainfall	2.42
Recharge from Canal System @ 15 % of 56 BCM	8.34
Return flow from Irrigation System @ 22.5 % of net flow	10.58
Return flow from GW Abstraction @ 22.5 %	0.97
Recharge from Rivers	0.37
Total	**22.68**
Discharge Components	
Groundwater Abstraction (Public + Private)	4.30
Non-beneficial ET losses	16.96
Base flow to rivers	1.42
Total	**22.68**

Outside the Indus Plains there is also an important need to improve groundwater management, though the options are limited. The drylands of Sindh are among the most densely populated deserts in the world (see also section 11). As one moves towards the south in the desert, annual rainfall increases considerably, reaching 350 mm/year. The rainfall pattern is highly variable and characterized by spells of dry years, causing outmigration as even drinking water sources fail. The groundwater in Thar and NRI Desert is mainly saline, with salinity of water in terms of electrical conductivity in 86% of the area, ranging between 2,000 and 10,000 µS/cm. Generally, this is unfit for consumption, but under duress water quality up to

[68] *Qureshi, A.S., T. Shah, M. Akhtar, 2003.The groundwater economy of Pakistan. IWMI Working Paper No. 64. International Water Management Institute, Colombo, Sri Lanka.23 pp.*

[69] *Lytton, L., Ali, A., Garthwaite, B., Punthakey, J. F., & Saeed, B. (2021). Groundwater in Pakistan's Indus Basin Present and Future Prospects. World Bank Group. https://openknowledge.worldbank.org/handle/10986/35065*

5000 µS/cm can be considered[70]. It has been argued that there is scope to develop groundwater resources in the Thar in a more systematic manner, particularly in the dune zone where coal bearing sedimentary units and basement formation have remarkable potential. Moreover, the recharge of aquifers would be immediate and the quality of deep groundwater can improve after long pumping. A major threat is the introduction of solar pumping that risks rapidly depleting the fragile groundwater resources in the dry land area.

[70] *Zaigham, Nayyer Alam. 2001. Strategic Sustainable Development Of Groundwater In Thar Desert Of Pakistan. COMSATS 1st Meeting on Water Resources in the South: Present Scenario and Future Prospects, Islamabad 1-2 November 2001*

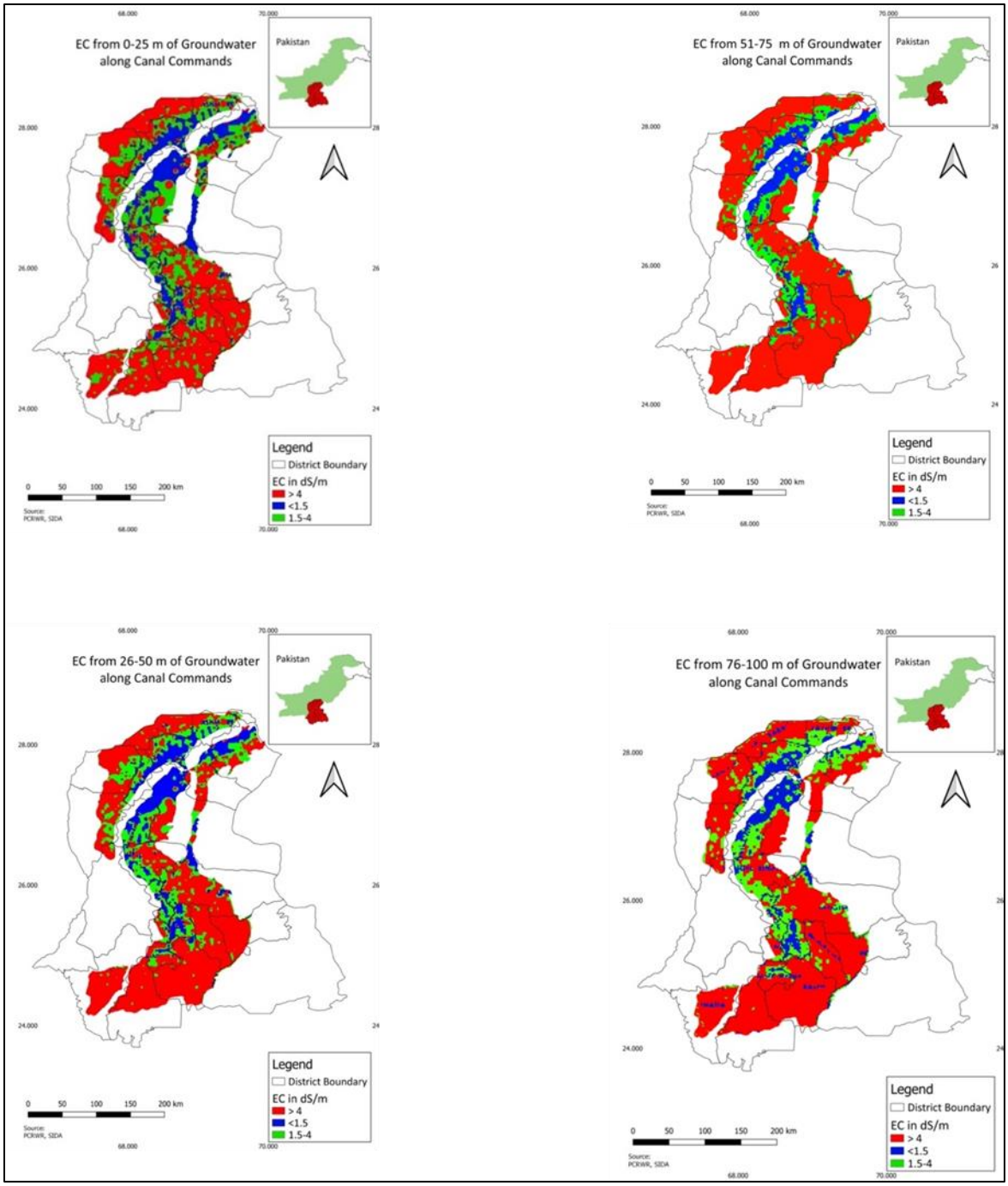

Figure 4: Groundwater salinity at different depths in Sindh Province (source PCRWR)[65]

SECTION 6. IRRIGATION AND DRAINAGE

In Sindh, Indus River water is diverted to the extensive canal network from three barrages: Guddu Barrage, Sukkur Barrage, and Kotri Barrage. The three barrages combined divert water to 14[71] main canals with a complex system of 117 branch canals, 1,500 distributaries and minors, and 44,000 watercourses [63]. Table 2 presents the list of canals under each barrage. Figure 5 shows the map of canal network of Sindh.

The canal system in Sindh has an aggregate length of 21,450 km, and it serves a gross command area (GCA) of 5.8 million hectares. These canals were designed to provide water for agriculture. Agriculture is the largest consumer of water in Sindh as well as in Pakistan, accounting for around 95% of total water used[72]. However, following recent economic development and rapid urbanization and industrialization, and the population increase, pressures from other sectors are increasing quickly. Effectively, the 14 main canals have been transformed into multi-purpose canals serving agriculture, industries, and domestic water uses but also wetlands and various natural habitats. In recent years, pipeline systems have been developed to take water from the canal network into the eastern dryland areas.

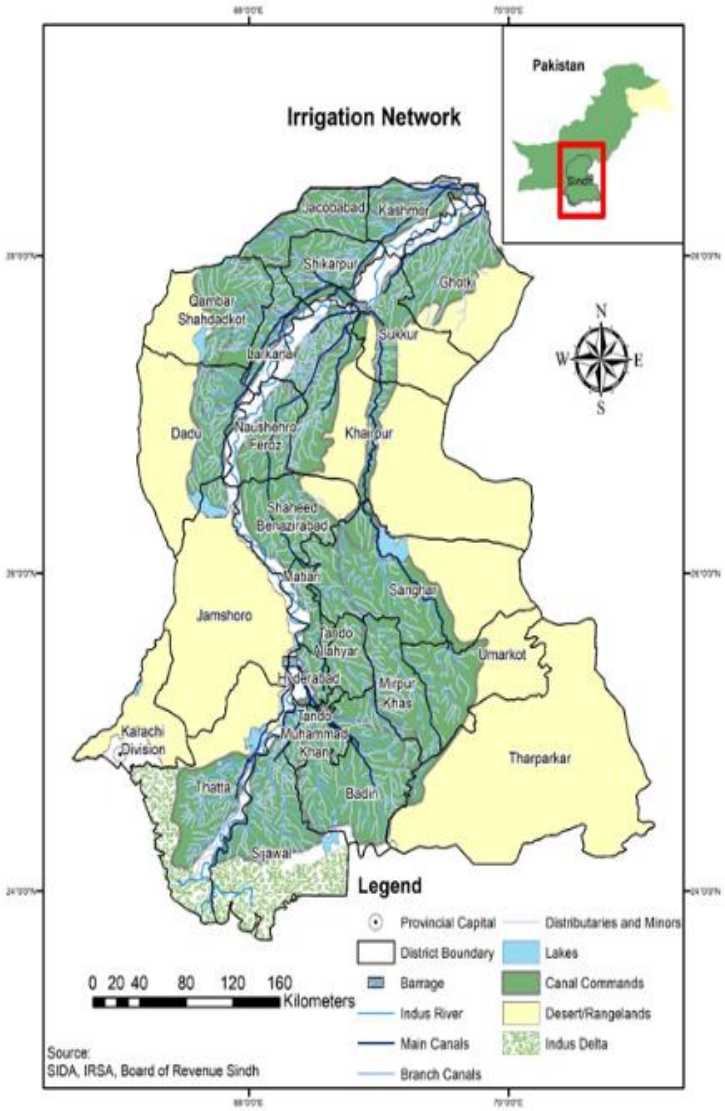

Figure 5: : Irrigation network in Sindh Province

The canals that were developed in Sindh are classified as perennial (P) and non-perennial (NP). This was in response to the Indus flow regime during barrage construction. The perennial canals are used for irrigation duties throughout the year. In contrast, the non-perennial canals receive water in the kharif season, when the flow in the Indus is abundant. Irrigation duties vary for each canal command based on prevailing cropping patterns, the supposed leaching requirement, and soil conditions. There is considerable variation in the irrigation duties

[71] *Of the 14 canals taking off from the barrages in Sindh, 2 are destined for Balochistan Province.*
[72] *Government of Pakistan, 2018. National Water Policy. Ministry of Water Resources*

in each canal area, with general irrigation duties in Sindh being high compared to elsewhere in South Asia. Table 2 presents an overview of the canals in Sindh.

Table 3: Main irrigation canals in Sindh Province

Canal Name	Status	Design Discharge (Cumec)	Command Area (mha)	Design Duty at Head (l/s/ha)	Main Crops [59]	Mana-gement
Guddu Barrage						
Begari Sindh	(NP)	418	406,000	1,03	Rice, Wheat	ID
Ghotki	(NP)	240	347,000	0,69	Wheat, Sugarcane, Cotton	AWB
Sukkur Barrage						
Rice	(NP)	302	210,000	1,44	Wheat, Sugarcane, Cotton, Rice	ID
Dadu	(NP)	147	210,000	0,70	Wheat, Sugarcane, Cotton, Rice	ID
Rohri	(P)	399	1,040,000	0,38	Wheat, Sugarcane, Cotton	ID
Khairpur West	(P)	55	169,000	0,33	Wheat, Sugarcane, Cotton	ID
Khairpur East	(P)	59	151,000	0,39	Wheat, Sugarcane, Cotton	ID
Nara	(P)	387	880,000	0,44	Wheat, Sugarcane, Cotton	AWB
Ghotki						
Pinyari	(NP)	386	318,000	1,21	Wheat, Sugarcane, Cotton, Rice	ID
Fuleli	(NP)	421	450,000	0,94	Wheat, Sugarcane, Cotton, Rice	AWB
Akram Wah	(P)	88	197,000	0,45	Wheat, Sugarcane, Cotton, Rice	AWB
Kalri-Baghar Feeder	(P)	258	240,000	1,08	Wheat, Sugarcane, Cotton, Rice	ID

Regulating the Indus flow following the commissioning of the Tarbela Dam in 1972 and Mangla Dam in 1975 made 24% more water available for irrigation with water discharges particularly increasing in the rabi season. The irrigation canal duties were, however, not reset after this additional water became available. The additional water found its way throughout the system. Actual discharges increased and some non-perennial canals were unofficially converted to perennial canals. As a result there is a lack of transparency in how much water is actually delivered to irrigated areas. This is also exacerbated by the practice of diverting more water into the canals than the official duties. The actual water deliveries per hectare may, in some cases, increase further as the water allocations from areas that are waterlogged (see next) or areas that have gone out of command are transferred to areas that can still be reached.

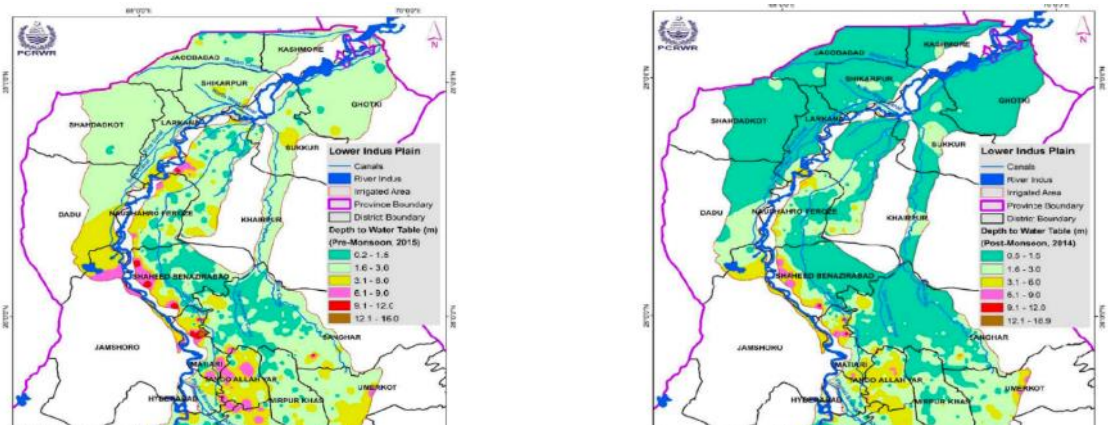

Figure 6: Depth to water table (waterlogging) in Sindh pre-monsoon 2016 (l) and post-monsoon 2015 (r)

Source: Iqbal et al/ PCRWR (2020) [65]

Over time, waterlogging and salinity came to define a large part of the irrigated canal command area in Sindh. By the 1960s, every year about 40,000 hectares of fertile farmland went out of production due to waterlogging and salinity. From that time onwards, water logging increased dramatically in Sindh. Whereas in 1959 12% of the canal command area was waterlogged, this had increased to 39% in 1999. It now persistently fluctuates between 35-45% on average. The area under waterlogging is closely related to the canal supplies of the previous year. A period when waterlogging dramatically decreased was in 1998-2002 when a drought caused a 20% reduction of water releases from the main reservoirs and farmers responded by developing more shallow tube wells; both factors reduced the waterlogged area for a while. Figure 6 presents snapshots of the area under waterlogging (with the ground water table in the top 1.5m of soil) in the pre-monsoon and post-monsoon period. Obviously, water logging is most widespread after the rainy season, covering more than 70% of the irrigated areas, dropping to 10% in the pre-monsoon period.

There are several reasons for the continued widespread waterlogging in Sindh. One is the presence of large flat areas with almost no natural gradient with excess water having no drainage outlet. In other areas, natural drainage has been blocked by the construction of roads, canal, railways, or urban expansion. Yet another main cause of extensive waterlogging and low cropping intensities is the high and generally outdated surface irrigation allocations. Overall, overgenerous surface irrigation supplies, especially in some canal commands, reduce the need for additional groundwater irrigation, which further compounds the problem. Waterlogging appears to be particularly persistent in the areas served by non-perennial canals. These canals receive copious supplies in the kharif season, causing the water table to rise significantly but to fall again in the winter season, when the canals are not flowing. This annual cycle of rise and fall of the water table brings salts to the upper soil strata. The increased water supplies to the non-perennial canals have increased the waterlogging and salinity challenges. The problems in the perennial channels in Sindh are different from those in the non-perennial channels. In the perennial canals, the water duties are generally lower. Here, salinity is concentrated in areas with deficient surface water supplies, as there is not enough water for leaching accumulated salts. This often concerns the tail reaches of the channels.

The response to widespread waterlogging and salinity in Sindh was not a reassessment of water allocations or the unblocking of obstructed natural drainage, but the development of a large drainage network. In response to widespread waterlogging, a remedial drainage network was developed, consisting of 6,000 km of drains and 5,000 drainage tube wells parallel to the existing irrigation infrastructure on both banks of the Indus. On the left bank of the Indus, an outfall to the sea was created with a tidal link excavated across the coastal mud plains. On the right bank, the so-called RBOD I/Main Nari Valley Drain was developed, taking the effluent from the Northern part of the province and Balochistan.

The overall performance of the drainage systems is mixed, at best. In general, the drainage system is beset with operational problems, causing among a large proportion of the drainage well not to function. In addition, the main purpose of the drainage network in Sindh has been to remove excess seepage. Due to this focus, the drainage system as it exists in Sindh has been relatively ill-equipped to deal with floods and peak run-off. In fact, the LBOD on the Left Bank has contributed to flooding events. By acting a drain during high rainfall events it has channeled flood water to Badin, where a number of regular flooding events have taken place. No overflow has been included in the Spinal Drain that would have alleviate this problem and would have served to make use of the flood water for recharge. The Tidal Link connected the drainage network of the Left Bank to the Arabian Sea has been beset with problems too. The Cholri weir meant to protect the brackish wetlands in the tidal plains collapsed soon after construction and the entire Tidal Link

scoured out causing tidal effects to be no longer cushioned in the mudflats but instead moving further upstream.

Similarly the RBOD has been problematic from a social and environmental point of view. On the right bank the drainage system is not connected to the sea. Ultimately the drain was to be connected to Gharo Creek and to sea, as part of the RBOD-II program. Though RBOD-II was taken up in 2000, the work has not been completed and is now suspended, yet with recurrent plans to restart. The connection of the Main Nari Valley Drain to Lake Manchar was at one time supposed to be a temporary measure, yet has become a permanent arrangement over the last decades. The drainage effluent carried by the drain to Lake Manchar has caused the water body to gravely deteriorate. Manchar Lake is the largest natural shallow lake of Asia. The lake has a mean depth between 0.5 and 3.75 meter and an average area of 233 km^2, that can extend from 200 to 500 km2, but has in the past fallen dry as well. Its significance goes beyond that of a water body: it has large cultural value, housing the ancient Mohanna boat people community for instance. The water in Manchar lake has three sources:; overflows of the Indus River, run-off from the Khirthar Mountain range, and since 1932 the Main Nara Valley Drain (MNVD). The importance of these sources has changed over time. As the inflows of the flood runoff from the Khirthar range reduced due to upstream development as have the high waters from the Indus, following the regulation of the river, the drainage inflows of the MNVD has become the prime source of water for Manchar Lake (Mahessar et al., 2019), only occasionally augmented by flood water releases either from Khirthar range or the Indus. In particular after 1981 when the MNVD was remodelled to carry the effluent of a large number of smaller drains, disposals from industries and domestic waste as well as excess water from agriculture and saline seeps started to dominate the inflow. The accumulation of polluted supplies in combination with the high evaporation from the shallow waters transformed Manchar into a saline lake (Kazi et al., 2009). Calcium, hardness, chlorine, arsenic, nickel, manganese, zinc, copper and sulphate for instance are all above permissible limits.

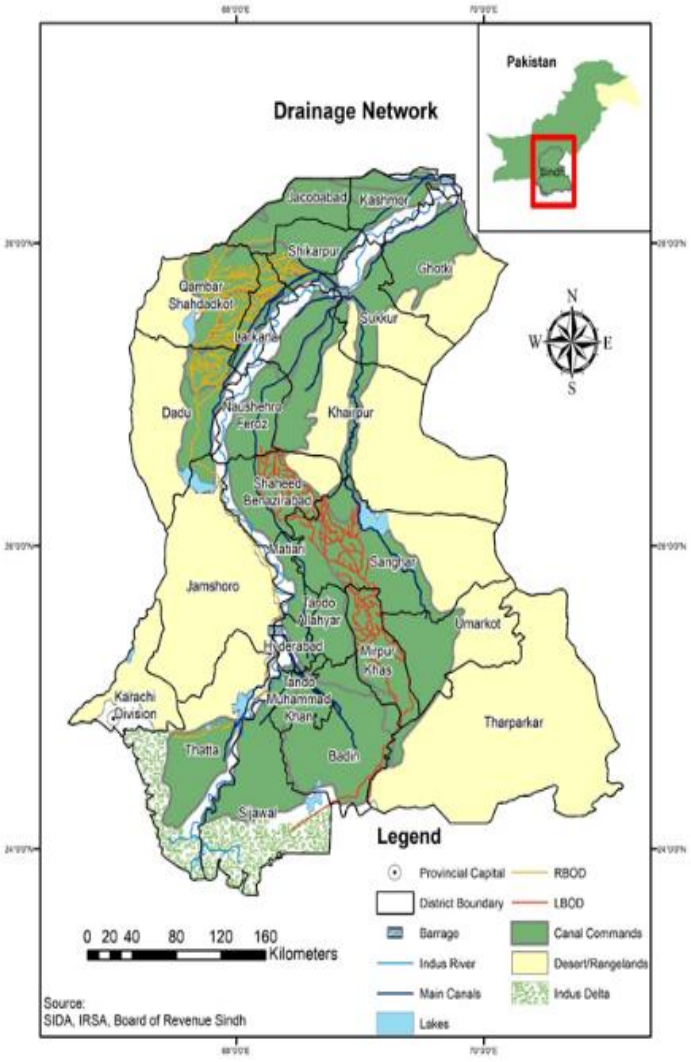

Figure 7: Drainage network in Sindh Province

The super flood of 2010 in the Indus River temporarily improved the quality of the lake. The presence of metals decreased, yet levels recovered within two years. Some of the positive effects on BOD, COD, NO3, NO2, NH3, and PO4 were present for a longer period, before they reverted (Jahangir et al., 2015).

Similarly, the canal system is faced with operational problems. Malfunctioning of the system has led to several issues. Particularly, breaches have caused displacement of people, destruction of property, damage to crops, and water shortages.

Embankment failures can be caused by overtopping, internal erosion, structural defects, and piping

A particularly problematic issue is the widespread presence of direct outlets, discussed also in section 1. These create conditions of inequity, lead to water waste, and complicate the hydraulic management of the canal system. The number of direct outlets is unknown, as is the amount of discharge they carry, but common estimates are that they may carry as much as 30% of the flow.

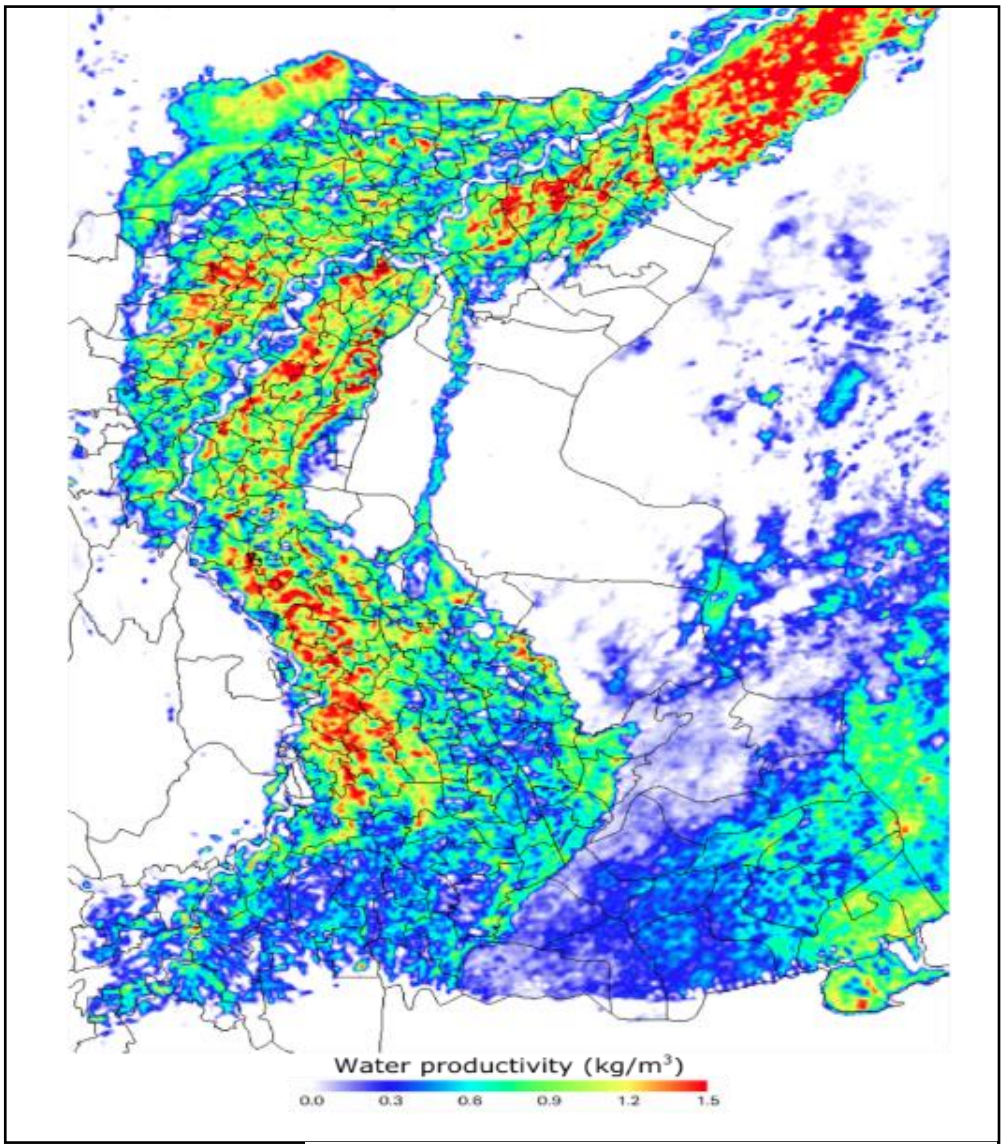

Figure 8: Bio-physical water productivity in IBIS

The consensus is that the performance of the canal system is far from optimal. A study on the Mirpurkhas Subdivision of the Jamrao Irrigation Scheme[73], estimated overall application losses of 23%. Surface irrigation methods are extensively used by the farmers in this area rather than pressurized irrigation methods. For the furrow irrigation method, the losses were of about 10 % less than other surface irrigation methods. Drip performance was found to be better, with 2 to 3% more efficiency compared to the sprinkler method. Overall performance of pressurized irrigation methods was considered most successful, with measured and estimated losses of less than 20 % in all cases compared to surface irrigation methods. These surface irrigation methods were estimated to contribute to field losses in the range of 20 to 40%

[73] *Shaikh, I. A., Wayayok, A., Abdullah, A. F. B., Soomro, A. M., & Mangrio, M. (2015). Assessment of water application losses through irrigation surveys: A case study of Mirpurkhas Subdivision, Jamrao Irrigation Scheme, Sindh, Pakistan. Indian J. Sci. Tech, 8(11), 1-15.*

[73]. Yu et al. (2013)[74] compare canal, watercourse, and field efficiency in the four Provinces of Pakistan. They suggest that only 35% of the water is used, with most losses occurring in the water course. This low score for Sindh does not differ much from other provinces.

Table 4: Irrigation efficiencies in Pakistan

	Canal	Watercourse	Field	Overall
Punjab	0.74	0.54	0.87	0.35
Sindh	0.80	0.52	0.85	0.35
KPK	0.76	0.59	0.89	0.40
Balochistan	0.78	0.61	0.83	0.39
Indus system-wide	0.76	0.55	0.86	0.36

Another way to measure the performance of the canal and drainage system is to look at biomass water productivity. Water management systems with high waterlogging lead to enormous water losses. For Sindh, some 74% of the water available is lost in the form of non-beneficial evaporation. Water productivity ranges widely within the province. To some extent, this reflects different cropping patterns and differences in temperature throughout the Province, but to an important extent it tells the story of inadequate water management. Figure 8 based on 1999-2000 data shows the large variation. Whereas the biomass water productivity in Khairpur East Ghotki Rohri Rice and Khairpur West ranges from 0.90 to 1.15 kg/m3 water used, it is much lower, especially in the systems in Lower Sindh, where in Kalri, Pinyari, Lined Canal, Fulelli, and Nara, it ranges from 0.32 to 0.60 kg/m3.

Before 2002, the irrigation system of Sindh was entirely managed by the provincial Irrigation Department. With the Sindh Water Management Ordinance (SWMO) in 2002, a major institutional reform was initiated to transfer the operation and management of the irrigation system to the Sindh Irrigation and Drainage Authority (SIDA). SIDA was created to promote participatory irrigation system management. Currently, 4 of 12 canals are managed under SIDA. Under this new water management system, the first tier is SIDA while the second tier consists of Area Water Boards (AWBs). The third tier consists of Farmers' Organizations (FOs) for the management of distributaries and minors. Finally, Water Course Associations (WCAs) operate and maintain the watercourses, delivering water to farm plots.

SECTION 7. URBAN AND RURAL WATER SUPPLY

Future domestic water demand in Sindh can be estimated using population projections and the prevailing guidelines on daily per capita requirements for urban (120 liters) and rural (45 liters) consumers, as given in the 2009 National Drinking Water Policy. It shows that domestic water demand in Sindh will almost double by 2050. Drinking water, in general, is derived from a variety of sources, depending on local availability[75]. However, groundwater is very important. Most cities in Sindh depend on groundwater for household water supplies. Karachi and Hyderabad are the main cities that rely on surface water. In both cities, private operators that use groundwater from nearby wells are active.

[74] *Yu, G. J., Huang, J. S., & Gao, Z. Y. (2013). Study on water and salt transportation of different irrigation modes by the simulation of HYDRUS model. J Hydraul Eng, 44, 826-834.*

[75] *Baig, J. A., Kazi, T. G., Arain, M. B., Afridi, H. I., Kandhro, G. A., Sarfraz, R. A., ... & Shah, A. Q. (2009). Evaluation of arsenic and other physico-chemical parameters of surface and ground water of Jamshoro, Pakistan. Journal of hazardous materials, 166(2-3), 662-669.*

Similarly, over 85% of rural households in Sindh depend on groundwater, accessing the resource via many thousands of hand-powered and motorized pumps. In some rural areas of Sindh, seepage from irrigation canals provides fresh groundwater lenses on top of groundwater that has high salinity. This very fragile resource plays a vital role in providing drinking water to villages and small towns. This has implications for the management of canal water, which is the source of seepage. Lining of canals in these areas, for instance, should not be taken up as it would reduce the seepage. For instance, lining of main canals is to be avoided, as it would dry up the resource. With 80% of the province underlain by saline to highly saline groundwater[65], the small precarious fresh groundwater lenses should also be protected from overuse.

Table 4 describes the main source of drinking water in urban and rural Sindh. It is remarkable that in urban areas there is a shift away from tap water to purchasing filtered water.

Table 5: Main Source of Drinking Water in Sindh

Survey Period	2018-19			2013-14		
Source	**Urban**	**Rural**	**Total**	**Urban**	**Rural**	**Total**
Tap Water	50	8	31	73	8	42
Hand Pump	7	70	36	8	69	37
Motorized Pump	17	8	13	10	7	8
Dug well	0	7	3	1	6	3
Tanker/Truck/Water bearer	7	2	4	6	3	4
Filtration Plant	2	1	2	1	0	1
Others	17	4	11	3	6	4
Total	**100**	**100**	**100**	**100**	**100**	**100**

Source: PBoS, 2019[76]

The shift away from tap water is directly related to the two main concerns about the water supply in Sindh: non-functionality and water quality of the water supply systems. According to a study by Tahir et al. (2010)[77], there are 1,247 water supply schemes in Sindh, excluding the cities of Karachi and Hyderabad. At the time of the study, out of the total 1,247 water supply schemes 718 were not functioning (58%). Of the non-functional systems, some were temporarily (75%) and others permanently (25%) out of order. Fund shortages have been singled out as the main cause of non-functionality.

[76] *Pakistan Bureau of Statistics. (2019). Pakistan Social and Living Standards Measurement Survey (2018–19). Ministry of Planning Development & Special Initiatives, Government of Pakistan.*

[77] *Tahir, M. A., Marri, M. K., & Hassan, F. U. (2010). Technical Assessment Survey Report of WSS. Pakistan Council of Research in Water Resources (PCRWR).*

As figure 9 shows, while non-functionality is widespread in Sindh, there are also distinct clusters in Sindh where a large majority of the system does not function. These are areas where water resources are problematic, such as in the dry zones of Tharparkar or areas with predominant saline groundwater, like Khairpur. In many respects, the water supply situation in Sindh is among the worst in the world. The high non-functionality is, for instance, far in excess of Sub-Saharan countries, where non-functionality usually does not exceed 40%. In addition, the majority of the rural population in Sindh is not served by an improved water supply system – functional or non-functional.

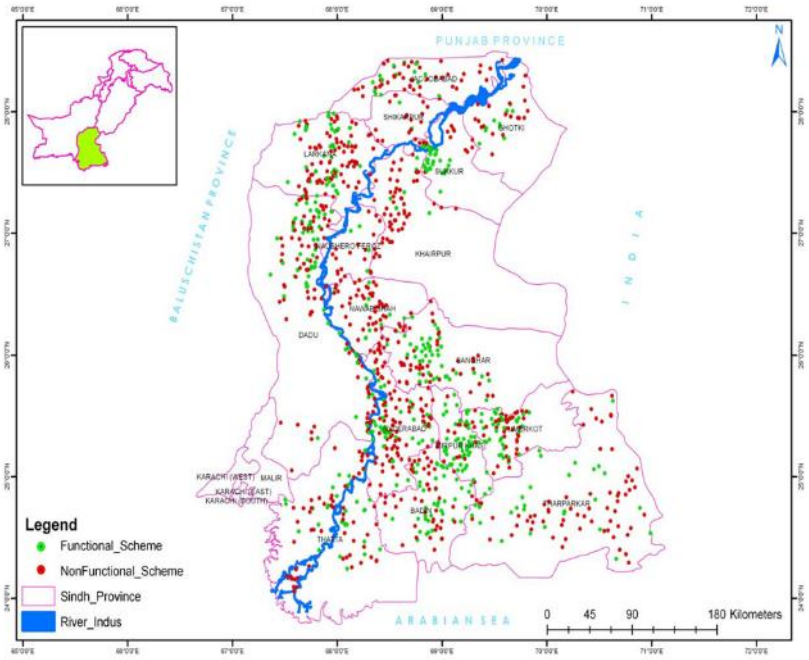

Figure 9: Functionality and non-functionality of drinking supply systems

What is more important in rural areas is the multitude of private systems. The drinking water survey of 2018-19, summarized in Table 5 , shows that in the rural areas of Sindh 78% percent of rural households rely on individual hand pumps (70 percent) and private motorized pumps (8 percent). This compensates for the abysmal performance of the public drinking water system.

Water quality is a second main issue. PHED and local governments are responsible for the operations of the schemes. However, water quality is not routinely checked; this only happens when problems arise. PCRWR (2010)[78] found that 98% of the functional schemes in rural Sindh are providing poor quality water that is unsafe for drinking purposes. Bacteriological contamination due to inadequate handling is the primary problem[79]. Microbiological pollution of groundwater poses another health risk (Mansuri et al., 2018). Studies in Sindh have found that contamination levels are amplified by the heavy dependence on handpumps, which typically extract water from shallow aquifers[80][81]. Poorly designed soak pit toilets, non-engineered septic tanks, and poorly constructed wells (for instance without a sanitary seals) increase microbiological groundwater contamination (Mansuri et al 2018). The waterlogged conditions in many parts of the province help to distribute the contamination. A comparison of faecal-oral diseases (diarrhea

[78] *Tahir, M. A., Marri, M. K., & Hassan, F. U. (2010). Technical Assessment Survey Report of WSS. Pakistan Council of Research in Water Resources (PCRWR)*

[79] *Daud, M. K., Nafees, M., Ali, S., Rizwan, M., Bajwa, R. A., Shakoor, M. B., ... & Zhu, S. J. (2017). Drinking water quality status and contamination in Pakistan. BioMed research international, 2017.*

[80] *Alamgir, A., Khan, M. A., Schilling, J., Shaukat, S. S., & Shahab, S. (2016). Assessment of groundwater quality in the coastal area of Sindh province, Pakistan. Environmental Monitoring and Assessment, 188(2), 78*

[81] *Memon, M., Soomro, M. S., Akhtar, M. S., & Memon, K. S. (2011). Drinking water quality assessment in Southern Sindh (Pakistan). Environmental monitoring and assessment, 177(1-4), 39-50.*

and dysentery) taken from a study of the impact of irrigation projects on the health of rural population in Sindh shows that peaks in infantile diarrhea, amoebic dysentery, and hepatitis are related to the very wet monsoons, which left vast areas waterlogged and inundated for several months. In urban areas, the situation is not substantially better. The Pakistan Council for Research in Water Resources collected water samples from different water sources in four cities of Sindh (Karachi, Hyderabad, Sukkur, and Badin) and found that 81% of samples were bacteriologically contaminated with total Coliforms, Fecal Coliforms, and E. coli and had excessive levels of minerals and elements[82].

In addition, there is chemical contamination of drinking water sources. The dry season is generally more hazardous, with higher concentrations of heavy metals and other parameters[83]. In the pre-monsoon season, generally the concentration of cadmium, lead, and mercury is far above prescribed limits[84]. The source of these contaminants is anthropogenic. The widespread practice of discharging untreated municipal and industrial effluents – which is only recently starting to be addressed in a sewerage outlet closure program — is a major factor. Hyderabad City, for instance, disposes its untreated sewage and comingled solid waste in the Phuleli Canal. The maximum of physiochemical and biological parameters in the Phuleli Canal, especially fecal Coliform (between 100-1600 MPN/100ml) and metal ions (Fe 1.90, Cd 0.004, Cr 0.082, Pb 0.045 and As 0.50 mg/l against WHO standards) exceeds the prescribed permissible limits. Similarly, the waterlogged toxic wastewater of Larkana District is pumped by Mashoori SCARP Pump House of Drainage and is dumped in Rice Canal without treatment. This contaminated water threatens public health. Waterborne diseases accounted for 20-30% of all hospital cases and 60% of infant deaths in YEAR[85].

Other important chemical parameters and indicators of groundwater quality are chloride and nitrate. Chloride and nitrate may leech with agricultural fertilizers and are related to the contamination of groundwater by poorly treated wastewater. High chloride levels are also an indicator of seawater intrusion. The results of a wide-ranging sampling program [86] show that higher values of Cl are clustered along the irrigated areas and in southern Sindh. Higher values of NO3 are clustered in the north and northwest of the country and in the south, and probably indicate anthropogenic pollution of shallow groundwater. The range in pH values is from 6.14 to 8.75, with no obvious spatial pattern discernible.

Within the lower Indus Basin, the shallow aquifers in the irrigated and coastal regions were studied by Shahab et al. (2019)[87] to determine their vulnerability to groundwater contamination from surface pollutants. They deemed 56.8% of the area to be highly vulnerable, and 28% to be very highly vulnerable,

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[82] Rao, M. I., Ashraf, M., Bhatti, A. Z., Salam, H. A., & Nazar, G. (2016). Water Requirements of Major Crops in Sindh. Pakistan Council of Research in Water Resources (PCRWR).

[83] Memon AH, Ghanghro AB, Jahangir TM, Younis M, Lund GM. During and Post Flood Health Impacts of Dissolved Metals on Adjacent Area of Manchur Lake, District Jamshoro, Sindh, Pakistan. Biomed Lett2016; 2(1):38-45.)

[84] Farooq, M. A., Shaukat, S. S., Zafar, M. U., & Abbas, Q. (2012). Variation pattern of heavy metal concentrations during pre-and post-monsoon seasons in the surface water of river Indus (Sindh Province). World Applied Sciences Journal, 19(4), 582-587.

[85] Ijaz, M. W., Mahar, R. B., Solangi, G. S., Panhwar, S., & Ansari, A. K. (2017). Impairment of Water Quality of Phuleli Canal, Sindh Pakistan: A Review. Mehran University Research Journal of Engineering and Technology, 36(3), 681-692.)

[86] Podgorski, J. E., Eqani, S. A. M. A. S., Khanam, T., Ullah, R., Shen, H., & Berg, M. (2017). Extensive arsenic contamination in high-pH unconfined aquifers in the Indus Valley. Science advances, 3(8), e1700935.f

[87] Shahab, A., Shihua, Q., Rad, S., Keita, S., Khan, M., & Adnan, S. (2019). Groundwater vulnerability assessment using GIS-based DRASTIC method in the irrigated and coastal region of Sindh province, Pakistan. Hydrology Research, 50(1), 319-338.

mostly in the upper northern and southern most coastal area of Sindh. They considered 15.2% to be in the medium vulnerable zone. Sensitivity analysis of DRASTIC4 parameters indicated that the depth to water table and net recharge caused the highest variation in the vulnerability index.

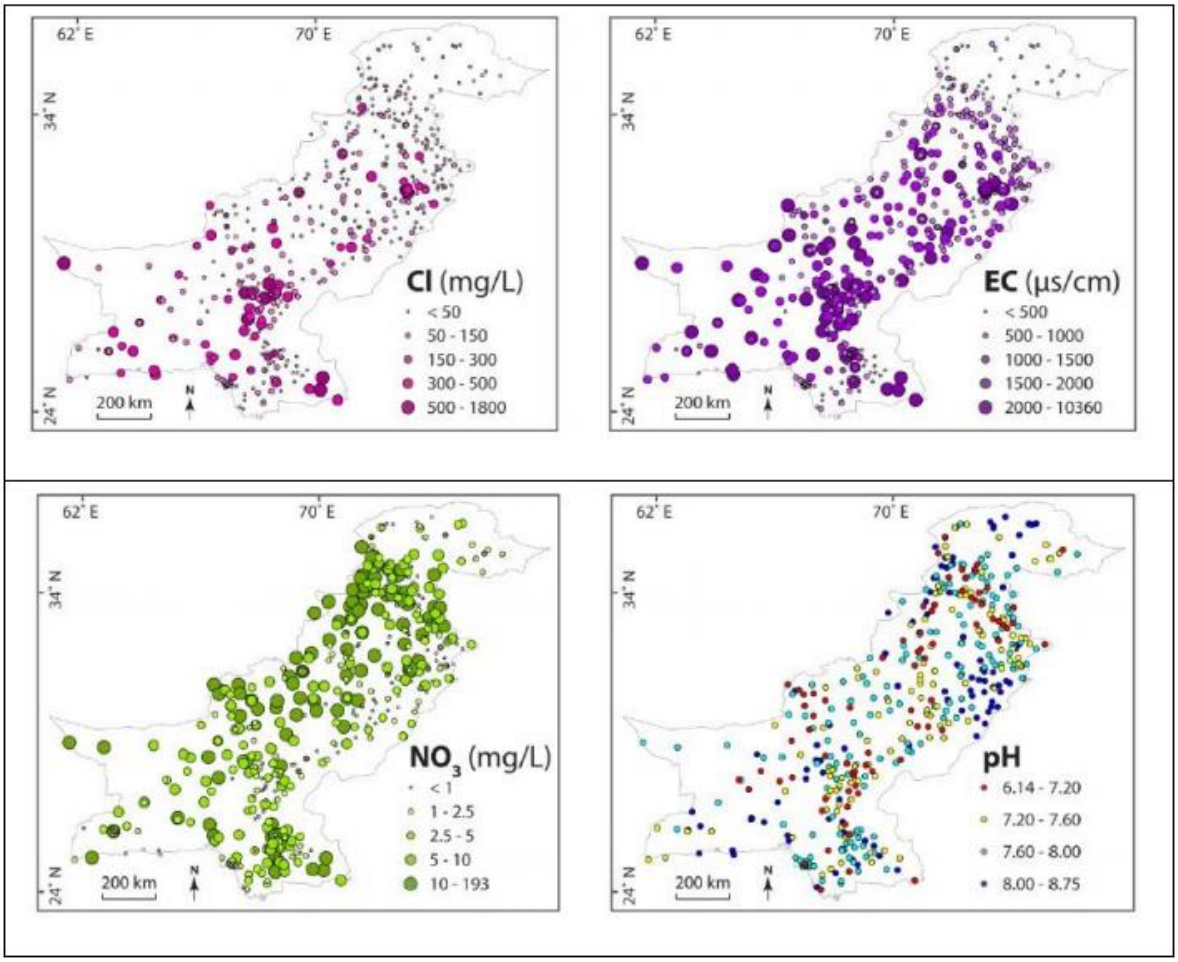

Figure 10: Main chemical water quality parameters in Sindh (Source: Podgorski et al.,2017)[86]

Arsenic and fluoride

Trace metals are a special case. Between and 100 million people in Pakistan are reported to be at risk of trace metal

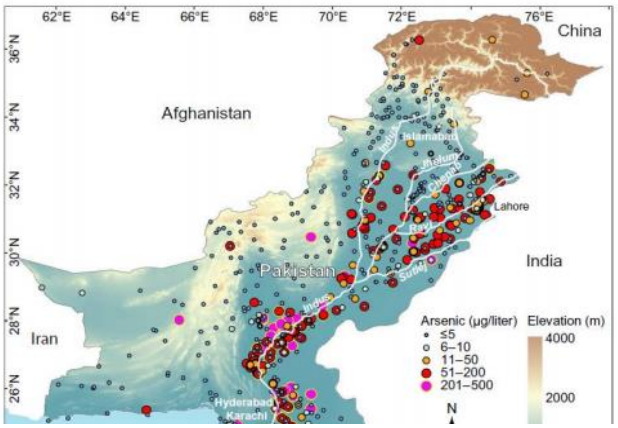

Figure 11: Arsenic concentration in groundwater in Pakistan (Source: Podgorski et al.,2017)[86]

contamination[8889], though this may be a high estimate as studies on this topic are limited[90]. Among the common trace elements studied in Pakistan, arsenic has received the most attention. Naturally occurring arsenic in aquifer sediments is released into groundwater as groundwater redox conditions change. Using a dataset of nearly 1,200 groundwater quality samples throughout Pakistan, Podgorski et al. (2017)[86] found dissolved arsenic concentrations in groundwater in the Indus Basin ranging from <5 to 500 µg/l. Many of the higher values >50 µg/l are clustered along the Indus River and its tributaries (Figure 3-5). Elevated arsenic concentrations (>200 µg/l) were measured primarily in Sindh[62]. A recent study by Shahab et al. (2016)[91] indicated a mean value of 22.77 µg/l. The spatial distribution of arsenic in Sindh shows parts of Larkana, Khairpur, Sanghar, and Mirpur Khas are within the acceptable range of As, while parts of Hyderabad, Mityari, Dadu, Ghotki, Tharparker, and Jacobabad are affected by higher concentrations. Of the 1,184 samples, 785 had arsenic concentrations that exceeded the WHO guidelines of 10 µg/l. Studies on the origin of As in Tando Allahyar in Sindh by Naseem and McArthur (2018)[92] indicated that arsenic contamination in groundwater arises from the chemical reduction of iron oxyhydroxides. Over-extraction and poor groundwater management also influence the release of arsenic into groundwater.

Studies by Rahman et al. (2018)[93] also report that fluoride is present in the groundwater of the urban and rural areas of Sindh. A review of contamination of groundwater by Raza et al. (2017)[89] indicates that arsenic and fluoride contamination of groundwater resources is a serious health risk for local communities of Tharparker, Nagarparker, and Umarkot.

SECTION 8. WETLANDS

Important wetlands have formed throughout Sindh. As a result, Sindh is not only endowed with a large number of wetlands, but also with an important variety of wetlands. Wetlands can be defined as "*areas where water is the primary factor controlling the environment and the associated plant and animal life. They occur where the water table is at or near the surface of the land, or where the land is covered by water*"[94]. According to Choudhry (2010)[95] the main types of wetlands in Sindh are the following:

- marine (coastal wetlands including coastal lagoons)
- estuarine (including deltas, tidal marshes, and mangrove swamps)
- lacustrine (wetlands associated with lakes)

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[88] Bhowmik, A. K., Alamdar, A., Katsoyiannis, I., Shen, H., Ali, N., Ali, S. M., ... & Eqani, S. A. M. A. S. (2015). Mapping human health risks from exposure to trace metal contamination of drinking water sources in Pakistan. Science of the Total Environment, 538, 306-316

[89] Raza, M., Hussain, F., Lee, J. Y., Shakoor, M. B., & Kwon, K. D. (2017). Groundwater status in Pakistan: A review of contamination, health risks, and potential needs. Critical Reviews in Environmental Science and Technology, 47(18), 1713-1762

[90] Azizullah, A., Khattak, M. N. K., Richter, P., & Häder, D. P. (2011). Water pollution in Pakistan and its impact on public health—a review. Environment international, 37(2), 479-497

[91] Shahab, A., Shihua, Q., Rashid, A., Hasan, F. U., & Sohail, M. T. (2016). Evaluation of Water Quality for Drinking and Agricultural Suitability in the Lower Indus Plain in Sindh Province, Pakistan. Polish Journal of Environmental Studies, 25(6).

[92] Naseem, S., & McArthur, J. M. (2018). Arsenic and other water-quality issues affecting groundwater, I ndus alluvial plain, P akistan. Hydrological Processes, 32(9), 1235-1253

[93] Rahman, Z. U., Khan, B., Ahmada, I., Mian, I. A., Saeed, A., Afaq, A., ... & Mianh, A. A. (2018). A review of groundwater fluoride contamination in Pakistan and an assessment of the risk of fluorosis. Fluoride

[94] Handbook, R. (2016). An Introduction to the Ramsar Convention on Wetlands. Gland, Switzerland: Ramsar Convention Secretariat.

[95] Chaudhry, A. A. (2010). Wetlands in Pakistan: What is happening to them. World Environment Day, 5.

- riverine (wetlands along rivers and streams)
- palustrine (meaning "marshy" - marshes, swamps, and bogs)

According to the Ramsar Convention[96] in 2021, 10 Wetlands are recognized in Sindh, which includes one (Hub Dam) that is shared with Balochistan. In addition to official wetlands there are many other wetlands, including game reserves and irrigated plantations[97]. There are also many other potential wetlands, including Badin and Kadhan Lagoons, Beroon Kirthar Canal, Charwo Lake, Clifton Beach, Ghauspur Jheel & Sindhi Dhoro Lake, Khango (Khowaj) Lake, Hawkes Bay / Sandpit, Khipro Lakes, Korangi and Gharo Creeks, Hamal Katchri Lake, Langh (Lungh) Lake, Mahboob Lake, Shahbunder & Jafri Lake, Phoosna Lakes, Pugri Lake, Sadhori Lake, Nara Canal, Soonhari Lake, Tando Bago Lake, and Sanghriaro Lake[98].

An overview of the main wetlands and protected areas in Sindh is given in the table below. Several of these wetlands are integral to the canal and drainage system, serving as a storage reservoir (Chotiari, Hub, Kinjhar) or as drainage disposal sites (Manchar).

Table 6: Main Wetlands and Protected areas in Sindh

Name	Type [99]	Area (ha)	Ramsar Status	Water Quality [99]
DehAkro-II Desert Wetland Complex	Palustrine	20,500	Recognized	Saline Water
Drigh Lake	Lacustrine	164	Recognized	Fresh water
Haleji Lake	Lacustrine	1,704	Recognized	Fresh water
Hub Dam	Lacustrine	27,000	Recognized	Fresh water
Indus Delta	Estuarine	472,800	Recognized	Fresh /Coastal water
Indus Dolphin Reserve	Riverine	125,000	Recognized	Fresh / Riverine Water
Jubho Lagoon	Marine	706	Recognized	Saline/Brackish water
Kinjhar Lake	Lacustrine	13,468	Recognized	Fresh water
Nurri Lagoon	Marine	2,540	Recognized	Saline/Brackish water
Runn of Kutch Wildlife Sanctuary	Palustrine	566,375	Recognized	Saline Water
Hamal Lake	Lacustrine	17,200	Potential	Fresh water

[96] *The Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat is the authoritative international* treaty *for the conservation and sustainable use of* wetlands*. It is named after the city where the convention was signed in 1971. Every three years, representatives of the contracting parties convene the* Conference of the Contracting Parties *(COP). This is the policy-making organ of the* convention, *which adopts resolutions to administer the work of the convention, including the updating of the list of officially recognized important wetlands.*

[97] *SBoR (n.d.). Board of Revenue, Government of Sindh. Retrieved 2021, from* http://map.sindhzameen.gos.pk/SindhMaps.aspx

[98] *Khan, A. A., & Arshad, S. (2014). Wetlands of Pakistan: distribution, degradation and management. Pakistan Geographical Review, 69(1), 28-45.*

[99] *Siyal, A. A. (2020). Study on Wetlands of Sindh (1st ed., Vol. 1). Mehran University of Engineering & Technology, Jamshoro.*

Name	Type [99]	Area (ha)	Ramsar Status	Water Quality [99]
Manchar Lake	Lacustrine	23,000	Potential	Fresh water
Chutyari Wetland Complex	Lacustrine	22,500	Potential	Fresh water
Nara Wildlife Sanctuary	Palustrine	630,000	Potential	Saline/Fresh Water [57]
Takkar Wildlife Sanctuary	Wildlife Sanctuary	60,000	Potential	-
Khirthar National Park	Wildlife Sanctuary	310,000	Potential	-
Mahal Kohistan Wildlife Sanctuary	Wildlife Sanctuary	60,000	Potential	-

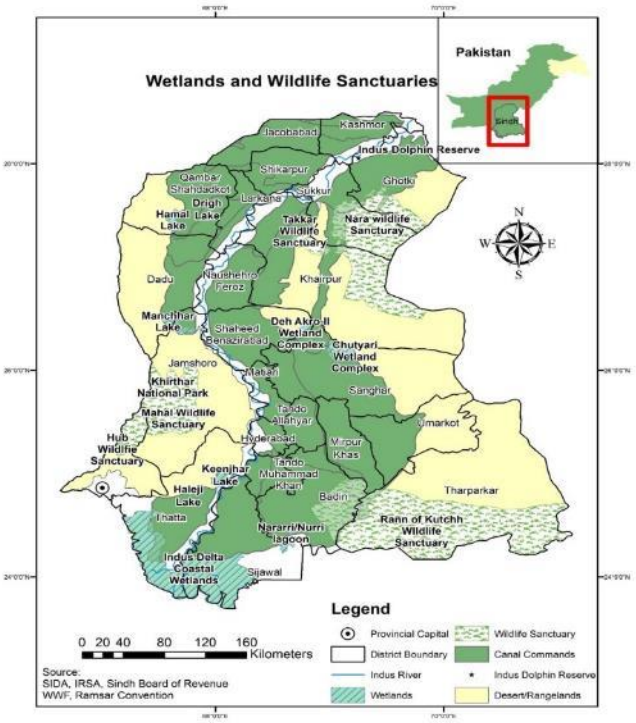

Figure 12: Wetlands and wildlife areas in Sindh Province

Wetlands are very important for the survival of local biodiversity. The aquatic flora and fauna in each wetland adapt to their bio-geochemistry. With the enormous variety of wetlands in Sindh, the cumulative biodiversity is large. In addition, wetlands serve important functions, acting as reservoirs of water, food, and timber, and being used for recreation and to protect against storms[100] [101] [98]. Examples of the rich biodiversity of wetland are given below, for instance, the Digri wetland, where there are at least 19 aquatic/marshy habitats and 37 species of bird [102].

Also, the Chotyari Wetlands Complex provides refuge to at least 12 globally threatened (3 Critically Endangered; 1 Endangered; 8 Vulnerable) and 8 near threatened species. The Indus Ecoregion is identified among the world's 40 most biologically rich ecoregions[103].

Wetlands should be part of the overall water management system in Sindh. In principle, they

[100] *Unwater. (n.d.). Unwater.Org. Retrieved 2021, from* https://www.unwater.org/the-global-wetland-outlook/

[101] *WWF. (n.d.). World Wildlife Fund. Retrieved 2021, from https://www.worldwildlife.org/habitats/wetlands*

[102] *Gabol, Karim, Sajid Mehmood , Nikhat Yasmin , R.M Tariq and Rahila Tabassum (nd) Distribution, Status of Migratory and Resident Waterfowls of Drigh Lake (Sindh) Wildlife Sanctuary. Crossmarks.*

[103] *Rais, M., Khan, M. Z., Ghalib, S. A., Nawaz, R., Akbar, G., Islam, S. L., & Begum, A. (2013). Global conservation significance of Chotiari Wetlands Complex, Sangahr, Sindh, Pakistan. J. of Animal and Plant Sc, 23(6), 1609-1617.*

have functions such as storing water, recharging groundwater, improving water quality, and protecting against flooding in addition to their other functions. The management of wetlands needs to be closely integrated with the management of canal and drainage systems. At the same time, wetlands are seriously affected by the way water is managed: the reduction of inflows, the discharge of polluted water, or the wholesale change of the hydrological regime (as with the failed Tidal Link). In Sindh, wetlands are largely unmanaged and vulnerable to many threats, which sometimes leads to changes but in many cases undermine their functions. An overview of anthropogenic threats to the wetlands of Sindh is given in the table 6 based on Siyal (2020)[99].

Table 7: Main wetland threats in Sindh Province

Threat	Concerned wetland
Shortage/unavailability of freshwater	Drigh, Langh, Manchar, Hadero wetlands
Disposal of polluted/untreated agricultural effluent	Manchar, Nareri and Jubho Lagoon
Dumping of untreated industrial waste	Keenjhar and Haleji wetlands
Siltation and shrinkage	Keenjhar, Drigh and Langh wetlands
Changed tidal regime	Coastal dhands
Conversion of wetland into agricultural land	Langh, Drigh
Deforestation	Chotiari and Tidal flood plains
Invasive species	Keenjhar wetland
Illegal hunting	Deh Akro-II
Unsustainable use and over-exploitation by local communities	Kinjhar, Manchar, Drigh

Wetlands are largely unmanaged in Sindh – either as part of the water system or separately as high value resource pools. There is a lack of proper legislation and awareness about the vital role of these ecosystems (their functions and value). Many departments have a bearing on wetlands, but there is a lack of coordination. There are no effective policies, no management systems, and inadequate legislation for the conservation of wetland areas and their immediate surroundings [95]. There is very limited capacity and among people no awareness of the importance of wetlands [99].

SECTION 9. 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. It contains many different ecosystems: riverine forest, freshwater lakes, irrigated areas, and brackish wetlands[104]. 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 an area of ecological deterioration, endemic poverty, and poor access to basic services such as clean drinking water.

A number of human-made interventions have caused significant environmental transformation:

vii. *Severe reduction of water deliveries with the expansion of the irrigation networks and the conversion of the floodplains*. 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

[104] *Khuhawar, M. Y., Brohi, R. O. Z., Jahangir, T. M., & Lanjwani, M. F. (2018). Water quality assessment of ramser site, indus delta, Sindh, Pakistan. Environmental monitoring and assessment, 190(8), 492*

the flow is available downstream for the Indus Delta. These average flows are, moreover, subject to significant interannual variability. For instance, in 2018-2019 the inflows were 49.80 MAF. 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. This is a figure that is, in fact, 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 freshwater availability in large areas of land in the Thatta, Sijawal, and Badin Districts. This has caused the abandonment of many villages.

viii. *Severe reduction of 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 Tarbela Dam (1972), sediment inflows into the delta were 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 has receded at average rates of 50 m/year[105].

ix. *Change of flooding patterns*. Due to construction of embankments, the Indus River has been confined. The flooding area has reduced, further affected by the changes in river releases. This has had several effects, an important one being the reduced recharge of groundwater along the Indus. This has also resulted in saline water ingression.

x. *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 water coming from 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 – basically creating a new river – moved the tidal effect much further upstream (70 km). The result is that there is now an open connection between the costal lakes (dhands) and the Tidal Link, exposing the 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 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 a vast area with salt water.

[105] *Giosan, L., Constantinescu, S., Clift, P. D., Tabrez, A. R., Danish, M., & Inam, A. (2006). Recent morphodynamics of the Indus delta shore and shelf. Continental Shelf Research, 26(14), 1668-1684.*

xi. *Change of mangrove forest cover*. One-third of the Indus Delta was originally covered by mangrove forests, in particular Avicenna Marina[106]. Over the years, this vegetation has changed: mangrove cover dropped from 16% in 1990 to 10% in 2010 due to the changed hydrology and encroachment. In recent years, with concerted efforts, mangrove cover has increased to 13% with success achieved especially on the Right Bank of the Indus. The mangroves have many economic and ecological benefits. They are sources of firewood, timber, and bee forage, and they serve as grazing areas for livestock and fish spawning grounds. 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[107]. Mangroves are able to store high amounts of CO_2 and are one of the most carbon-rich forests. When these forests are destroyed, a lot of carbon is released, possibly intensifying global warming and other climate change trends[108].

Table 8: Mangrove species in Sindh

Family / (Local Name)	Growth Habit	Distribution
Rhizophoraceae		
1) *Bruguiera conjugata*	Tree	Karachi, Indus Delta, Estuary of Indus
2) *Ceriops tagal* (Chanhr)	Tree	Karachi, Sindh Coast; Indus mouth
3) *Ceriops decandra*	Tree	Sindh tidal zone
4) *Rhizophora apiculata*		Tidal marshes at the mouth of Indus
5) *Rhizophora mucronata* (Kumri)	Tree	Indus mouth, muddy shores and tidal creeks
Myrsinaceae		
6) Aegiceras corniculatum (Chore)	Shrub	Indus mouth, Karachi, China creek, Kajur creek
Avicenniaceae		
7) Avicennia marina (Timr)	Tree	Sindh all along the coast
Sonneratiaceae		
8) Sonneratia caseolaris	Tree	mouth of Indus, tidal zone
Source: Stewart (1972)		

xii. *Sea level rise*. There is a gradual rise of the sea level along the coast of Sindh. Data from PSMSL (2020)—Permanent Service for Mean Sea Level—shows that the sea level near Karachi has risen from 7,029 to 7,238 mm during the 1916–2016 period, indicating a rise of 209 mm (or 20.9 cm) in the past 100 years. This shows that the average rise in sea level has been 2.09 mm per year. Sea level rise has been greater in recent years relative to the past century, approaching 3 mm per year. Combined with the reduced inflow of water and sediment from the Indus, this has caused an increase in the area in the Indus Delta that is salt-affected and permanently inundated, at 97,000 and 135,000 ha from 1972 and 2018 respectively due to sea intrusion. During this period, the area under water has increased by 97,000 hectares, while the salt-affected area has increased by 135,000 hectares.

[106] *Young, W. J., Anwar, A., Bhatti, T., Borgomeo, E., Davies, S., Garthwaite III, W. R., ... & Saeed, B. (2019). Pakistan: getting more from water. World Bank.*

[107] *Kathiresan, K. (2012). Importance of mangrove ecosystem. International Journal of Marine Science, 2(10).*

[108] *Abbas, F., Rehman, I., Adrees, M., Ibrahim, M., Saleem, F., Ali, S., ... & Salik, M. R. (2018). Prevailing trends of climatic extremes across Indus-Delta of Sindh-Pakistan. Theoretical and applied climatology, 131(3), 1101-1117*

SECTION 10. FLOODS

Floods have affected Sindh heavily, with the episodical flood of 2010 being most dramatic. More than 20 million people in Sindh province were affected by the floods of 2010. The consequences were diverse. For instance, many schools were closed due to flooding, and students were transferred to other schools while others dropped out of the school system. Approximately 12,000 schools attended by more than 1 million children were affected- either used as shelter (2,674 in Sindh) or damaged (9,232 in Sindh)[109]. The 2010 flood brought about other major social changes too. There is, for instance, anecdotal evidence of bonded labourers leaving/escaping from their landlords who could no longer employ or control them.

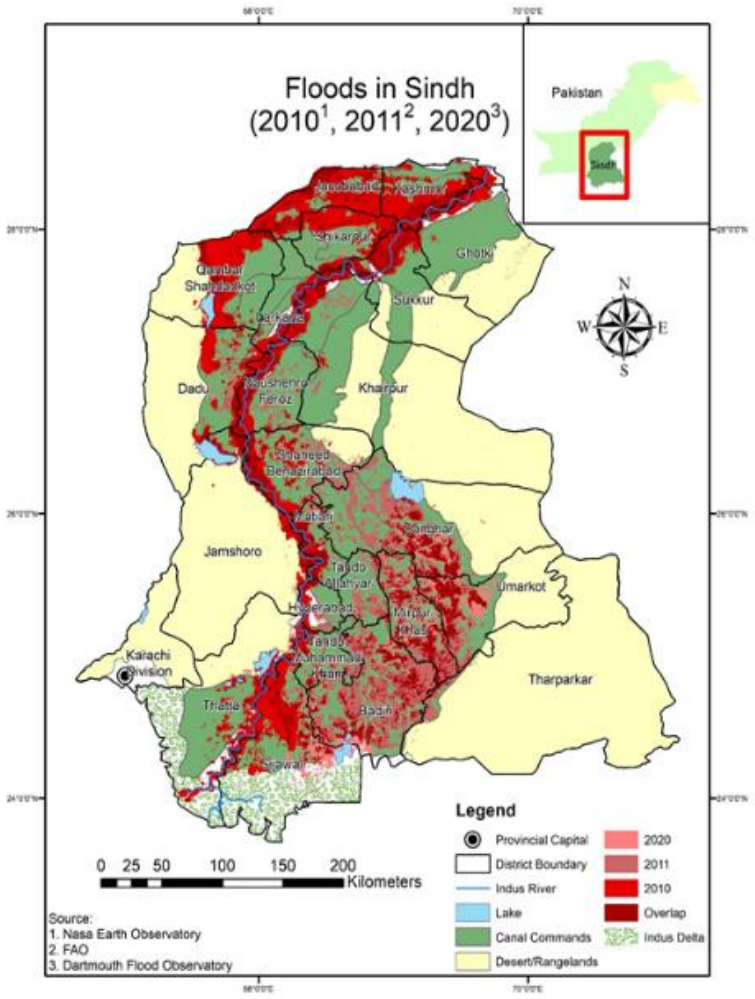

Figure 13: Areas flooded in Sindh 2010-2020

Floods risks rank higher than any other disasters in Sindh [110]. Major flood events occurred in 1942, 1956, 1957, 1958, 1973, 1975, 1976, 1979, 1992, 1994, 1995, 2003, 2005, and 2007 [110], 2010, 2011, [111] 2012, and 2013 (ACE, 2016), and in 2020 [112]. Figure 13 shows the area that was flood affected, making clear that the impact of floods has affected large areas throughout the province. The floods have had different origins. Whereas the 2010 flood was generated by high rainfall and reservoir releases in the upper catchment, the 2013 flood was caused by erratic, extremely high rainfall over part of the province. Floods have occurred mainly in the monsoon season [111] with the intensity of floods increasing during the period of snow melts. In the Lower Indus Basin/Sindh, the elevation of land

[109] *Chang, M. S., Khatoon, Z. S., & Shah, S. A. (2013). Flood disasters and its impacts on child education in Sindh: a case study of 2010 flood. Int. J. Adv. Res, 1(3), 329-344.*

[110] *PDMA. (n.d.). Pakistan Disaster Management Authority, Government of Sindh. Retrieved 2021, from http://www.pdma.gos.pk/new/aboutus/history.php*

[111] *PMD & UNDP. (2012). Diagnostic Study of Heavy Rainfall over Pakistan Producing Catastrophic Floods in 2010 and 2011. Pakistan Meteorological Department.*

[112] *Reliefweb. (2020). Reliefweb. https://reliefweb.int/disaster/fl-2020-000185-pak-0*

is lower than that of the Indus River. As a result, the water that escapes from the river does not return to it. This situation causes the flood water to stay on the land longer [113].

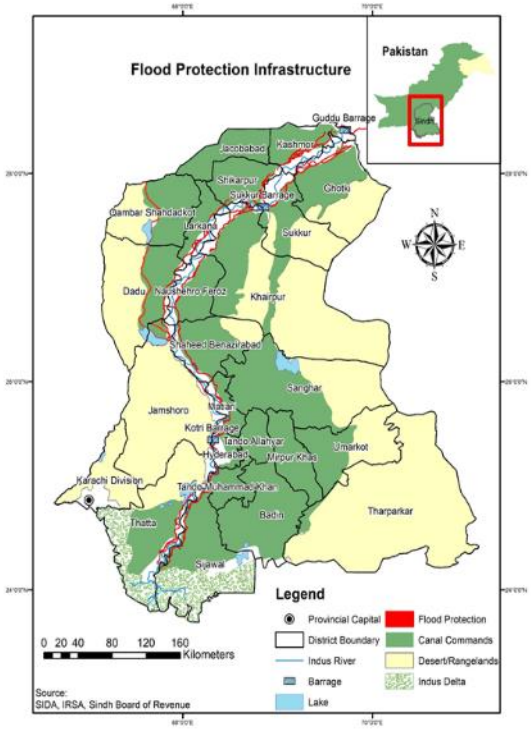

Figure 14: Flood protection embankments in Sindh Province

There is a 2,120 km flood protection system in place to protect the land against the floods [114] (see diagram 14). Yet, the flood protection infrastructure should extend beyond dikes and bunds. The canal and drainage system should be part of flood protection infrastructure too, in a number of ways:

- The drainage network that is in place in Sindh is designed to remove excess seepage, but in reality the surface drains convey run-off during high rainfall too.
- Particularly in the LBOD systems, this has resulted in flood water accumulating at the tail of the Outfall Drain, causing severe flooding near Badin[115].
- This is exacerbated by the common practice of landowners quickly draining their land, causing a huge flood pulse.
- The management of the canal system often amplifies the floods, as canal water deliveries are not immediately suspended.
- The widespread drainage congestion resulting from natural drains being blocked by past road, railway, and canal development has altered the flooding pattern, with local floods as a result.
- There is general scope to retrofit and upgrade the flood management and drainage infrastructure, developing opportunities to retain flood water or to divert to productivity uses. For instance, escapes can be created in Sindh's outfall drains.

SECTION 11. DRYLAND AREAS

There are large and important areas in Sindh where water supply, agriculture, and livestock keeping depend on the effective use of rain runoff or floods. These are the dryland areas outside the Indus Basin Irrigation System, covering 60% of the Province. The dryland areas in Sindh have received relatively little attention, yet they are very important, serving as watersheds, grazing areas, wildlife reserves, and sources of special botanical products, charcoal, and timber. These areas house a surprisingly large human population in Sindh, due to the intimate integration with the economy of irrigated areas. Irrigated areas provide seasonal labour income opportunities and are used for livestock grazing in the high temperature

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[113] Haider, N. (2006). Living with disasters: disaster profiling of districts of Pakistan. National Disaster Management Authority Islamabad, Pakistan, 65.

[114] SID. (n.d.). Irrigation Department. Retrieved 2021, from https://irrigation.sindh.gov.pk/irrigation-network

[115] Ansari, K., Memon, N. A., Pathan, A. F. H., & Memon, A. (2013). Analysis of the Runoff Generated due to the 2011 Monsoon Rainfall in Sindh using HEC-HMS. Sindh University Research Journal-SURJ (Science Series), 45(1).

season, with workers shifting back to arid areas in the mild winter. The major concern of pastoralists is the quantity and quality of available forage in the desert so that the needs of their animals can be met. However, there are other factors that determine their movement patterns. These include escaping extreme heat, a need for shade, avoiding disease-ridden areas, being close to markets, the availability of labour, and social/ritual relations. Major problems include shortages of drinking water for both human and animal populations and basic health facilities. As they harbour unique flora and fauna [99] [116] [117], several parts of the dryland zones have been designated as protected areas: Khirthar National Park, Hub Wildlife Sanctuary, Mahal Wildlife Sanctuary, Nara Wildlife Sanctuary, Takkar Wildlife Sanctuary, and Rann of Kutchh Wildlife sanctuary.

Droughts are part of the nature of these areas, but they sometimes come in extended shocks that leave long-lasting effects. The persistent 1997-2001 drought caused the people to diversify their occupational sources. There was a severe impact of drought on fodder crops and orchards. About 55% of the fodder crop and 60% of orchards were damaged. On average, about 7 goats/sheep per household in Sindh died during this drought. Almost the same numbers of goats/sheep were sold at three times lower than normal prices for fear of their death. Nonavailability of water and feed for animals was reported as the major reason for these deaths. The majority of households were served in this period by different national and international NGOs, an indication of the strength of civil society in Sindh. The help was mostly provided in rain-fed areas and consisted of flour, oil, pulses, sugar, and tea given daily. The quantity and quality of the help provided were insufficient for the average family..

Since 2013 drought have been frequent again, in particular affecting these dryland areas. An assessment of the recent 2017-2018 drought (NDC 2019[118]) similarly shows how significant the impact can be. In eight of the dryland districts the area under cultivation of the main crops registered severe declines: wheat (17%), rice (70%), cotton (16%), cluster beans (30%), millet (38%) and pulses (45%). Production losses where even higher compared: wheat (23%), sorghum (33%), rice (35%), cotton (18%), cluster beans, millet and sesame each by 83% and pulses by 95%. The own production of cereals for household consumption was only sufficient for about 2.8 months. Similarly the livestock population reduced due to death (affecting 18-57% of households) and distress sales.

[116] *Qureshi, R., & Bhatti, G. R. (2005). Nara Desert, Pakistan. Part I: soils, climate, and vegetation. Rangelands, 27(5), 27-31.*

[117] *Ghalib, S. A., Ghalib, R., Zehra, A., Siddiqui, S., Hussain, B., Yasmeen, G., & Begum, A. (2018). Review of the distribution, status and conservation of wildlife of Sindh. Canadian Journal of Pure and Applied Sciences, 12(2), 4519-4533.*

[118] *Natural Disasters Consortium (NDC) (2019). Sindh Drought Needs Assessment Report.*

Within Sindh there are three main watershed / desert areas:

- Kohistan (West)
- Nara Desert (Northeast)
- Tharparkar (Southeast)

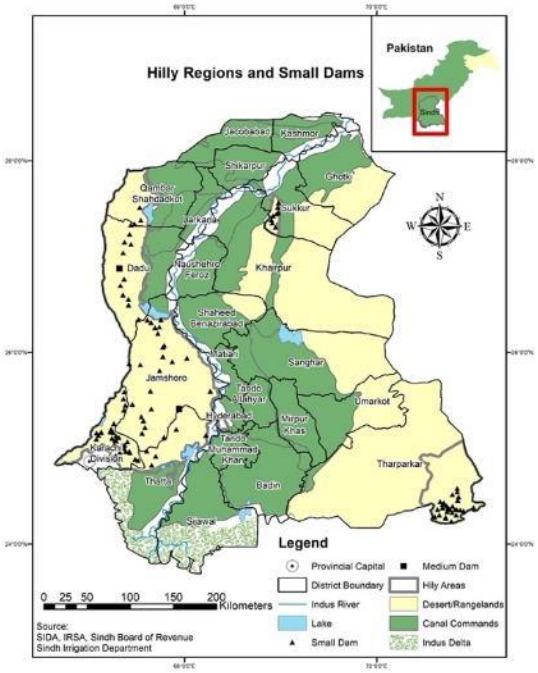


Figure 15: Small dams constructed in Sindh Province

Kohistan

Kohistan, in the west of the province, differs from in the eastern desert in Sindh. Kohistan is a barren hilly tract consisting of flanks of the Kirthar Range. Cultivation is possible only along the numerous hill streams (*nala*s) that carry water during the rains. Spate irrigation is practiced here, covering a relatively modest area of 11,000 ha. Over time, many small dams have been constructed retaining short term floods. The effectiveness of the use of the water stored is sometimes in doubt. A number of larger dams have been constructed or are under planning, in particular Darawat and Naj Gaj. The benefits of these structures against the effect on downstream areas (including the interception of base flows) needs to be reassessed.

Cattle grazing is the principal occupation in Kohistan[119] [120]. The region is a mostly hilly and partly plain area in the southwest of Sindh. It consists of Kirthar mountain, which is a hilly strip at the western border of Sindh and Baluchistan, stretching from Karachi in the south to District Dadu in the north. Water is a very scarce commodity here. People used to fetch water from dug wells or rainwater collection ponds. The water in dug wells is usually brackish, so many people preferred water in rainy ponds, which could be highly contaminated. Waterborne diseases are very common in this region. As in most parts of Pakistan, women bear the burden of fetching water from dug wells, ponds, and hand pumps. One can witness poor, feeble, and malnourished women waiting for hours for their turn to fetch water and carry it on their heads, walking for miles in the scorching sun. The situation worsens during the summer and drought seasons, when water dries up in the village ponds, springs, and wells. People are forced to drink very dirty water. Livestock and other animals share the same water from stagnant rainwater ponds. Drinking water from the pond and open dug wells causes waterborne diseases such as diarrhea, dysentery, typhoid, cholera, malaria, and gastro-enteritis, particularly among young children. Child mortality is a serious issues in this area, especially during the drought season.

Nara Desert

The Nara Desert (covering around 23,000 km^2) is hot and arid with sandy hills, steep slopes, and vast low-lying areas (known as *Patt*). It is marked by high wind speeds, shifting sand dunes, high diurnal temperature variation, scant rainfall, extreme solar radiation, and high rates of evapotranspiration. The sandy soils of the desert have a rapid infiltration rate of water, poor fertility, low organic matter due to

[119] *FAO. (2004). Food and Agriculture Organisation of the United Nations. http://www.fao.org/3/y5460e/y5460e06.htm*

[120] *Herani, G. M., Pervez, M. W., Rajar, A. W., & Shaikh, R. A. (2008). Livestock: A reliable source of income generation and rehabilitation of environment at Tharparkar.*

hasty oxidation, and high salinity. Both stabilized (with a mixed population of plant species) and unstabilized dunes occur in the Nara desert. These different ecological niches harbour a variety of dryland vegetations: crest ranges, slopes, and swales vegetation; sandy plain vegetation; and sand-sodic land vegetation, the latter found in the between interdunal areas of the desert, where such *kharror* lands were formed by the evaporation of water from temporary lakes.

The only source of water for humans and livestock in these drylands is dug/natural ponds in which rainwater is stored during the monsoon. Groundwater resources are limited and occur at a depth of 50-300 feet from the surface. Despite its low productivity, the Nara Desert sustains relatively high human and livestock populations—1.05 million and 1.25 million, respectively[116]. There is a tendency to increase the livestock population, since it is the only livelihood of pastoralists. However, increases in the livestock population come at the expense of the fragile ecosystem. Severe periods of prolonged drought (such as in 1997-2001) cause severe depletion of the rangeland grass and sedge populations, exacerbated by overgrazing. In line with trends in other arid parts of Pakistan, the populations of grasses and highly palatable annual plants are gradually decreasing because of excessive use as forage at the early growth stages (before seed formation) and the trampling of young foliage, especially at the start of the wet season. This practice removes the herbage cover from the soil surface. Grazing directly on the topmost fertile layer of the soil results in soil deterioration. This exposes the land area to sun and wind. With the resulting decrease in litter formation, fertility decreases over time. This is compounded by the indiscriminate cutting of trees for fuel, timber, and charcoal formation.

Tharparkar Desert

Tharparkar, in southern Sindh, supports a population of 1 million people spread over 2,350 villages distributed over 20,000 km^2. Agriculture is not feasible due to a shortage of rainfall. The main source of income is livestock. Rain is rare and comes at 3-4 year intervals. A semi-nomadic lifestyle prevails.

There is a historical symbiotic relationship between the pastoral communities of the rangelands and the farmers of the irrigated agricultural lands, which has withered away to a certain degree. In the past, pastoralists maintained their livestock during drought periods by migrating from one area to another without much restriction, while also harvesting and threshing wheat crops from and for farmers. Currently, there is less need for animal power and these relationships have changed.

Drinking water access is a challenge in Tharparkar. Dug wells are the only source of drinking water in the area. Yet this underground water is largely brackish with only limited areas of sweet water. The depth of groundwater wells ranges from 60 feet in the southwest to 300 feet in the northeast. Particularly in *vat* areas, water is at low depth and can be pulled out relatively easily. There has been much development of pipelines from the canal areas into the desert areas, so as to relieve the pressing needs for humans and livestock. For instance, sweet water is supplied from Naukot to Mithi and Kunri to Chachro. In general, wide gaps persist in the coverage of key services such as primary education, preventive health care, village electrification, skills promotion, livestock farming, and micro-finance.

As in the other desert territories in Sindh, when there is no cultivated crop on farmlands, farmland is used as open meadows for livestock. Nobody refuses anybody else the right to leave their livestock in the farmland. The only prohibition is that no one is allowed to fell trees from farmland that does not belong to them.

In all arid rangelands in Sindh there is a need to conserve rangeland by controlling and restricting access and by undertaking measures to increase the carrying capacity of these arid areas. The experience of grass reseeding in Dera Ghazi Khan shows promise. Indigenous and exotic plants and grasses should be planted for the conservation of farmland and rangeland. This should be combined with water harvesting

measures, e.g., using instance road infrastructure to collect and concentrate run-off. When desert territory is wetted by rain or floods, the dormant seeds in the soil also are activated. This can form the basis for farmer-managed natural revegetation, whereby emerging valuable tree seedlings are protected and others are removed. The areas contain many useful species [99] [116] [117], such as Trifolium alexandrinum (high moisture content), Capparis deciduas, Salvadora oleiodes and Ziziphus nummularia (high crude protein content), Acacia nilotica and Alhagi maurorum (high carbohydrate content), Zea (high in organic matter), and Alhagi maurorum (high in free nitrogen).

The dryland areas have received far less attention than the Indus Basin canal areas. However, they are home to a large vulnerable population whose well-being depends to a large extent on how these more sporadic waters are managed. As water scarcity becomes manifest in Sindh, more attention is required for dryland water resources. These areas also witness dynamic change, as can be seen in the five-fold expansion of settlement land cover in the last 10 years and the steady increase in livestock population, especially for sheep and goats. Interventions in the Sindh dryland areas have been few and far between. They have, by and large, also not had the expected impact. There has, in particular, be an emphasis on the construction of dams – some large and many small—but not all dams have lived up to expectations, with large dams being particularly problematic. They have often not filled with water and some have accumulated large amounts of sediment. They have interfered with the existing hydrology to the detriment of downstream uses and their established rights of use. They have often left the population in these areas worse better.

A range of options for improved dryland management have been developed in different parts of the world that may work well in Sindh, if tried. Examples are controlled holistic grazing, reseeding of native grass, hay making, run-off retention with roads or earthen measures, developing local storage, and farmer-managed natural revegetation.

Annex 9.1. General Scope of the Sindh Strategic Water Plan

1. Introduction

Building upon the 2022 Sindh Water Policy, SWAT will support the development of a broad Sindh 'Strategic Water Plan' (SSWP) to address key water and water related environmental and social issues. Annex 9.1 of the ESMF provides an overview of the alarming state of water-related environmental degradation and the driving forces that need to be addressed to reverse this decline. Key issues include:

Reducing land degradation caused by waterlogging and salinity

- Managing climate-related risks including floods, droughts, heat, and sea level rise
- Recalibrating water allocation regimes to ensure equity, economic efficiency, and sustainability
- Reviving the Indus Delta ecosystem
- Protecting and restoring wetlands and lakes in Sindh Province
- Addressing severe water scarcity in Sindh drylands, Kohistan and Tharparkar/ Nara Desert
- Strategically managing groundwater resources
- Improving water quality in canals, natural water bodies, and along the coast.

This complex set of inter-related issues can only be tackled through an integrated water resources management perspective that considers the rapidly evolving socio-economic and climate context.

Following the Sindh Water Policy (about to be endorsed), Sindh Province is in the incipient phase of developing an Integrated Water Resources Management (IWRM) system. The SSWP will be the centerpiece of the Government of Sindh's (GoS) efforts to develop a vision, objectives, and action plans for sustainably managing its water and related resources while also fostering socio-economic development. The SSWP will be approved by the newly formed Sindh Water Resources Commission (SWRC), which is the multi-sectoral apex body for water resources management in the province. Aligned with the Sindh Water Policy, the SSWP will layout a near-term plan of action for the next five years, a medium-term indicative program for the next twenty years, and a long-term 50-year vision and strategy.[121] The SSWP will be periodically updated every five years, with major revisions every ten years. A regular water resource planning process will help manage the various water resources challenges in the province and protect the vital role that water resources play in the society and economy of Sindh.

2. Objectives

The objective of the SSWP is to provide a road map for integrated water resources management in Sindh considering the following dimensions:

- the short (5 year), medium (20 year), and long (50 year) term for the entire province
- key water resources management challenges
- regional IWRM planning
- resource management strategies

In addition, the first SSWP crafting exercise has the following objectives:

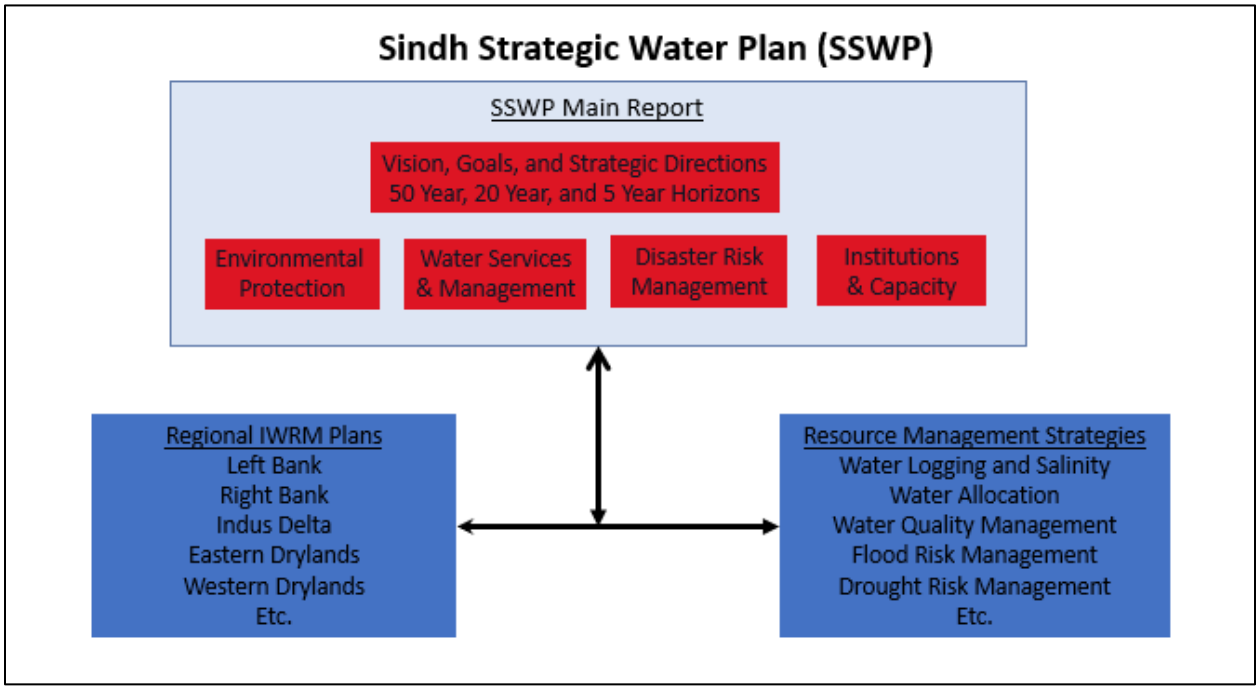
[121] These time scales reflect a nested process of planning levels: operational planning (5 years), strategic planning (20 years) and visioning (50 years). See: Pegram, Guy C. River Basin Planning Principles: Procedures and Approaches for Strategic Basin Planning. Manila, Philippines: Asian Development Bank, 2013. http://www.adb.org/sites/default/files/pub/2013/river-basin-planning.pdf.

- Define hydrological planning areas for regional IWRM plans
- Identify and address key resource management issues to arrive at situation of sustainable water resource use in Sindh
- Create opportunities for new, innovative and path-breaking approaches to water management
- Develop a GoS approach for addressing trans-provincial water issues in the Indus Basin
- Ensure an inclusive and participatory planning process

3. General SSWP Structure

The general structure of the SSWP, which will be fined-tuned during the preparation of the SSWP, is presented below. There will be three sets of inter-related documents: i) the overall Sindh Strategic Water Plan (Main Report); ii) a set of priority resource management strategies; and iii) regional IWRM plans. These sets of documents are interlocking and together can be considered the "Sindh Strategic Water Plan."

Figure 1: General Structure of SSWP



Vision, Goals, and Strategic Directions:

The formulation of visions, goals and broad strategic actions is an indispensable starting part for developing the SSWP. A broad range of stakeholders should collaboratively develop a common vision and strategic directions for Sindh province over the next 50 years, 20 years, and 5 years. This will build upon and expand upon Sindh Water Policy by defining a set of specific goals and strategic directions to achieve the vision. There are four main areas to be addressed at each time scale:

Environmental Protection: Identifying water-related valued environmental components (VECs) in Sindh and establishing goals and visions for these VECs. Some examples include: i) Indus Delta; ii) Manchar Lake; iii) Indus River, including maintaining a healthy Indus river dolphin population and an environmental flow downstream Kotri Barrage; iv) protecting valuable groundwater aquifers; and v) reducing water-related land degradation.

Water Services and Water Resources Management Optimization: Optimizing the delivery of water-resource related services such as irrigation and drainage and urban/rural water supply and sanitation. Water service optimization includes aspects such as safeguarding essential services (resource availability in urban water supply, in rural water supply performance targets), water productivity (in agriculture), balancing water resource use with availability, safeguarding water quality (controlling effluent disposal), reliability of the service, equity of the distribution, and additional parameters like improved flexibility of the deliveries. Water resources optimization focuses on the ensuring efficient, equitable, and sustainable allocation of water among users including meeting environmental protection needs. A dynamic and flexible water allocation system will be required in the face of a changing climate and the requirements for conjunctive management.

Disaster Risk Management: Comprehensively addressing waterlogging, flood and drought risks by strengthening all aspects of the disaster risk management cycle: mitigation and prevention, preparedness, response, and recovery. Monitoring and adapting to changing climatic extremes will be required to adapt to a warming planet.

Institutions and Capacity Building: Adopting effective policies, laws, regulations, and capacity building for water-related management departments and water-related service entities. Management departments include water resources management, environmental protection, and disaster risk management. Water service entities include irrigation and drainage, urban WSS, and rural WSS providers.

Resource Management Strategies

A set of more detailed resource management strategies will be developed to help inform specific actions for regional IWRM plans and inform provincial-wide programs. These strategies will help inform, but not prescribe, water-related planning and decision making at lower levels such as Area Water Boards (AWBs) providing bulk water supply, farmer organizations (FO) providing localized irrigation services, and municipalities responsible for water supply and sanitation. The specific strategies will be identified and developed during the preparation of the SSWP but could potentially include the following topics:

- Water Allocation Procedures
- Groundwater Management
- Drought Management
- Flood Management
- Wetland Management and Flood Plain Management
- Coastal Resilience, Delta Management and Aquatic Resources
- Dryland Management
- Water Pollution Control and Waste Water Disposal
- Managing Water Logging and Salinity
- Water Quality Management
- Management of Water Storage
- Catchment Management
- Indus Basin Irrigation System (IBS) Engagement

These resource management strategies will both inform and be informed by the regional IWRM plans (discussed in next section). The strategies should present principles and practices and outline a five-year plan of action that prioritizes programs and projects and include monitoring and evaluation.

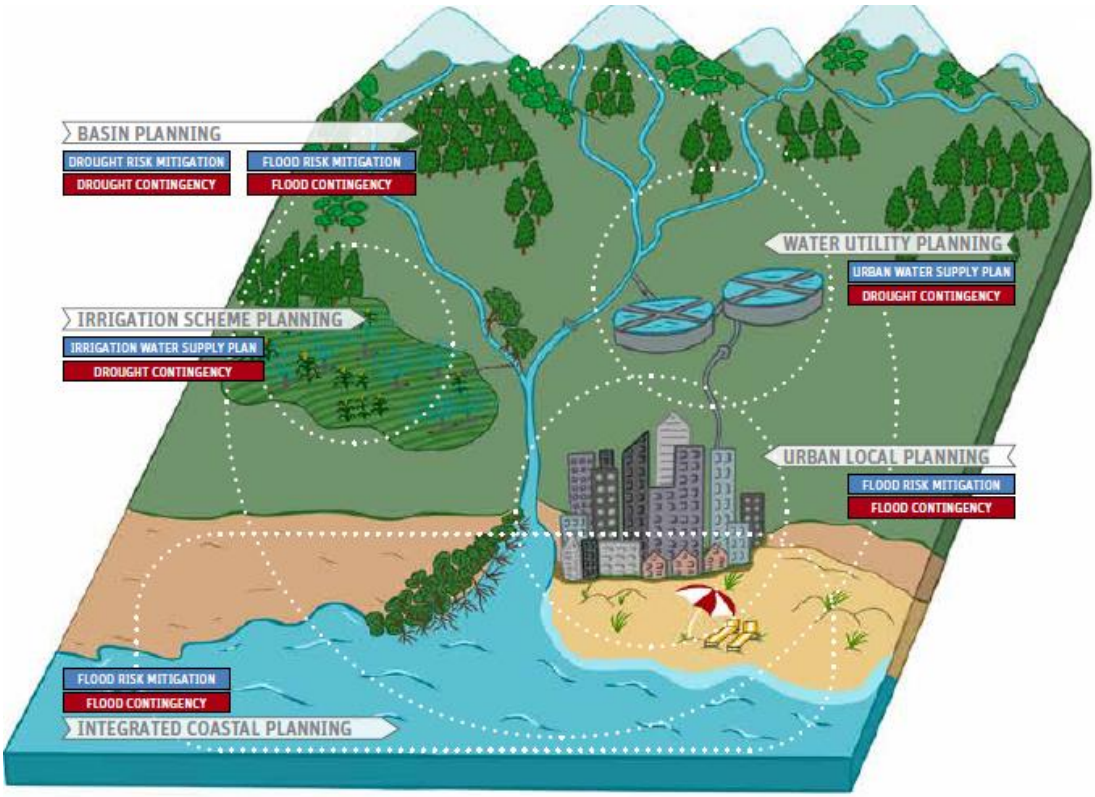
Regional IWRM Plans

The SSWP shall establish clear hydrological planning regions with unique characteristics and prepare IWRM plans that incorporate relevant resource management strategies. Hydrological regions could potentially include the following.

- Left Bank of the IBIS
- Right Bank of the IBIS
- Indus Delta
- Eastern Drylands
- Western Drylands

The IWRM plans should both fit into the broader SSWP and provide a framework for more local planning for Area Water Boards (AWB), water utilities, urban planning, and coastal zones. Figure 2 below shows the geographically nested and hierarchical nature of IWRM planning.

Figure 2: Nested IWRM Planning Levels



Source: Browder, et. al, (2021), "An EPIC Response: Innovative Governance for Flood and Drought Risk Management." World Bank

The SSWP and the regional IWRM plans will not be able to undertake planning at the local level but can recommend gaps, constraints, and opportunities for improvements at the local level. For example, the regional IWRM plan could call for improving a specific local level plan as a target in the five-year plan. To provide a starting point for this process, under the Left Bank IWRM planning process technical assistance could be provided to AWBs involved in the SWAT project and to a few select municipalities.

The regional IWRM plans should present specific 20-year vision, goals, and strategic directions, as well as a five-year plan of action that will prioritize structural and non-structural investments and management actions.

4. SSWP Organization and Principles

SSWP Organizational Arrangements

The first SSWP will be prepared under the coordination of the SWAT Project Coordination and Monitoring Unit (PCMU) which is housed in the Planning and Development Department (PDD) with the support of the SWAT project management consultants. Over the course of the next five years, the Irrigation Department will be transformed into the Irrigation and Water Resource Department (IWRD) and a Water Resources Management Directorate is expected to be established in the new IWRD. It is expected that this Directorate will manage the formulation of the subsequent SSWPs. The development of the SSWP will be under the overall supervision of Sindh Water Resources Commission (SWRC) and will include all relevant departments, including irrigation, agriculture, environment, PHED, disaster management, etc. as well as other stakeholders. Formal adoption of the SSWP by the Commission will help ensure that it becomes official government policy.

The SSWP should be prepared with active inputs of all departments concerned as well as relevant stakeholders in the different regions. It is particularly important to include the Karachi Water and Sewerage Board (KWSB), which is currently implementing the large World Bank-financed Karachi Water and Sewerage Services Improvement Project (KWSSIP). Support will be provided by a multi-disciplinary consultant consortium, whose role is not only to prepare the SSWP but also support the different departments, build capacity, and contribute to the consultative processes. The consultant consortium undertaking this task will employ a combination of international experts and Sindh professionals, including recent graduates. All studies, materials, data, and models collected for the first SSWP are to be handed over to the Sindh Hydro-Agro information Centre and the IWRD upon conclusion of the engagement for use in the development of future SSWPs.

Stakeholder Engagement

It is important for the preparation of the plan to be a well-managed process that develops a common direction shared by different organizations and stakeholders. Such a planning process creates the basis and thrust forward for cooperation and sustainably managing Sindh's water resources and lays the basis for water management to happen by decision and design, and not by default. The strategic water resource planning process should also recognize and incorporate the diverse perspectives of stakeholders at different scales that will have an influence on the implementation of the strategy as well as researchers and practitioners from within Sindh and outside and the private sector. Cooperation with potential partner institutions in other related sectors is also important in creating the necessary linkages with other developmental and environmental planning processes.

Extensive stakeholder consultations, communication, and media outreach will be employed throughout the preparation of the SSWP. The guiding principles for stakeholder participation include:

- Undertaking a stakeholder analysis and developing a clear stakeholder engagement plan
- Engagement at different stages, i.e., scoping of priorities and discussion of options
- Inclusive and bonding
- Gender-conscious
- Engaging the public, civil society, academia, and the private sector
- Meetings are transparent with clear objectives and sharing of results
- Managed well – to have quality inputs and build up broad ownership

Water and Socio-Economic Development

The potential socio-economic trajectory of Sindh province is uncertain. The SSWP shall consider different socio-economic scenarios and adaptive management options when developing medium-term (20 year) and long-term (50 year) strategic approaches. Potential impacts of key driving forces such as population growth, land use changes, urbanization, and industrialization should be factored into the various scenarios. The SSWP should not only consider how these factors affect water and water-related resources, but also how SSWP can influence key trends such as water and land use, patterns of economic development, etc. to help achieve the overall vision.

Levels of poverty and inequality in Sindh province are quite high, particularly in rural Sindh where land ownership is highly skewed toward large farmers. Around 37% of Sindh's rural population is estimated to live below the poverty line. The SSWP shall consider the needs of poor and marginalized communities, including women. It should be based on the principles of fair access to basic needs and service related to water such as irrigation and drainage, and water supply and sanitation, Poor and marginalized groups are also disproportionally affected by floods and droughts and special considerations should be given to managing climate related risks of the most vulnerable populations.

Climate Change Principles

The SSWP will identify actions to increase Sindh's climate resilience and help reduce water-related Green House Gas (GHG) emissions. The medium term (20 year) and long term (50 year) strategies will analyze different climate change scenarios and relevant adaptive management strategies, including no-regrets measures, monitoring and early warning systems, and resilient infrastructure design recommendations. The following is an overview of some of the critical climate change related pressures, that will be addressed in the SSWP:

Climate Driving Force	Potential WRM Issues in Sindh
Sea level water rise	Coastal saline water intrusion in Delta, impeded drainage
Temperature rise	Changes in water demand and crop choices
Drought management	Need for better buffering, making better use of recharge and aquifer recharge
High incidental rainfall, floods	Flood protection, flood escape, recharge, aquifer management, water shed protection, drainage management
Reduction and/or modifications in Indus River Flows	Flexible and dynamic water allocation system, and changing crop patterns to match water availability

Cumulative Impacts

In the SSWP an IWRM approach will be used, that considers the interaction of different components of the water system such as climate, weather, watersheds, water quantity, water quality, water use, and water-related eco-systems and analyzes how these different components cumulatively interact to affect economic, social, and environmental outcomes.

Given the complexity of these interactions, the SSWP will develop a set of sophisticated modelling tools and decision support systems to better understand the implications of different strategies, and most importantly how they interact to cumulatively affect outcomes. The results these types of analyses should be presented to stakeholders and decision makers in easily understandable formats to facilitate a common understanding of the basic relationships between different sets of strategies.

Information and Analysis

The Sindh government is currently developing a Hydro-Agro Informatics (HAI) program that will use a combination of remote sensing and ground-based observations related to water and agriculture parameters to provide information on water balances, cropping patterns, irrigation requirements, and drought and flood monitoring. A HAI Center will be established to help coordinate the different information flows and provide services. As much as possible the information base of the HAI Center will produce the data inputs for the SSWP. The team working on the SSWP will synchronize its activities with the HAI Center and come to an agreement on standardization of data (parameters, quality/source, time interval, timeliness) with the HAI Center.

5. SSWP Methodology and Key Tasks

The general methodology for the SSWP is presented in the Figure 3 below and will be further refined by the consultant consortium in consultation with the Sindh stakeholders and the PCMU. Each key task is briefly presented below.

Stakeholder Engagement Plan

A stakeholder mapping exercise will identify all relevant groups, including policy makers, provincial departments, local governments, civil society, academic researchers, and the public. Large urban water supply utilities in Karachi (KWSB) Hyderabad are important stakeholders. An engagement plan will identify when different groups should be consulted, the objectives of the consultations, how information will be shared, and how consultations will feed into the formulation of the SSWP.

Ownership Plan

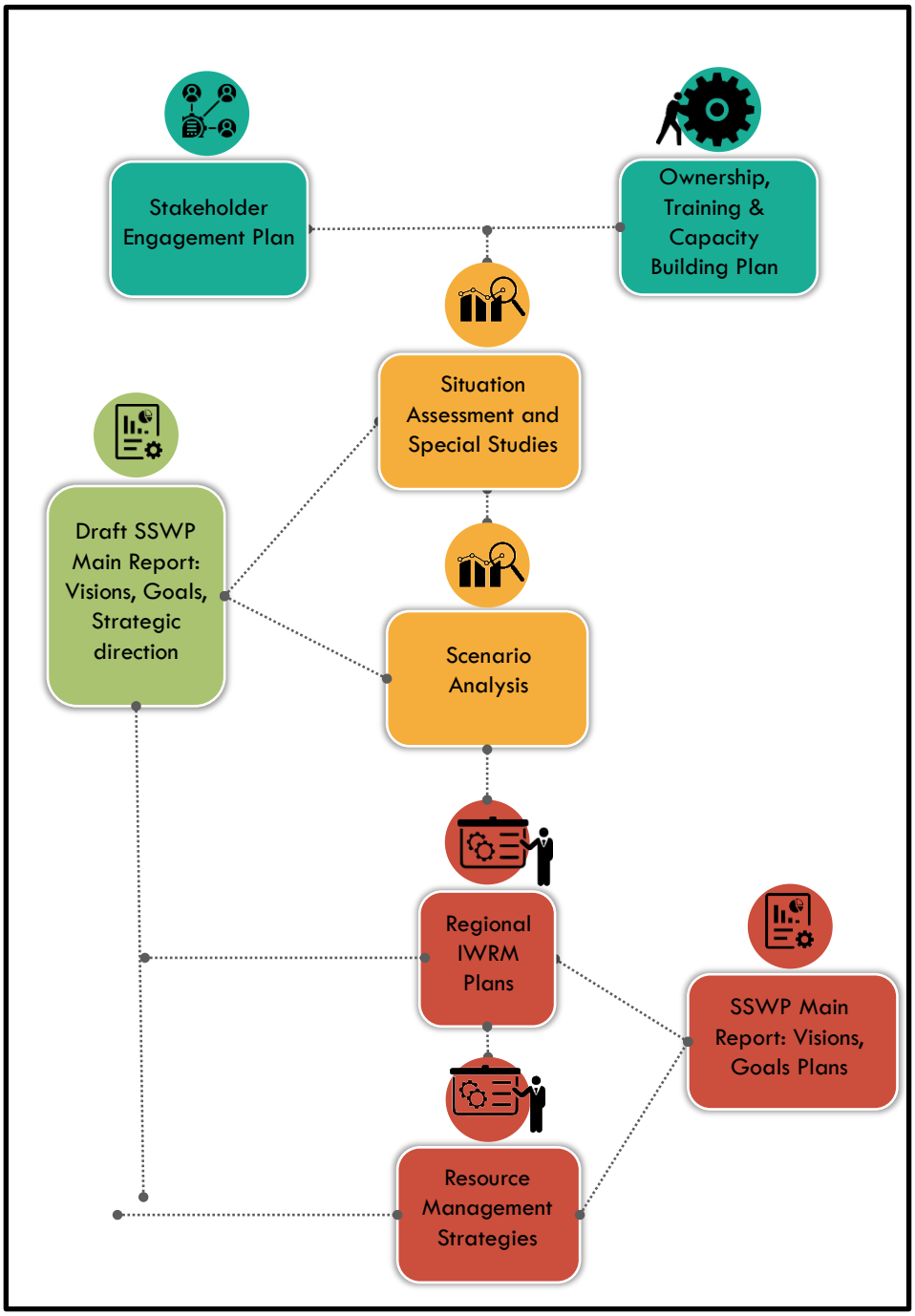
With an exercise of the scale envisaged to prepare the first SSWP, there is the risk of the plan developed in isolation of the main mandated organizations, whereas no capacity is developing in these mandated organizations. The fate of the SSWP could then not be unlike other studies: that of unread volumes on hard drives.

There needs to be a SSWP Ownership Plan, that is also budgeted with resources. This will:

- Specify the working arrangements with the main organizations, in secondments or implanting SSWP Team staff
- Describe accessing data and contributing to improvement of such data quality, coverage or frequency

- Describe the review process with the mandated organizations and with the Government of Sindh as a whole.

Figure 3: General Methodology for SSWP



Training and Capacity Building Plan

Preparation of the first ever SSWP should be viewed as a process as much as a product and will require substantial training and capacity building with a wide group of stakeholders. Based upon the stakeholder mapping exercise, a training and capacity building program will be developed and implemented in parallel with key steps along the formulation of the SSWP. Key target audiences include the Irrigation and Water Resources Department staff (including Area Water Board staff); Environment, Climate Change & Coastal Development Department; Sindh Provincial Disaster Management Authority (PDMA); federal agencies including WAPDA and Ministry of Water Resources; and relevant civil society organizations.

Situation Assessment

The historical evolution and status of water and water-related environmental resources will be assessed. A similar exercise will also be undertaken for the provision of water services, including irrigation and drainage, storage, water supply and sanitation, as well as water resource management functions, including water allocation, flood risk management, and drought risk management. The selection of IWRM planning regions will be confirmed during this stage. The situation assessment should be done at both a provincial and IWRM regional level as appropriate.

Scenario Analysis

A set of plausible set of socio-economic and climate scenarios will be developed for a 20-year and 50-year time horizons. The impact of different water management and water service provision approaches will be superimposed upon the different scenarios to generate alternative water futures Sindh. Advanced modelling, decision support, and presentational tools should be developed to provide stakeholders an understanding of the how Sindh's water management system functions, the implications of different strategic decisions and their economic, social, and environmental trade-offs.

Provision for special studies

The preparation of the SSWP will have a provision to undertake special studies, as on some of the main themes there are likely to be important unknowns. These studies may also be placed with the Hydro-Agro Informatics Centre, but the SSWP will have the possibility to issue such studies quickly.

Draft SSWP: Vision, Goal, and Strategic Directions

Based upon the scenario analysis, the SSWP process should help develop consensus on the preferred water future, in line with the Sindh Water Policy, and its accompanying goals and broad strategies for the 20-year and 50-year period. An approach for adaptive management to adjust to changing climate and socio-economic circumstances (including technological changes) should be highlighted, along with the monitoring and evaluation processes to ensure that Sindh stays on track to achieve its medium- and long-term vision. The draft version of the SSWP should be presented at this time to help guide the formulation of resource management strategies and regional IWRM plans.

Resource Management Strategies

A set of resource management strategies to address the highest priority issues shall be developed to help inform provincial programs, regional IWRM plans, and local plans. The resource issue issues should be identified through a collaborative process, and could potentially include water logging and salinity, water allocation, water quality management, drought risk management, flood risk management, data, and information, institutional development, etc. The strategies should be relatively short documents that highlight best practices, gaps, constraints, and opportunities. The resource management strategies should be developed in parallel with the regional IWRM plans and feed into the overall SSWP.

Regional IWRM Plans

IWRM plans should be developed for each hydrological region and address relevant water issues in an integrated manner, including WSS, I&D, floods, droughts, and water-related environmental and social issues. Advanced modelling, decision support, and presentational tools shall be used to build a common vision, goals, and strategies for the region, as well as prioritize investments and management practices. The regional IWRM plans will include 5-year and 20-year horizons and feed into the SSWP. Regional plan consensus building should include relevant provincial departments, local governments, and Area Water Boards.

The regional IWRM plans should both guide and be informed by planning at more local levels, including the Area Water Boards (AWBs) for bulk water supply, and municipalities for water supply and sanitation including KWSB. Although development of local plans is beyond the scope of the SSWP, the consultant consortium will also work with the three AWBs on the Left Bank involved in the SWAT project: Ghotki, Nara, Left Bank to help them develop their own specific water management plans. In addition, water resource management plans for two municipalities in the Left Bank will also be formulated.

SSWP Main Report

The Main Report of the SSWP shall layout the strategic water plan for Sindh province for the near-term (5 years), mid-term (20 years), and long-term (50 years). It should incorporate and adjust as necessary the resource management strategies and the regional plans in a logically consistent manner to ensure an integrated approach consistent with the overall vision, goals, and strategic directions. The SSWP should include a 5-year plan of action that will provide a roadmap for the GoS's policies, programs, and infrastructure investments, including an annual SSWP monitoring and evaluation exercise.

6. SSWP Time Frame and Consultant Support

Formulation of the SSWP is expected to take approximately 3 years after mobilization of the SSWP consultant consortium. The indicative time frame is presented below.

Milestone	Time After Consultant Mobilization
Inception Report	1 Months
Detailed Workplan	3 Months
Stakeholder Engagement Report	6 Months
Situation Assessment Report	9 Months
Scenario Analysis Report	12 Months
Completion of Special Studies	18 Months
Draft SSWP	18 Months
Resource Management Strategies	30 Months
Regional IWRM Plans	30 Months
Final SSWP (Approved by SWRC)	36 Months

A consortium of consultant firms will be contracted to assist the GoS prepare the SSWP. The following experts are expected to be mobilized by the consortium. In total, the assignment is expected to require around 300 months of consultant input. In addition, a provisional sum for undertaking specialized field studies will be included in the consortium contract.

Position	Input (Months)
Team Leader	18
Deputy Team Leader	36
Lead WRM Planner	12
Senior WRM Planner	24
Lead Environmental Expert	12
Senior Environmental Expert	24
Lead Agricultural Water Specialist	12
Senior Agricultural Water Specialist	24
Groundwater Specialist	6
Lead Coastal Expert	12
Senior Coastal Expert	24
Lead Social Expert	12
Senior Social Expert	24
Lead WRM Modeler	6
Senior WRM Modeler	12
Climate Expert	6
Lead Hydro-Informatics Expert	6
Senior Hydro-Informatics Expert	12
Financial Expert	12
Lead Communication Expert	6
Senior Communication Expert	12
Totals	312

Annex 10: ESMP for Agriculture FERC

1. Background

Floods caused by abnormally heavy monsoon rains starting in mid-June 2022, have impacted over 30 million people across the country. Sindh is the among the worst affected provinces causing flood damage across all 30 districts, affecting over 10 million people. Over six million people in Sindh have been displaced from their homes, while half a million people are living in Government-run relief camps. Based on preliminary numbers, it is evident that this is an unprecedented disaster in magnitude and scale, requiring urgent near-term support to the agriculture sector to help restore rural incomes and address food security concerns.

There are particular risks related to the forthcoming winter (rabi) season. Wheat is the main rabi crop, and planting should start between mid-October and end of November. The water is slowly receding and according to the government 85% of farmland has been cleared of water since the beginning of October 2022. The return of soil moisture to cultivatable levels, together with farmers' ability to access key inputs, could delay planting. Since there is a vast network of dealers and agents of input providers for whom rabi is a major selling season, access to key inputs by farmers is constrained primarily by their ability to procure them, as they lost their kharif crop which would have been used to pay of their credit for that crop and allow them to get new credit for rabi crop.

The SWAT project aims to support the production system's recovery from the shock of floods by providing cash assistance to small farmers access to support rabi cultivation in line with the third objective of the project PDO ("facilitate the recovery of small farmers from the 2022 floods."). Since the rabi season started in the middle of October, speed of response is critical to ensure timely support to farmers.

This project complements the efforts of Sindh Flood Emergency Response Support (SFERS) which is using community organizations to target the poorest population of the affected areas. SFERS aims to support the most vulnerable households, identified by community organizations using the socio-economic registry data, through livelihood, cash-for-work, and livestock assistance. While SFERS supports the most vulnerable households to help them not fall further into poverty, the SWAT Component 5 will focus on subsistence, semi-subsistence, and market-oriented farmers to ensure recovery of production system.

2. Objective of this Annex

Given the fact that Component 5 FERC will result in a number of small activities to facilitate the recovery of small farmers from the 2022 floods, which will only be identified during the implementation, the exact locations and environmental and social risks/impacts are not precisely identified yet at this stage. A framework approach is therefore adopted at the preparation stage for E&S risks management.

The objective of this annex to SWAT ESMF is to establish and explain a framework for E&S risks and impacts management during the implementation of Component 5 FERC with E&S risk screening, management procedures and Institutional Arrangement.

3. FERC Description

This component will support small farmers affected by the 2022 floods. This will consist of consisting of cash transfers to small farmers. . . The component may also finance supporting services provided by NGOs and consultants, as well as incremental operating costs.

The support will be targeted to small producers (.This will ensure that the resources are targeted to those who are significant contributors to food supply in the production system but have relatively less buffer to cope with the shock, while bigger producers can use other channels, like formal or informal lenders, to finance their rabi crop. These farmers will be identified using land holdings records shared by the Revenue Department together with sub-district level committee that validates this information, together with other information on their cultivation and losses. The verification and delivery of assistance to eligible farmers will be done either through sub-district level committees notified by the agriculture department, or through community-based organization. A communication campaign will be used to ensure communities are aware of this benefit and it is used for farming inputs.

4. Environmental and Social Risks and Impacts screening

The activity will not have major environmental and social safeguards risks. The component will stimulate a range of farm activities including land preparation and use of seeds, fertilizer, or other agro-chemicals. In view of the situation, it is anticipated that most of the resources will be used for seeds and fertilizers to start the cropping season. The support is hardly enough to restore the normal levels of cultivation and input use. However, to 'build back better', awareness raising campaigns will be made part of the support to inform farmers about appropriate use (timing, dosage, method) and safe handling of inputs. Inequalities may result between those that receive the benefit and those who do not (particularly landowners and tenants) however, transparent targeting and beneficiaries' selection, and robust Grievance Redress Mechanism (GRM) system will be set up to identify and address complaints. Clear communication campaign on the eligibility criteria and its purpose to finance inputs for rabi crops will be used to manage expectations within communities regarding the responsibility of landowners to finance inputs. The potential environmental and social risks and impacts are summarized below in Table 1.

Table 1: Environmental and Social Screening of FERC

Potential Activities	Potential Environmental and Social Risks and impacts	Suggested Mitigation measures
Cash transfer to small farmers	Unequal benefits if targeting is not equitable or in accordance to an acceptable beneficiary identification.	Preparing a practical and relevant beneficiary selection criteria which favors small and medium sized farmers. Using a clear qualification criterion, well communicated in advance, to avoid claims of wrongful exclusion or inclusion; and Setting up a robust GRM to identify and address complaints.
Use of fertilizer or other agrochemicals	Usually, small farmers' lack awareness about or are not careful enough in the use of modern inputs like (fungicides) treated seeds, fertilizers and pesticides. These include the lack of appropriate knowledge on dosages, ratios/seed rates, timing and methods of application, their handling and disposal of containers. This would result not only in the underutilization of these inputs but can also cause harm to the environment due to over usage and/or unsafe handling, storage and disposal (soil, air and water pollution as well as health impacts). Accumulated nitrogen and phosphorus harm terrestrial and aquatic ecosystems by eutrophication. As excessive amounts of organic matter decompose in aquatic environments, they can bring about oxygen depletion and create "dead zones" within bodies of water, where limited number of species can survive, let alone strive. Nitrogen accumulation in water and on land threatens biodiversity and the health of native plant species and natural habitats. In addition, fertilizer application in soil leads to	The Project will not procure or distribute pesticides. An agreement will be signed by the farmer beneficiaries upon receiving the support to avoid and mitigate the environmental and social risks and impacts including the following: 1) As per Integrated Pest Management (IPM) approaches, storage of agrochemicals in their original packaging and in a dedicated location that can be locked and properly identified with signs, handling of agrochemicals with adequate PPEs, usage of only recommended amount of agrochemicals and disposing the waste fertilizer and other agrochemicals as per the producer's instruction and local regulations 2) No application of fertilizer, pesticide and other agrochemicals on the land next to protected wetlands 3) Limit the land development and use of agro-chemicals within the lands owned or rented by the farmers.

Potential Activities	Potential Environmental and Social Risks and impacts	Suggested Mitigation measures
	the formation and release of nitrous oxide, one of the greenhouse gases.	4) Avoid land conversion from natural habitats such as forests, rangelands and wetlands 5) No encroachment on the public lands 6) Grazing only at existing designated locations. No expansion of grazing land Awareness raising campaign will be undertaken as part of social mobilization movement and using the ICT based extension service of the agriculture department to inform farmers about proper management of fertilizer and other agrochemicals, prevention of land conversion and reduction of impacts due to livestock faming
Land preparation	If the new farmland is established at natural habitats such as forests, rangelands, wetlands or other ecologically sensitive areas, there will be the potential deforestation and/or loss of natural habitats.	
Livestock farming	Excessive grazing would cause degradation of rangeland and forest land, soil compaction and erosion. Livestock manure would also cause contamination of water, air and soil.	

5. E&S Risk Management Procedures

5.1. Agreement with farmers

Upon receiving cash transfers and/or registering for the program, the beneficiaries confirm that they will not undertake certain activities. The confirmation will include the following measures and will be prepared in simple terms in Urdu and Sindhi languages.

1) As per Integrated Pest Management (IPM) approaches,
   - Storage of agrochemicals in their original packaging and in a dedicated location that can be locked and properly identified with signs, access to which is limited to authorized persons
   - Personal Protective Equipment (PPE) should be used when handling fertilizers and other agrochemicals according to the Safety Data Sheets (SDS) of the product
   - Ensure judicious use of all chemicals including fertilizers, pesticides, etc. as per recommendation of Agriculture Extension Department. Minimize losses to the environment
   - Disposing the waste fertilizer and other agrochemicals as per the producer's instruction and local regulations
2) No application of fertilizer and other agrochemicals at the land next to water sources, rivers, streams, ponds and lakes
3) Avoid land conversion from natural habitats such as forests, rangelands and wetlands to farmland
4) No encroachment on the public lands
5) Grazing only at existing designated locations. No expansion of grazing land

5.2. Awareness Raising Campaign

Awareness raising campaign will be undertaken Agriculture Extension Department using their ICT based extension service to inform and educate farmers about judicious use and management of fertilizer and other agrochemicals, prevention of land conversion and reduction of impacts due to livestock faming. The Campaign will explain the beneficiary selection criteria and will disseminate the GRM channels available to end users. Sub-district local government offices (tehsils and talukas) will play an important role in the awareness raising campaign and will serve as the primary third-party verification agent in the distribution of agri-input and/or cash transfers. Provided sufficient time is available local NGOs may also be contracted as part of the social mobilization process.

5.3. GRM

The Agriculture Department, through its Directorate of Extensions, will ensure that a robust, accessible, and relevant FERC-specific GRM system is available to deal with any complaints from affected stakeholders. The Directorate of Extension will work in coordination with sub-district government offices (tehsils and talukas) to manage the GRM. The main objective of the GRM will be to assist and resolve complaints in a timely, effective and efficient manner. . The GRM will be culturally appropriate, effective, accessible and should be known to the affected population. The Agriculture Department will conduct awareness raising for the affected communities about the presence of the GRM and inform their right to file any concerns, complaints and issues they have related to the project. Complaints received through the GRM will be consolidated . into a central project grievance database. Each database entry will correspond to a single complain, and will include all pertinent details such as the complainants name and contact information, nature of the complaint, location, time of receipt, steps taken to address, resolution

status, etc. Consolidated grievances will be screened and classified into categories on the basis of priority. Criteria will be developed to determine the classification of grievances. Grievances will then be investigated and resolved within a timeframe specified to the complainant at the time of receiving the grievance—this timeframe shall not be longer than 10 days from receipt of the grievance. In the event that resolution demands a longer timeframe, the complainant will be notified. Upon resolution of a grievance, the complainant will be contacted within 2 days of resolution to ensure that they are satisfied with the outcome.

6. Institutional Arrangements and General Implementation Plan

The flow of responsibility for implementing E&S procedures under the Project is summarized below.

Agriculture Department's Agricultural Development Unit (ADU). The ADU serves as the PIU for Component 3 and 5 of the Project. The ADU works closely with the various Directorates in the Agricultural Department in the implementation of the project, including the Directorate of Agricultural Extension. The ADU is staffed with one environmental and one social specialist who will provide overall coordination of E&S procedures under the direction of the ADU Director. To boost their capacity to manage the FERC on short notice, the ADU will select and train a group of professionals from the Agriculture Extension Department to be part of the FERC Environmental and Social (E&S) team.

Directorate of Agriculture Extension: Agriculture Extension Services are the main source of farmers advisory services in Sindh Province. There are extension service offices in each sub-district (talukas) with a cadre of extension agents. Support is provided through face-to-face methods, but also through Information and Communication Technologies (ICTs). Sindh has established ICT Agricultural Extension Services Centre under World Bank-funded Sindh Agricultural Growth Project (SAGP) to provide ICT Agricultural Extension Services to the farming community and strengthen the existing Extension Services system by equipping field staff with ICTs tools and approaches to enhance their capacity. Key activities of the center are; Farmer Helpline, Text and voice sms, facebook live program, android applications, YouTube channel, etc.

The ADU E&S team will implement training sessions for Extension officers at the Taluka level to inform them of the FERC E&S procedures, and guidelines for establishing a local GRM that feeds into the ADU's broader GRM. The ADU E&S team will also work with the ICT Center to develop a set of appropriate dissemination tools informing beneficiaries of eligibility requirements, procedures, and E&S responsibilities.

The Taluka-level (sub-district) government plays a key role in the overall implementation of the FERC alongside the Agriculture Department. They will have overall responsibility for third-party verification of transactions with farmers in collaboration with the Extension officers. The ADU E&S team will also provide training and support to the designated Taluka-level officers.

SWAT Project Coordination and Management Unit (PCMU). The PCMU has oversight responsibility for the Project and is staffed with one environmental specialist and one social specialist. The PCMU will support the ADU E&S Team . and ensure high-quality reporting to the Bank.

External Monitoring and Evaluation (M&E) Consultant Firm: An organization will be contracted by the ADU to undertake monitoring (to the extent possible) and evaluation of the FERC activities. This includes an analysis of actual project beneficiaries and the extent to which targeting goals were achieved; how the cash transfers were utilized; the efficacy of the E&S procedures; and an overall impact evaluation. Given the lead time .required to select a suitable organization, the organization may not be mobilized until the

FERC is well into the implementation phase, but it should be able to produce a comprehensive M&E report by late 2023.

7. Budget

The incremental costs associated with the FERC, —that is in addition to the budget in the main text of this ESMF, is estimated at around $270,000. This amount has been incorporated into the Component 5 overall cost.

Item	Unit Cost	Number	Cost
M&E Firm	$100,000 lump sum	1	100000
ICT Products and Printing	Lump Sum Estimate		25000
Incremental Costs-Transport & Travel	Lump Sum Estimate		75000
Incremental Costs-Training/Meetings	Lump Sum Estimate		25000
		Sub-Total	225,000
		Contingency	20%
		Total	270000

Annex 10: Stakeholder Engagement Plan

1. Introduction/Project Description

Sindh Water and Agriculture Transformation Project (herein after referred to as the **SWAT** or the **Project**) is the proposed project by the Government of Sindh. The Project Coordination & Monitoring Unit (PCMU) of the Planning and Development Department (PDD) 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. 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 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

The project development objective is to increase agricultural productivity and improve water resources management to support rural development and environmental sustainability. SWAT focuses on three AWBs on the Left Bank Canals of the Indus River: Ghotki (Ghotki Feeder canal with a command area of 381,000 Ha), Nara (Nara canal with a command area of 1,047,946 Ha) and Left Bank (Akram Wah and New Fuleli canals with a command area of 592,548 Ha). SWAT will also focus on completing the "last mile connections" in the canal network upgraded through the recently completed Bank-funded Water Sector Improvement Project (WSIP)[122] and ongoing Sindh Barrages Improvement Project (SBIP)[123]. In addition, SWAT will introduce modernization concepts for canal operation and irrigation service that will help Sindh make better use of these infrastructure investments.

This Stakeholder Engagement Plan[124] (SEP) has been prepared as a part of the ESMF. This SEP has been prepared in accordance with the legal framework provided in Article 19 A of the constitution of Pakistan, Government of Sindh Transparency and Right to Information Act 2016, World Bank Operational Policies (OPs) on the environment and social safeguards and international best practices.

The SEP includes: (i) the identification of stakeholders for the Project, (ii) analysis of relationships of the stakeholders with the Project, (iii) details of consultation methodologies, (iv) activities carried out to-date and those planned for the future stages of the Project, (v) details of the process for managing stakeholders' concerns and grievances, and explains how the stakeholder engagement process will be recorded, monitored, evaluated and reported.

2. Brief Summary of Previous Stakeholder Engagement Activities

Extensive consultation and information dissemination (also including women) were carried out during ESMF, ESIA, RPF and RAP preparation and disclosure. A total of 7 consultation meetings, with 137

[122] The Water Sector Improvement Project (WSIP), closed in 2020, financed the renovation of the main canal networks for the three AWBs under SWAT.

[123] The on-going Sindh Barrages Improvement Project (SBIP), scheduled to close in 2024, is improving the safety of the three large barrages on the Indus River which feed the Sindh irrigation system.

[124] Stakeholder engagement is the process whereby those who are the program proponents/developers communicate and consult with those who are directly and indirectly affected by the program and those who may have an interest in it or have the ability to influence the Project, either positively or negatively. An effective stakeholder engagement helps to develop constructive and productive relationship with the stakeholders. Listening to stakeholder concerns and feedback is a valuable source of information that can be used to improve project design and outcomes, and helps to identify and monitor trends, challenges and perceptions over time with specific groups of stakeholders. It also helps to address the concerns of the stakeholders in a timely fashion.

participants were conducted. These include 5 local AWB-level meetings, one disclosure workshop at Hyderabad on August 24, 2021, to share the draft ESMF and ESIA of Akram Wah, in which the local communities, including affected communities, AWBs, FOs and Sindh EPA, have participated. Feedback from the consultations was overall supportive of primary and secondary stakeholders of the Project. The general concerns of the local community (also including women) focused on minimization of impacts on private land, payment of compensation based on the market rates, forms of payment, employment in the construction activities, and adequate mechanism for grievance redress.

The ESMF and ESIA, along with their Executive summaries, have been disclosed on the PIUs websites.

3. National/Provincial Legal Framework for Stakeholder Engagement

Article 19 A Right to Information states that **Every citizen shall have the right to have access to information in all matters of public importance subject to regulation and reasonable restrictions imposed by law**. The Sindh Transparency and Right to Information Act ensure transparency and accountability through a mechanism whereby citizens can seek information of public importance from public bodies as enshrined in Article 19-A of the constitution of Pakistan.

To oversee the enforcement of the law, the Sindh Right to Information (RTI) Commission was established in 2017 as an independent statutory body headed by Sindh Chief Information Commissioner, RTI Commission and two Commissioners with the primary function to receive and decide complaints of citizens who are denied information by the public bodies. The commission also has the responsibility to create awareness about the law and take all other measures for the effective implementation of the law. The primary responsibility of the Commission is to ensure that the request of the citizens is processed in time by the public bodies. If the citizens file any complaint against a public body, the Commission, after hearing the citizen and the public body, takes a decision.

In order to more effectively manage risks and impacts of projects, the PIUs and all parties involved in project implementation are required to engage Project Affected People through:

- disclosure of information;
- meaningful Consultation and
- Development and implementation of systems for responding to complaints and grievances commensurate to the level of social risk. The nature, frequency, and level of effort of this engagement will be commensurate with the project's risks and impacts and the project's phase of development".

4. Stakeholder Identification and Analysis

The three main categories of stakeholders are outlined below:

4.1 Affected Parties

Project Affected Persons (PAPs), who are directly affected by land acquisition and indirectly affected due to their proximity to the construction sites, and along the roads that will be used to supply goods and services to the project sites for construction and operations. The PAPs are defined as a group of people who are directly or indirectly being affected by the project; both positively and negatively. The primary project affected persons are those who will be directly affected due to loss of arable lands, crops, fruit and wood trees, structures, income and livelihoods due to rehabilitation works.

4.2 Other Interested Parties

There are broader stakeholders who may be interested in the project because it indirectly affects their work or has some bearing on it. These include the following:

- Responsible Government Officials/Departments
- Planning and Development Department, Government of Sindh
- Irrigation Department
- SIDA
- Agriculture Department
- Water Resources Department
- Sindh Environment Protection Agency
- Forest, Environment and Wildlife Department
- Fisheries Department
- Communication and Works Department
- Project Financier (World Bank)
- Project Personnel
- Environmental and Social Experts
- NGO's/Civil Society Organizations
- Environment Conservation Organizations
- Academia
- Electronic and Print media
- Interest Groups

Project implementing Parties

There will be several parties that will assist PCMU, SIDA and Agriculture Department in project implementation, and include:

- Project Implementation Consultants
- Contractor
- Sub-Contractors
- Service Providers
- Suppliers
- Traders
- Individual Consultants
- Other consultancy firms

Provincial Regulatory Authorities

The following are the major relevant regulatory authorities to the project:

Board of Revenue: The Board of Revenue is responsible for acquiring land for the public purpose as per the procedures prescribed for the acquisition of private land in the Land Acquisition Act 1894 and Rules, as well as the instructions issued by the Board of Revenue (BOR), Government of Sindh

Revenue Department: The Revenue Department is responsible for providing information on land acquisition related matters to the Board of Revenue, GoS.

Sindh Environment Protection Agency: In accordance with the requirements of the Environmental Protection Act (EPA) 2014, public participation is an essential legislative requirement for environmental authorization.

Farmers Organisations

Area Water Boards (AWB) are quasi-autonomous organizations under the Irrigation Department. They deliver water to the Farmer Organizations (FOs). The Farmer Organizations (FO) are legally constituted organizations responsible for managing the smaller distributary canals but rely upon the Irrigation Department to cover most costs, including the provision of technical staff. The FOs deliver water to Water Course Associations (WCAs). The WCAs are community organizations supported by the Agriculture Department

Local/District Government

Pakistan is divided into provinces. The provinces are autonomous administrative units that are further divided into divisions and then districts, tehsils (sub-districts) and union councils, respectively. A number of government agencies will be involved in project-related activities.

District-based agencies have jurisdiction over land acquisition and compensation through the application of the Land Acquisition Act 1894 and Rules, orders and notifications. Land acquisition functions rest with the Board of Revenue represented at the District level by the District Collector (Deputy Commissioner) and Land Acquisition Collector (LAC). The LAC works under the powers of the District Collector/Deputy Commissioner as per LAA 1894. Functions pertaining to the assessment of compensation of non-land assets (structures, crops, trees) lie with other line agencies and their District offices support LAC in the valuation process.

Other Government Departments

The LAC requests the government departments to carry out detailed measurement surveys of (i) structures, (ii) crops, (iii) fruit trees, (iv) wood trees. The assessment of the affected structures pertains to the Works and Communication Department; the assessment of affected wood trees pertains to the Forest Department, and the assessment of crops and fruit trees pertains to the Agriculture Department. The LAC will be responsible for payment of the compensation to the affected titleholders and registered sharecroppers and cultivators of village common/gov't lands.

Civil Society Organizations

The Civil Society Organizations (CSOs) role is to advocate for the sustainable management of the environment and social performance of the project, including improving people's lives and conserving natural resources. The key CSOs are UN Women and SPO.

Academic Institutions

The academic institutions help in educating citizens for development, offer insights on urgent challenges, reduce and manage the environmental and social footprints of the project operations. They provide sound advice and exchange views for the effective implementation of environmental and social instruments. The

academic institutions that show interest in the project are Agriculture University Tando JAM and Mehran University of Engineering and Technology Jamshoro.

Print & Electronic Media

Printed, electronic and social media are the important stakeholders; they deliver messages to a wider audience within and beyond Project affected areas. The Project and the stakeholders who have an interest and positive or negative influence toward the Project may use the media to convey their messages and aspirations. Any information related to the Project might interest them and help in developing a positive image of the Project.

Financier

The World Bank is a multilateral development bank with a mission to improve social and economic outcomes in developing and poor countries by investing in sustainable infrastructure and other productive sectors. The Bank thus is working to better connect people, services and markets that, over time, will impact the lives of billions and build a better future. The WB environment and social Operational Policies are applicable to this project that includes:

- OP 4.01 Environmental Assessment;
- OP 4.11 Physical Cultural Heritage;
- OP 4.12 Involuntary Resettlement

4.3 Disadvantaged and Vulnerable Groups

The disadvantaged and vulnerable groups of affected people include the poor and marginalized, which include small landholders of arable land, agriculture tenants and affected households below the poverty line. The impacts on their social and economic conditions revealed that additional measures are required in terms of resettlement and rehabilitation assistance to mitigate impacts on their livelihoods.

5. Stakeholder Engagement Plan

5.1 Purpose and Timings of the Stakeholder Engagement Plan

The approach for the stakeholder engagement analysis will be underscored by three elements: belief in the primacy of qualitative data, commitment to participatory methods and flexible, responsive methods. An inclusive and participatory approach will be followed, taking the main characteristics and interests of the stakeholders into account, as well as the different levels of engagement and consultation that will be appropriate for different stakeholders.

In general, engagement is directly proportional to the impact and influence of a stakeholder. The stakeholder analysis is used to classify stakeholders based on their level of interest and influence related to the project. Results of the analysis are used to recommend the level of engagement as under:

(i) High Interest and High Influence (to be engaged): These stakeholders are to be informed and engaged in the form of a formal interaction on the environmental and social aspects of the project. If they raise any concerns, they should be actively involved in identifying mitigation measures and developing subsequent plans. The aim of their engagement is to obtain their acceptance of Project activities and management plans. They are engaged at the stage of ESIA/ESMP studies and in key decisions in project planning, implementation and operational phases.

(ii) High Interest and Low Influence (monitoring of their interest): These stakeholders have limited ability to directly influence the project but have a keen interest in one or more aspects of the project. The

recommendation is that the views of these stakeholders be tracked and monitored through communications.

(iii) Low Interest and High Influence (leverage): These stakeholders may not seriously be concerned about the environmental and social aspects of the project, but they are critical about project success. They are recommended to be engaged in active communication on key project activities throughout the project lifecycle. The approval of these stakeholders will be critical for the Project; and

(iv) Low Interest and Low Influence (to be informed): These stakeholders should be provided information on key Project activities through press releases, briefings, and other modes of communications during the project lifecycle.

Table 1. Preliminary Classification of Stakeholders

Engage	BOR/Revenue Department; Affected Persons, general public residing along the project area; public representatives; print and electronic media (provincial and federal), World Bank; Project Steering Committee
Leverage	Academia
Monitor	CSOs, Environment Protection Agency; Labor Department
Inform	Relevant Gov't departments

This SEP will be a living document and will need to be updated and refined throughout the lifecycle of the Project. During this process, the focus and scope of the SEP will be updated to ensure that PIUs address external changes and adhere to its strategy (which itself may change over time). The key life-cycle phases to be considered when implementing stakeholder engagement are briefly discussed below.

Engagement Phases

Stakeholder engagement throughout the project cycle safeguards the risks and impacts and mitigates them as soon as they are identified. This is to avoid or minimize potential adverse impacts, cost-effective project design, smooth running of project activities during the planning/designing, implementation and operational phases of the Project. Thereby, stakeholder engagement is an ongoing process throughout the project lifecycle to guarantee that the interests of the affected people and other stakeholders are safeguarded. The stakeholder engagement phases include:

- Engagement during ESIA/ESMP and RAP/ARAP Baseline
- Engagement during ESIA/ESMP and RAP/ARAP Disclosure
- Engagement during ESMP and RAP Implementation
- On-going engagement during the operational phase

Engagement during Implementation of ESMP and RAP

A continued process of stakeholder engagement with PAPs and other stakeholders will be followed to ensure transparency in the implementation of ESMP and RAP and to keep the PAPs and other stakeholders informed. Stakeholder engagement will assist in obtaining cooperation from informed PAPs and other stakeholders, to avoid cost and time in dealing with complaints and grievances. As per the requirements of the WB OPs, plans for stakeholder engagement/consultation and participation during the implementation of ESMP and RAP are delineated in the ESIA and RAP. The PIUs will continue the

stakeholder consultation process by following WB OPs (disclosure and exchange of information) by taking the following steps:

- The PIUs, through the male and female Environment and Social Staff of PIUs, PICs and the Contractors will keep a close liaison with the stakeholders, including male and female PAPs;
- Address stakeholder concerns, complaints and grievances, and keep their record;
- The Project will engage a female social staff at each AWB to ensure ongoing consultations with women and address their concerns, and to benefit the women and girls from the Project equally. During implementation, the PIUs will take into account the women and young girl's views and priorities, as a result of planned consultations;
- Organize periodic meetings with the stakeholders and appraise them about the implementation progress of the Project including implementation of environment and social instruments (ESMP/RAP);
- Detail and outcome of all stakeholder engagement activities will be included in monthly, quarterly, bi-annual and annual internal monitoring reports of PIC; and
- Disclose all monitoring reports in the same manner as that of the approved ESIA and RAP at PIUs and WB websites and to the PAPs and other stakeholders through appropriate means of communication.

Engagement during the Operational Phase

The PIUs and WB websites and other localized means of communication will be used for ongoing information dissemination to literate and illiterate via face-to-face meetings and consultations with the affected persons, while Grievance Redressal Mechanism will be used for registration and redressal of complaints and grievances of the stakeholders, general public and PAPs.

5.2 Proposed Strategy for Information Disclosure

Multiple (one for each subproject) pubic meetings will be held, with a representative sample of directly affected and other interested parties along with vulnerable groups will be invited. These platforms will be used to gather input on the project design/implementation and would also serve as information disclosure forums.

The SEP has also been disclosed on World Bank and PIUs websites as a part of ESIA.

5.3 Proposed Strategy for Consultation

FO-level Information Centers

In order to ensure effective consultations and disclosure of information during the preparation of ESIA and RAP, the FO-level Information Centers (FICs) will be established. The Project stakeholders, particularly PIUs, PICs, the Contractors, sub-contractors and service providers, will use the FICs to disseminate and disclose information related to the PAPs, project construction activities or any other issues.

Notice Boards

Notice boards will be provided at each of the FICs to inform literate audiences and can be used by PIUs and other project implementing parties to inform PAPs about project activities in Sindhi. The locations for the notice boards will be selected in consultation with affected persons. These notice boards will be regularly updated with project-related information and to inform community members about employment opportunities in the Project and impact management measures, including the updates on grievances. The PIUs will fix grievance/suggestion boxes close to the notice boards and place them at other appropriate locations in affected villages to be selected in consultation with PAPs.

Engagement Activities with Women

Several cultural and economic obstacles exist for women's participation in public consultations in the affected villages; this is compounded by constraints due to limited interaction. The engagement activities were conducted with women separately during the ESIA and RAP preparation process and will also be conducted separately with women during the Project implementation by E&S staff of PIUs, PICs and the contractors. These included females of AHs, the general public . The redressal actions against the concerns and issues raised by women are incorporated in the ESMP and RAP, and will also be addressed adequately at the implementation and operational phases of the project.

Engagement with Vulnerable Groups

Special engagement efforts may be required to ensure that vulnerable stakeholders are reached and engaged meaningfully. Special measures to be taken by PIUs, PICs, and other parties involved in Project implementation include home visits to their households to ensure that they receive resettlement and rehabilitation assistance in a timely and transparent manner, have access to income-generating interventions under livelihood restoration and improvement plan and project-related jobs at construction and operation phase of the Project and transportation to attend consultation meetings.

Stakeholder Consultation Methods

There are a variety of engagement techniques used to build relationships with stakeholders, gather information from them, consult them, and disseminate project information to them.

When selecting an appropriate consultation technique, culturally appropriate consultation methods, and the purpose for engaging with a stakeholder group should be considered. The technique which will be used are:

Table 2. Methods of Stakeholder Engagement

Engagement Technique	Appropriate Application of the Technique
Correspondences (Phone, emails)	▪ Distribute information to AWBs, FOs, WCAs, officials of government, district and tehsil governments, and parties involved in project implementation, financier, NGOs ▪ Invite stakeholders to meetings and follow-up
One-on-one meetings	▪ Enable stakeholder to speak freely about sensitive issues to seek views and opinions ▪ Build personal relationships ▪ Record meetings
Formal meetings	▪ Present the Project information to a group of stakeholders to allow the group to comment/provide opinions and views ▪ Build an impersonal relationship with high-level stakeholders ▪ Disseminate technical information ▪ Record discussions
Public meetings	▪ Present Project information to a large group of stakeholders, especially communities, to allow the group to provide their views and opinions ▪ Build a relationship with the communities, especially those affected by the Project ▪ Distribute non-technical information ▪ Facilitate meetings with presentations, PowerPoint, posters, etc. ▪ Record discussions, comments, questions.
School Awareness Programs	▪ Awareness programs to school children on construction related health and safety aspects

	▪ Raising interest to school children on the science and technology by explaining the agriculture development in the project area
Focus group meetings	▪ Present Project information to a group of stakeholders to allow them to provide their views on targeted information ▪ Build relationships with communities residing within the project AOI ▪ Record responses
PIUs/Project website	▪ Present project information and progress updates; ▪ Disclose ESIAs, ESMPs RAPs and other relevant project documents
Direct communication with affected persons, their committees and display at village information centres	▪ Share information on schedule and locations for distribution of compensation and resettlement and rehabilitation assistance ▪ Dissemination of notices for the vacation of affected land ▪ Share information about civil works schedule, the timing of land clearance and agree on removing assets from affected land and relocation of assets
Road signs	▪ Share information on project activities ▪ Reminders of potential impacts
Project leaflet	Brief project information to provide regular update Site-specific project information

Table 3. Proposed [125]Plan for Stakeholder Activities

Information to be Disclosed	**Target Stakeholders**	**Method Proposed**	**Timetable/Locations/Dates**	**Proposed Location of Engagement**
Information Dissemination, addressal of outstanding issues, complaints or grievance, resettlement planning and RAP/ESMP implementation	• Project Affected Households (PAHs) • Vulnerable Groups • Communities Leaders	Meetings	As and when required during preparation of ESIA/ESMP/RAP, environment and social impact assessment of unanticipated additional impacts. Weekly during the planning and active implementation of RAP and ESIA/ESMP	FO-level information Centers (VICs) or locations agreed in consultation with PAHs
	• Project Affected Households (PAHs) • Vulnerable Groups	Meetings	Weekly during the planning and active implementation of RAP and ESIA/ESMP	FO-level information Centers (FICs) or locations agreed in consultation with PAHs
	• Local Communities • Leaders	Public meetings	Monthly	Locations identified in consultation with the stakeholders
	• Public representatives • Officials of relevant gov't departments	Meetings	As and when required during construction and RAP/ESIA/ESMP implementation	Respective Offices

[125] This plan is for guidance only, the stakeholder engagement activities will be conducted extensively as and when required

Information to be Disclosed	Target Stakeholders	Method Proposed	Timetable/Locations/Dates	Proposed Location of Engagement
	• PAHs • Local Communities in project area Vulnerable Groups • Vulnerable Groups • Local Community Leaders • Local NGOs	Open public meetings	Annual through the operation and closure phase	Community center in powerhouse colony or in locations identified in consultation with the stakeholders
	• Contractor, Sub Contractors and service providers	As part of the GRM process	As and when required	As required in GRM
	• District Administration • EPA • Other relevant departments	Meetings with Officials	As and when required through the construction, operation and closure phase	Administration Offices
	• PAHs • Local Communities • Vulnerable Groups • Community Leaders	Focus Group Discussions	At least six-monthly through the operation and closure phase	Locations identified in consultation with the stakeholders
	• PAHs • Affected communities	Questionnaires	At least 6-monthly through the construction phase and annual during the closure phase	Locations identified in consultation with the stakeholders
	• PAHs • Affected communities • All other stakeholders	As part of the GRM process	Regularly through the construction, operation and closure phase	As per GRM provisions
Training on occupational/community health and safety	• Contractors and Sub Contractors	Tool Box talks	Daily before the start of work	At construction sites
	• Contractors and Sub Contractors	Training	Monthly training programs on construction health and safety	At the project/construction campsite
	• Contractors and Sub Contractors	Training	Monthly training programs on community health and safety (including topics on code of conduct, GBV, SEA, etc.)	At the project/construction campsite
	• Hygiene and sanitation promotion	Posters	Awareness program to workers on personal hygiene and sanitation	At construction campsites
	• Code of conduct	Posters	Display of code of conduct in local language	At construction campsites
	• Emergency response	Drills	Monthly drills on fire safety and emergency response measures	At construction campsites

Information to be Disclosed	Target Stakeholders	Method Proposed	Timetable/Locations/Dates	Proposed Location of Engagement
Monitoring of implementation of the RAP and ESIA/ESMP	• Project Affected households • Local Communities • Vulnerable Groups • Local Community Leaders • institutional stakeholders	Focus Group Discussions	At least twice a month formally during the construction phase	At FO-level Information Centers (FICs) / PIU, office/ district and tehsil government offices/locations identified in consultation with the stakeholders
		Interviews with key informants	At least monthly; through the construction phase	
		Questionnaires	At least annually through the construction phase by external party or as and when required	
		As part of the GRM process	Regularly through the construction phase	As per GRM provisions
Monitoring of the project activities and regular engagement	• Project Affected households • Local Communities • Vulnerable Groups • Local Community Leaders	Open public meetings	Monthly and Quarterly	VICs or locations identified in consultation with the stakeholders
		Focus Group Discussions	At least annually through the construction phase	
		As part of the GRM process	As and when required through the construction phase	As per GRM provisions
Project Status Update	• District Administration • Regulatory Authorities • Concerned departments	Meetings with Officials	As and when required through the construction, closure and operation phase	Administration/ Offices

6. Grievance Redressal Mechanism

A grievance redressal mechanism (GRM) has been developed. The aim of the grievance mechanism is to achieve a mutually agreed resolution of grievances raised by such stakeholders. The grievance mechanism is described in section 7.3 of the ESMF main report and Section X of the RPF in more detail.

Resources and Responsibilities for Implementing Stakeholder Engagement Activities

7.1 Resources

An estimated cost of PKR 15 million/USD 0.1 million has been allocated in the budget of RPF for the consultations and GRM. A part of cost for these activities will also be contributed from administrative costs under the budget.

PIUs will be responsible to hire and retain environment and social staff as per details provided in Section 7 of ESIA and Section XX of RPF. The E&S staff of PIUs will be responsible for overseeing and coordinating all activities associated with stakeholder engagement in collaboration with E&S staff of CSC/PIC and the Contractor(s).

7.2 Management Functions and Responsibilities

The roles and responsibilities of stakeholder engagement activities have been described in this section as per management functions of PIUs. The head of PIUs, Project Directors and E&S staff of PIUs, PICs and Contractor(s) will be responsible to successfully implement the SEP:

- The head of PMO (Program Director) will be overall responsible for implementation of SEP;
- The E&S specialists of PIUs will be responsible for implementing the stakeholder engagement activities in coordination and collaboration with PIC and Contractors' ESS including maintaining database and documents;
- Project Director of PIUs will be responsible to manage all activities related to logistics which relates to the interaction with other departments or projects; and
- The Admin and Finance officials of PIUs will be responsible for the timely and adequate provision of budget as per allocations and other related support as and when required.

Role of Environment and Social Specialists

The E&S specialists of PIUs will oversee stakeholder engagement activities. Furthermore, they need to ensure that all stakeholder engagement aspects are a permanent item on all high-level management agendas, within PIUs, and that all actions arising from management decisions are implemented. Responsibilities of the Directors include the following:

- Implement and monitor all stakeholder engagement strategies/plans for the subrojects ESIAs/ESMP/RAP/;
- Oversee all stakeholder engagement related activities for the Project;
- Manage the GRM;
- Act as mediator between PIUs and stakeholders;
- Liaise with other Project Director(s) s to ensure that stakeholder engagement requirements/protocols are understood; and
- Proactively identify stakeholders, project risks and opportunities and inform the Program Director and Project Director(s) to ensure that the necessary planning can be done to either mitigate risk or exploit opportunities.

The Directors will play a critical role as internal change agent for social and stakeholder-related matters in PIUs. This becomes important if social and environment and stakeholder risks identified need to be escalated for higher-level decision-making to identify a resolution. The Directors need to remain actively involved with the SDP, LRIP, land acquisition and resettlement planning and implementation, ESIA and ESMP implementation in order to identify potential risks or opportunities and ensure that the needed administrative support is provided. Moreover, grievances submitted as part the ESIA/ESMP/RAP planning and implementation are addressed under the GRM timely and efficiently.

Administrative Support

The stakeholder engagement activities will influence other departments/entities or require their inputs. The Directors will ensure the various directors are included or kept informed on the stakeholder engagement process. Decisions taken by directors might have a direct or indirect impact on affected people or local communities which would need to be communicated at the appropriate time. Anticipated stakeholder engagement roles for the various decision-makers are outlined below:

- **Project Directors:** The Project Directors will be responsible to sustain relationships and communicate with Government and other stakeholders. These engagements will be required throughout the Program and respective projects life cycles and decisions taken as a result of these engagements could potentially impact IUs relationships with communities e.g. agreements on compensation of land and other immovable properties.

7. Monitoring and Reporting

7.1 Monitoring

Monitoring and evaluation of the stakeholder process is considered vital to ensure PIUs are able to respond to identified issues and alter the schedule and nature of engagement activities to make them more effective. Adherence to the following characteristics/commitments/activities will assist in achieving successful engagement:

- Sufficient resources to undertake the engagement;
- Inclusivity (inclusion of key groups) of interactions with stakeholders;
- Promotion of stakeholder involvement;
- Sense of trust in PIUs shown by all stakeholders;
- Clearly defined approaches; and
- Transparency in all activities.

Monitoring of the stakeholder engagement process allows the efficacy of the process to be evaluated. Specifically, by identifying key performance indicators that reflect the objectives of the SEP and the specific actions and timings, it is possible to both monitor and evaluate the process undertaken. Two distinct but related monitoring activities in terms of timing will be implemented:

- During the engagement activities: short-term monitoring to allow for adjustments/improvements to be made during engagement; and
- Following completion of all engagement activities: review of outputs at the end of engagement to evaluate the effectiveness of the SEP as implemented.

A series of key performance indicators for each stakeholder engagement stage have been developed. Table shows the indicators, and performance against the indicators will show successful completion of engagement tasks.

Table 4. Key Performance Indicators by Project Phase

Key Indicators	**Responsibility**
Planning for Construction Phase	
▪ Share updates on project activities ▪ Bill Boards displayed in allocated locations by time specified	PIUs
▪ Affected community stakeholders, with at least 30% women, have received and understand the ESIA and RAP information disclosed and attended the public meetings ; ▪ Communities provided feedback. ▪ No complaints about non-receipt of information dissemination material.	PIUs
ESIA / RAP Implementation Phase	
Confirmation that the ESIA/ESMP/RAP tasks are defined as specific individual or grouped environmental and social clauses in contract bid documents.	PIU (Director Procurement) to draw on ESIA/ESMP/SEP/RAP for bidding documents

Confirmation that environmental and social management criteria are included as part of the contractor selection process, including their experience preparing and implementing ESIA/ESMPs, etc.	PIUs (Director Procurement) to draw on ESIA/ESMP/SEP for Contractor selection process
E&S specilaists hired and retained by PMO, providing assistance with ESIA/ESMP and RAP implementation, contractor ESIA/ESMP supervision (including observations during construction), and participation in meetings with community/affected persons, general public consultations and institutional stakeholder	PIUs safeguard strengthening
Compliance monitoring checklists prepared and being used by the contractor and PIC consultant relevant staff and due diligence notes, completed as defined in the ESIA/ESMP and RAP, and making the notes available in an easily accessible file for the contractor, ES and technical staff of PIUs, PIC and others to use.	ESIA/ESMP/SEP/RAP to guide management and monitoring processes

The identification of subporject related impacts and concerns is a key element of stakeholder engagement that will occur over the complete subprojec life-cycle. As such, the identification of new concerns and impacts as the Project progresses will serve as an overall indicator for the utility of the stakeholder engagement process.

In the ESIA and RAP progress and monitoring reports, there will be a review of the engagement activities conducted; levels of stakeholder involvement (particularly for affected persons and affected communities, women and vulnerable groups); the issues discussed and outcomes; and the extent to which stakeholder issues, priorities and concerns are reflected in the ESIA ad RAP Reports, particularly with respect to mitigation and monitoring strategies contained in the Environmental and Social Plans.

8.2 Reporting

Monthly Reports

The E&S of PIUs, PICs, and Contractor will prepare brief weekly and monthly reports on stakeholder engagement activities to report to the PCMO that will include:

- Activities conducted during each month;
- Public outreach activities (meetings with stakeholders, dissemination of information education and communication material i.e. leaflets, posters brochures, newsletters, local radio and TV channels, non-technical summary of documents and reports etc.);
- Number of feedback forms;
- Entries in stakeholder engagement activity register;
- Entries to the grievance register;
- Number of visitations to the Information Centers;
- Number of meetings with APCs;
- Monthly stakeholder engagement activity plans.

Six Monthly and Annual Reports

Monthly reports will be used to develop six monthly and annual reports; E&S staff of PIC will compile a report summarizing stakeholder engagement activities and their results on an annual basis and will submit to the PIU for review. This report will provide a summary of all public consultation issues, grievances, Corrective Action Plans and their implementation status/resolutions. The report will provide a summary of relevant public consultation findings from informal meetings held with APs and other stakeholders.

The external monitoring of SEP implementation will be done by a third-party monitoring agency. A midterm and end of the project evaluation will be conducted by a third-party consultant/firm using a perception survey, which will use same set of indicators over time to achieve continuity. The first survey to assess stakeholder perceptions should be conducted before major construction work to provide a baseline of APS and other stakeholder perceptions.

Reporting Back to the Stakeholders (Disclosure)

PIUs will report back to the affected persons and other stakeholders on matters relating to:

- main findings from the annual monitoring;
- progress on implementation of the mitigation measures;
- Overall progress on the ESIA, ESMP, RAP, and SEP implementation;
- Corrective Action Plan to address any outstanding issues.

The exact reporting mechanism and formats will be finalized during initial stage of project implementation, and upon finalization, the SEP will be updated. The annual monitoring reports will be disclosed to the PIUs and WB websites and will be accessible to all interested stakeholders.

Annex 11: Public Consultation Meetings – Photographs

Details of Participants in the Consultation Meetings

S#	Name	Organization	Designation
1	Rub dino jamali	FO	Farmer
2	Abdul Khaliq	FO	Farmer
3	Muhammad Nawaz laghari	FO	Farmer
4	Noor muhammad	FO	Farmer
5	Ali bux	FO	Farmer
6	Baboo	FO	Farmer
7	Ghulam qadir	FO	Farmer
8	Ali shah	FO	Farmer
9	Ali noor	FO	Farmer
10	Asghar	FO	Farmer
11	Rajab shah	FO	Farmer
12	Faheem akbar	FO	Farmer
13	Ayaz ali khuwaja	LBCAWB	Assist manager social mobilization
14	Zaib unisa	LBCAWB	Assistant manager social mobilization
15	Shakeela leghari	SIDA	Sociologist/ Participation Specialist
16	Muhammad Amin	SIDA	Ecologist
17	Maaz Effundi	SIDA	Environmental Inspector
18	Haji Ehasn	FO	Farmer
19	Muhammad Afzal	FO	Farmer
20	Muhammad asif ali	FO	Farmer
21	Muhammad Atif	FO	Farmer
22	Masherwon lal	FO	Farmer
23	Muhammad asad	FO	Farmer
24	Muhammad hashim solangi	FO	Farmer
25	Shahnawaz umrani	FO	Farmer
26	Prem partab	FO	Farmer
27	Moamar kabil jalbani	FO	Farmer
28	Malik maza	FO	Farmer
29	Sheema khuram	Consultant	Social Consultant
30	Ghulam Rasool	FO	Farmer
31	Mir Ahmad	FO	Farmer
32	Jamshed Ahmed	FO	Farmer
33	Muhammad Din	FO	Farmer
34	Sana ullah Bullo	FO	Farmer
35	Abdul Ghafar	FO	Farmer
36	Pathan khan bullo	FO	Farmer
37	Mehar khan bullo	FO	Farmer
38	Muhammad bachal	FO	Farmer

S#	Name	Organization	Designation
39	Hadi bux bullo	FO	Farmer
40	Tania Hussain indher	FO	Farmer
41	Abdul hameed khoso	FO	Farmer
42	Muhammad ishaq	FO	Farmer
43	Abdul waheed chachar	FO	Farmer
44	Amir bux bullo	SIDA /EMU	Environmental Inspector
45	Allha bux mahar	FO	Farmer
46	Abdul shakoor deho	FO	Farmer
47	Shams din gopang	FO	Farmer
48	Nazeer chachar	FO	Farmer
49	Gull shah	FO	Farmer
50	Jhangal khan	FO	Farmer
51	Noor hassan samejo	FO	Farmer
52	Mehrab khan sameho	FO	Farmer
53	Allah dad khan	FO	Farmer
54	Abdul hameed kalhoro	FO	Farmer
55	Bashir Ahmed Chachar	FO	Farmer
56	Raees daim khan chachar	FO	Farmer
57	Manzoor ahmed endhar	FO	Farmer
58	Dr syed Imtiaz ali shah	Fisharies	DD AAP livestock and fisheries
59	Hazoor bux khoso	Fisharies	DD
60	Ms. Munawar sultana solangi	Agriculture extension	DD
61	Chetan mal	Agriculture extension	Director AE
62	Asadullah solangi	Agriculture extension	DD
63	Ali Nawaz chana	Agriculture extension	Director Technical
64	Ameer hajan	Agriculture extension	Director Ped
65	Islamud din Rajpoot	Agriculture extension	Director
66	Dr Manzoor ahmed bughyo	Agriculture extension	Planning and progressive officer
67	Professor dr Muhammad ismail kumbhar	Agriculture University Tando JAM	Director
68	Ms. Uzma Imran	Mehran University of Engineering and Technology Jamshoro	Assistant professor
69	Abdul Rauf	Sindh environmental protection agency	Deputy director
70	Imran abbas		Environmental inspector
71	Shireen ram	Tando muhammd khan	Women Farmer
72	Khotar	Tando muhammd khan	Women Farmer
73	Sikrier	Tando muhammd khan	Women Farmer
74	Pnanmonghal	Tando muhammd khan	Women Farmer
75	Mhanoor	Tando muhammd khan	Women Farmer
76	Abdul sattar	Tando muhammd khan	Farmer
77	Ghulam Mustafa ujjan	SIDA	GMT

S#	Name	Organization	Designation
78	Akbar Azam Rashidi	SIDA	GM RnD
79	Jai Ram Motvani	SIDA	GMO
80	Hizbullah Mangrio	SIDA	Communication Specialist
81	Parvaiz banbhan	SIDA	Assistant manager transition
82	Masroor Shahwani	SIDA	Institutional Specialist
83	Ambar sanam laghari	SIDA	Assistant Director Engineering
84	Nauman Memon	SIDA	IT Specialist
85	Aftab akhund	RDF	Program manager
86	Batool Shaukat	IDC	Gender Associate
87	Shadab Bughyo	Agriculture department	Environmental and Social Specialist
88	Reema Latif	SPO /INGO	Program officer

	Name	Organization
1	Fareeha Umar	UNWomen
2	Faisal Iqbal	ILO
3	Barkat Ali	SPO
4	Mansoor Khanzada	Assistant Engineer for FOs, SIDA
5	Bilawal Soho	SIDA
6	Masroor Shahwani,	Institutional Specialist, SIDA
7	Shakila Laghari	SIDA
8	Sajid Soomro	Deputy Director, DCWD
9	Hidayat Narejo	Assistant Manager Social Mobilization, AWB Nara Canal
10	Sikandar Mangrio	Assistant Manager Social Mobilization, AWB Nara Canal
11	Sajjan Khan	Assistant Manager Social Mobilization, AWB, Ghotki Feeder Canal
12	Zaib Jatoi	Assistant Manager Social Mobilization LBCAWB
13	Chetan Mal	Director Division Mirpurkhas, Agriculture
14	Asad Solangi	Deputy Director Larkana Division
15	Abdul Basit	Deputy Director Environment, PCMU
16	Habib Ahmadani	Deputy Director Agriculture Economics, PCMU
17	Marium Minhas Bandeali	Deputy Director Training and Communications, PUMU
18	IIbad Ur Rehman	World Bank

Details of Participants in Gender Consultatoin Meeting

(held on June 20, 2021 through a video conference)